ROUTLEDGE EXPLORATIONS IN ENVIRONMENTAL ECONOMICS

Entrepreneurship and Management in Forestry and Wood Processing

Principles of business economics and management processes

Franz Schmithüsen, Bastian Kaiser, Albin Schmidhauser, Stephan Mellinghoff, Karoline Perchthaler and Alfred W. Kammerhofer

ROUTLEDGE

Entrepreneurship and Management in Forestry and Wood Processing

Forestry has long been in a rather favourable position by offering a valuable raw material source in high demand. However, with rapidly changing end-user demands and cost competitiveness within the forest and wood chain as a whole, the industry needs to adapt. Explaining entrepreneurial action as part of a chain of comprehensive value-added processes leads to a new perception of forest production and wood processing.

This book applies the main concepts of modern managerial science to the world of forestry and renewable natural resources utilisation. It is the perfect book for students studying forestry, environment and wood processing, as well as entrepreneurs and managers within the wood-based sector.

Topics are covered from an entrepreneurial perspective and include perspectives from accounting, finance, economics, supply chain management, marketing and strategy.

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Foreword

Forests were a major subject of international political attention at the United Nations Conference on Environment and Development that took place in 1992 in Rio de Janeiro. Since then, forestry issues have come to be understood in a much more integrated and cross-sectoral way that captures how this important land use is shaped by interacting and competing activities. Forests contribute to poverty alleviation, rural development, green jobs, renewable bio-energy, energy security, climate change adaptation and mitigation, soil and water conservation, biodiversity protection, sustainable building and city development. Although forests alone will not provide comprehensive solutions to these challenges, without forests there can be no sustainable answers. In June 2012, the Rio+20 Conference revisited the great challenges humankind is facing and in its final report, “The Future We Want,” identified seven major global themes: jobs, energy, cities, food, water, oceans and disasters. All of these issues are interrelated, and all involve sustainable development.

Three major, interrelated challenges that humankind faces are dwindling energy from nonrenewable sources, the growing threat of climate change and the need to provide food security for all. None of these challenges can be solved in isolation. As the world population grows, so does the demand for energy, food and materials – as well as the quest for more modern, convenient life styles. Modern technology helps accommodate the changing preferences and higher consumption levels, in particular of people in the developing world. To avoid further damage to the world’s natural resources, countries will need to adjust their approaches to land use, restore soils and degraded land, and optimize the management of agriculture, forestry and rangelands. Consumers need to be more aware of how their choices affect our planet.

Multiple demands for environmental services (water, soil, carbon sequestration, biodiversity) and material uses (energy, food, wood) need to be balanced to prevent overuse of land resources. The world still derives about 9 per cent of global energy from forest sources, mainly for cooking in developing countries. Advances in technology research and industrial development processes can improve the combined production from agricultural lands and forests, considering employment, value added, carbon efficiency and life-cycle analysis. Energy can be produced either at the end of the value chain or from by-products that would otherwise go unused. Agroforestry as well as intensive bio-energy tree crops on poorer agricultural land might offer additional possibilities to produce food, forest products and energy for local populations.

Sustainability is a crucial element in unlocking the full potential of forests – to provide wood (a local, national and global renewable raw material), to offer a renewable natural resource for the enjoyment of present and future generations and to maintain biodiversity and rare forest ecosystems in our varied and changing landscapes. Providing environmental services leads to a larger range of interventions with additional costs; this is an important reason for sharpening the economic perspective in forestry. Income from sustainable wood production is by far the most important source of funding for sustainable forest management. How this income might be augmented in a sustainable way is crucial for improving the living conditions of forest-dependent communities and procuring the necessary funds to maintain environmental services that depend on the quality of forest management practices. Developing countries' commitment to stop and reverse deforestation will be strengthened when they see that forest management is a profitable and noncontroversial business, and they will then abandon the unsustainable patterns of the past decades.

Landscape approaches are increasingly being advocated. Maintaining the resilience of forest ecosystems and restoring overused and degraded forest areas are essential activities that have gained increasing attention. Harmonizing different forms of land use and optimizing management strategies of natural renewable resources to increase the sustainable production of goods and services is the only possible way to accommodate a world population of 9 billion by 2050 and lift billions of people out of poverty. Forests are often located in remote, climatically disadvantaged areas, on steep terrain and on poor soils. In such places, forestry is the main endogenous economic support of vast areas of the world, and it forms the beginning of a value chain while providing vital environmental services.

Green economy, green growth, low-carbon economies and bio-based economies are related emerging concepts with a focus on new pathways to long-lasting economic development that is environmentally and socially acceptable. Reducing the effects of climate change means requiring fewer material inputs, especially of nonrenewable materials, decoupling economic growth from energy consumption, and lowering emissions of carbon and other greenhouse gases. The social and cultural dimensions of forests have gained attention – forest area is an important asset for urbanized societies, for example – and a renewed interest in their economic dimension can be observed. Global discussions on forest governance have identified economic issues as crucial, and the 10th session of the United Nations on forests, held in Istanbul in April 2013, has been devoted to the economic dimensions and challenges.

Forests have a high potential for entrepreneurial initiatives related to wood production and bioenergy, nonwood forest products and leisure activities. Some challenges for the development of entrepreneurship lie in public legal frameworks and technological or social issues, such as uncertain or undefined ownership status or scattered forest ownership. Comprehensive action to overcome these problems from the governance side is crucial for strengthening an enabling entrepreneurial environment. Entrepreneurial thinking and competent action increase the economic and social standards of the rural and urban population. The ability to mobilize the full economic potential of a country is thus related to its culture of entrepreneurship.

Six experienced colleagues in the field of forestry and economics, led by Professor Franz Schmithüsen from the Swiss Federal Institute of Technology (ETH) in Zurich, have written this book devoted to entrepreneurship and management principles in sustainable forestry and in the wood-based sector. The reader will find valuable information on the broad area of forest economics for teaching and research as well as consultation for professionals. I thank the authors for their excellent contribution to implementing sustainable forest management and future forest-based sector strategies in Europe, and in other continents as well. I congratulate Routledge for publishing the book in its Explorations in Environmental Economics series.

Rome, 15 July 2013
Eduardo Rojas-Briales
Assistant Director-General, Forestry Department
Food and Agriculture Organization of the United Nations

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Preface

This book explains the principles of entrepreneurship and management and the application of modern managerial science to forestry and the wood-based sector. It examines how business management is shaped by external economic, social and technological factors and by the goals, culture and internal processes of private and public enterprises. It trains a critical eye on forests' long-term production potential as a renewable natural resource. Altogether, the book is a source for application-oriented knowledge about multifunctional forest development and sustainable uses of wood.

Forests provide economic, social and environmental benefits and represent significant cultural and human values. The specific nature of particular forest ecosystems is determined by the local, regional and global climate, by different soil properties and water regimes, and by a great diversity and dynamic flux of flora and fauna. Human influence is also a major factor that affects the extent, resilience and biodiversity of forests. It determines how close to nature the forests are and what their economic and social potential is at a given time and place. Human beings benefit from protecting and managing the forest sustainably, just as they suffer from its misuse and destruction.

Entrepreneurship and Management in Forestry and Wood Processing takes an integrative approach and considers forests as a multifunctional economic, social and cultural natural resource that contributes to sustainable development at a time when climate change and the ecological functions of ecosystems are of growing concern. European forests have a long history of supplying wood raw material for a wide range of goods, from lumber and paper to bioenergy, as well as nonwood products and ecosystem services. Rapidly changing market demands and competition on cost, however, are forcing the industry to adapt and develop new resource utilisation and industrial processing strategies.

Entrepreneurship is the first word in the title because the authors focus on initiative, innovation, opportunity, openness to change and ability to manage short- and long-term risks in a rational, reasoned manner. They are convinced that with a broad understanding of risks and opportunities, production and marketing processes, interactions between different processing levels, and options for creating value-added chains and industrial clusters – all as related to renewable natural resources – individual entrepreneurs and managers will succeed in modernising the forest and wood-processing sector. Explaining entrepreneurial action as part of a chain of comprehensive value-added processes leads to a new understanding and a more integrative perspective on forest production and wood processing.

Entrepreneurs act in a dynamic political, economic, social and cultural environment shaped by competition for physical, financial and human resources and interlinked production and consumption chains. Innovations in technology and business practices, new product and process developments, and changing social and cultural values, such as growing concern for environmental protection, are decisive determining factors. They lead to changing demands for goods and services as well as to changing supply opportunities in production. Actual and prospective market demands and supply potentials in turn drive change in business management. The complex skills that must be mastered by entrepreneurs, managers and employees at all levels include operating in competitive markets, improving value-added production based on sustainable resource use, enhancing the economic efficiency and effectiveness of business activities, and working productively with staff and external stakeholders.

The book may be used in teaching forestry and wood-processing courses and as a reference for landowners, entrepreneurs and managers working in the wood-based sector as well as international consultant and government advisors. Decision makers who shape policy or manage private, communal or state forests and environmental leaders who preserve forest ecosystems will find information on strategic and operational management systems that bring together sustainable uses and strict preservation. Topics include marketing; business management, personnel and organisation; accounting, investment and finance; logistics and production processes; and wood-based sector strategy. References and suggestions for further reading in the scientific and general business literature lead to additional information.

Whether used as a textbook by students or consulted as a reference by professionals, the book has the following goals:

- to explain the fundamentals of business management and the specific conditions of forest production and wood processing;
- to convey principles, methods and techniques of entrepreneurial decision making through practical examples;
- to develop readers' analytic skills in using information and finding solutions to achieve goals and business objectives;
- to encourage creative and reflective capabilities in the search for workable alternatives in decision making;
- to develop social competencies and leadership in personnel management and organisational systems; and
- to link readers to complementary general and specific literature and develop their ability to use such sources.

European forestry developed its successful, sustainable model over a long period, albeit with often controversial practices. A similar quest for sustainability began in North America during the second half of the nineteenth century. Now, however, many countries in other regions do not have the luxury of decades in which to build the necessary institutional and economic basis for sustainable forest management and a productive wood-based sector. Practical and effective management activities need to be applied today on a large scale in all regions. The world's forests are under pressure and in many cases exploited. The demand for different goods and services rises constantly, and powerful forces of world trade are driving change. The European experience in multifunctional forest management can make a significant contribution if it is adapted to local conditions, promoted by the private and public sector and systematically transferred in teaching and research.

The forest and wood-based sector can and should make an exemplary contribution to developing a green economy and has great potential for enhancing conservation, mitigating climate change, and demonstrating how natural, renewable resources can be used to benefit both society and the environment. Multifunctional forest management practices, based on conflict resolution procedures and physical planning methods, are an indispensable requirement for preserving valuable ecosystems, maintaining biodiversity and reconciling social and cultural needs and values with growing economic and industrial demands.

The starting point is a process- and actor-related analysis cutting across the full value-added chain, from forest production to processing and end-user markets. That is, the wood-based sector is considered as a series of interdependent business management engagements. Guidelines along which the concept is developed include the following:

- Market focus is the foundation for entrepreneurial success.
- Process management, including appropriate direction and controlling methods, is the prerequisite for entrepreneurial performance, effectiveness and competitiveness.
- Innovation is the basis for entrepreneurial growth and adjustment in a rapidly changing economic, social and political environment.
- Forests, forestry, wood processing and use of biomass are all part of a common context.

The book began as a German text that was published in 2003 and revised in 2009. Academic and professional experience has encouraged the authors to come forward with a new, revised and expanded book in English that takes, simultaneously, a broad, global perspective and a regional point of view. The chapters are self-contained and can be studied independently. The citations and general bibliography are extensive and list references in both German and English.

We thank Michael Robertson for having made a first translation of the German base text and the University of Applied Sciences in Rottenburg for co-financing. Special thanks are due to our colleague Kit Prins, who has followed the preparation of the new English text from beginning to end with critical, pertinent and enriching contributions. We owe great thanks to Sally Atwater for her editing. We thank our colleagues who reviewed chapters and offered advice: Yves Dubé, Jabory Ghazoul, Volker Hoffmann, Klaus Josef Kammerhofer, Marius Lazdinis, Dennis Le Master, Alex McCusker, Peter Niemz, Adisa Omerbegovic and Florian Steierer. And we thank those colleagues and friends who have encouraged us and participated over the course of our work.

Finally, we are grateful for the very generous financial support of the Swiss Federal Institute of Technology (ETH) in Zurich, without which the preparation of this book would not have been possible.

Franz Schmithüsen, Bastian Kaiser, Albin Schmidhauser,
Stephan Mellinghoff, Karoline Perchthaler and Alfred W. Kammerhofer

1 Forestry and the wood products industry

1.1 Forest distribution and vegetation

1.1.1 World forests and regions

The forest is part of the biosphere and covers vast areas in many parts of the earth. Forests include a wide variety of ecosystems, defined as areas of landscape in which there are complex structural relationships and functional processes between soil, climate, plants, animals and microorganisms (Barnes *et al.* 1998; Kimmins 2004; Otto 1994). The worldwide distribution of forests and the structure of forest areas in world regions and individual countries are assessed through periodic surveys of the extent of forest resources (the Global Forest Resources Assessment), published at regular intervals by the United Nations Food and Agriculture Organization (FAO 2010a). Regularly updated information on forestry, wood and processed forest products at the global scale is provided by the FAOSTAT database and FAO reports, such as ‘State of the World’s Forests’, published every two years (FAO 2011a).

According to available FAO data, approximately 4 billion hectares (ha), or 31 per cent of the earth’s total land surface, are forests. Another 1.1 billion ha, or 9 per cent, are classified as other wooded land, meaning that it is stocked with trees and perennial shrubs. Total wood growing stock is estimated at 527 billion m^3, but stocking density per hectare varies considerably, ranging from 205 m^3 per hectare in South America to 84 m^3 per hectare in the Caribbean (see Table 1.1). Biomass and dead wood stocks per hectare vary between 90 tonnes in Europe and 247 tonnes in South America. Total carbon stock per hectare ranges between 113 tonnes in Oceania and 217 tonnes in South America. Nearly half of all forests are located in the tropical zone. Around 15 per cent are situated in subtropical or moderate latitudes and slightly more than one-third in the boreal forest zone. Two-thirds of the world’s forests are within the territory of 10 states: the Russian Federation, Brazil, Canada, the United States, China, Australia, the Democratic Republic of Congo, Indonesia, Peru and India.

As indicated in Table 1.1, the world’s population in 2010, based on the revised 2008 United Nations Population Database, was 6.8 billion people (United Nations 2010). At the end of 2011, the world’s population had reached 7 billion people with a further current annual increase of around 80 million. According to current

Table 1.1 Land area, population and forest data by world region, 2010

	Land area	*Population*		*Forest area*	*Forests*		*Total growing stock*	*Growing stock*	*Biomass and dead wood stock*	*Total carbon stock*
Region	*(million/ ha)*	*(millions)*	*(population/ km^2)*	*(million/ ha)*	*(% of land area)*	*(% of world forest area)*	*(million/ m^3)*	*(m^3/ha)*	*(tonnes/ ha)*	*(tonnes/ ha)*
Africa	2,974	995	33	674	23	16.8	76,951	114	176.0	145.7
Asia	3,091	4,140	132	593	19	14.6	53,685	91	124.7	125.7
Europe	2,215	739	33	1,005	45	25.0	112,052	111	90.2	161.8
North America	2,061	460	22	679	33	17.0	82,941	122	113.3	151.8
Central America	51	43	80	20	38	0.5	2,891	148	190.5	185.4
Caribbean	23	44	182	7	30	0.1	584	84	157.5	149.2
South America	1,746	386	22	864	49	21.0	177,215	205	247.4	217.1
Oceania	849	36	4	191	23	5.0	20,885	109	111.3	113.3
World	13,011	6,843	52	4,033	31	100.0	527,204	131	148.8	161.8

Source: compiled from United Nations 2010; FAO 2010a: 15–45, 218–28 projections, the world's population is expected to rise to 9 billion people by the middle of the twenty-first century.

A comparison by world region between population and forest area distribution reveals large differences (see Figure 1.1). Although 60 per cent of the world's population lives in Asia, the proportion of the world's total forest area represented by that continent is only 15 per cent. By contrast, Europe, including the Russian Federation, contains 25 per cent of the world's forests and 11 per cent of the world's population. North America, with close to 7 per cent of the world's population, has 17 per cent of the world's forests; the Central American and Caribbean region has 1.2 per cent of the world's population and 0.6 per cent of the world's forest area; South America, with around 6 per cent of the world's population, has 21 per cent of the world's forests. In Africa, the ratio of population (15 per cent) to forest (17 per cent) is more balanced. In Oceania the population is small (0.5 per cent) and the forest area large (5 per cent). On average, the global

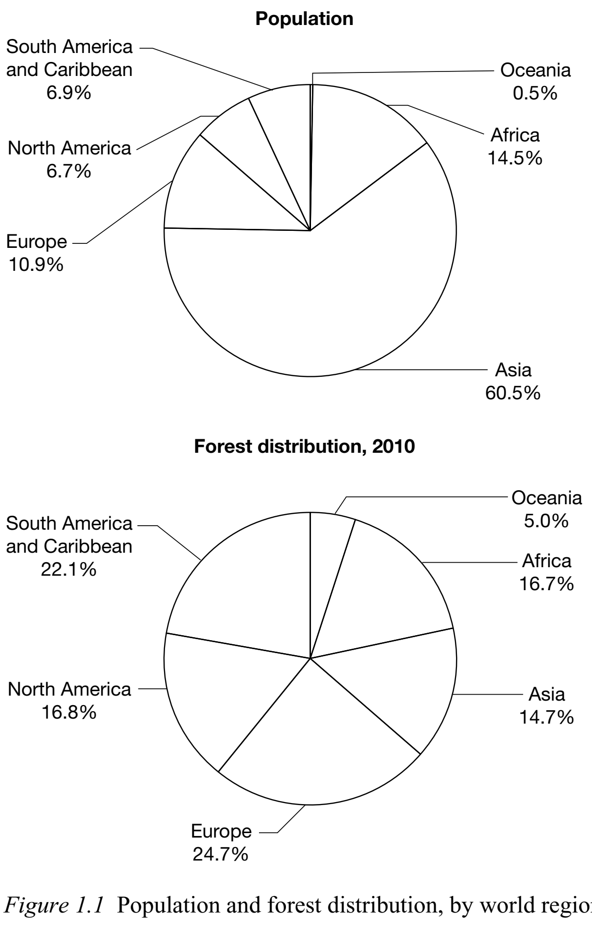

Figure 1.1 Population and forest distribution, by world region, 2010

Source: compiled from United Nations 2010; FAO 2010a: 15–45, 218–28.

ratio between forest area and people amounts to 0.6 ha per inhabitant and ranges from 0.1 ha in Asia, 0.7 ha in Africa, 1.4 ha in Europe and 1.5 ha in North America to 2.2 ha in South America and 5.5 ha in Oceania.

1.1.2 European forests

Data on the distribution of forest resources in Europe are based on reports to the Ministerial Conference on the Protection of Forests in Europe, using the following regional classification by country groups (FOREST EUROPE, UNECE and FAO 2011):

- Russian Federation;
- North Europe: Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden;
- Central-West Europe: Austria, Belgium, France, Germany, Ireland, Liechtenstein, Luxembourg, Netherlands, Switzerland, United Kingdom;
- Central-East Europe: Belarus, Czech Republic, Georgia, Hungary, Poland, Republic of Moldova, Romania, Slovakia, Ukraine;
- South-West Europe: Andorra, Holy See, Italy, Malta, Monaco, Portugal, Spain; and
- South-East Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Montenegro, Serbia, Slovenia, Former Yugoslav Republic of Macedonia, Turkey.

The forests of Europe comprise 1 billion ha, of which 85 per cent has been classified as available for wood supply. Half of the forest area is formed by coniferous forest stands and slightly more than one-quarter by broadleaf stands; the remaining part is mixed forest with varying combinations of coniferous and broadleaf species. Together with an additional 109 million ha of other wooded land, close to half (45 per cent) of the total European land area is forest and other wooded land.

Forests are unequally distributed over the European territory, and their distribution shows significant differences among European countries (see Table 1.2). The Russian Federation, for example, has 809 million ha of forests – approximately four times the combined forest area of the other European countries, amounting to 211 million ha. Three-quarters of Europe's forests, not including the forest area of the Russian Federation, are in the 27 member countries of the European Union (EU). Of the EU-27's total land area (420 million ha), forest and other wooded land occupies 177 million ha (42 per cent), and forest occupies 157 million ha, based on the FAO definition.

Forest cover expressed as a percentage of the total land surface varies among country groups. It is high in the Russian Federation (49 per cent) and in North Europe (52 per cent), at 35 per cent in South-West Europe, at slightly more than 25 per cent in Central-West and Central-East Europe, and lowest in South-East Europe (23 per cent). Other wooded land ranges between 1 per cent and 5 per cent of the country area in several country groups but is markedly higher in South-West

Table 1.2 Extent of forest and other wooded land in Europe, 2010

	Forest		*Forest area available for wood supply*		*Other wooded land*		*Total land area*
Region	*1,000 ha*	*% of land area*	*1,000 ha*	*% of land area*	*1,000 ha*	*% of land area*	*1,000 ha*
Russian Federation	809,090	49.4	677,204	41.3	73,220	4.5	1,638,139
North Europe	69,278	52.1	54,478	41.0	5,651	4.3	132,869
Central-West Europe	36,882	26.4	34,382	24.6	1,923	1.4	139,962
Central-East Europe	43,959	26.8	33,925	20.7	848	0.5	164,051
South-West Europe	30,795	34.8	24,839	28.1	11,496	13.0	88,475
South-East Europe	29,936	23.1	21,316	16.4	15,427	11.9	129,778
Europe	1,019,940	44.5	846,144	36.9	108,565	4.7	2,293,274
Europe without Russian Federation	210,850	32.2	168,940	25.8	35,345	5.4	655,135
EU-27*	157,194	37.6	133,262	31.8	19,810	4.7	418,613

Source: FOREST EUROPE, UNECE and FAO 2011: 18

*On 1 July 2013 Croatia became a member-state of the European Union (EU28)

Europe (13 per cent) and South-East Europe (12 per cent). The average forest area per inhabitant in Europe is 1.4 ha. More important than this average figure is the range, from a mean of 0.3 ha per inhabitant in Europe without the Russian Federation to 5.7 ha per inhabitant in the Russian Federation. Depending on the social and economic conditions of a country, population density, level of urbanisation, utilisation requirements and cultural traditions, the importance of forests for people varies in many ways (CE 1994: vol. 1, 532–3).

Total European wood growing stock has increased by 8 per cent from 106 billion m^3 in 1990 to 114 billion m^3 in 2010 (see Table 1.3a). Today, close to 80 per cent (82 billion m^3) is in the Russian Federation and 33 billion m^3 is in the other European countries. The EU-27 has 24 billion m^3. The annual increase of the growing stock during 1990 to 2010 for Europe as a whole was more than 400 million m^3 per year. High positive yearly change rates of wood growing stock, between 1.4 per cent and 1.8 per cent, have occurred in Central-East, South-West and South-East Europe, probably reflecting considerable land-use changes. In North and Central-West Europe wood growing stock increased between 1990 and 2010 by around 1 per cent per year, whereas only a small increase has been reported for the Russian Federation.

Carbon stocks in biomass in Europe's forested areas in 2010, measured in metric tons of carbon (MT C), are estimated at 46 billion MT C, with 37 MT C (80 per cent) in biomass above ground and 9 MT C (20 per cent) below ground (see Table 1.3b). Of the total biomass in forests, 70 per cent is in the Russian Federation and 30 per cent in other European countries. Carbon stocks in the EU-27 amount to slightly more than 20 per cent. For Europe as a whole, an annual increase of 0.3 per cent of carbon stocks in biomass has been reported between 1990 and 2005. For 2005–2010, the annual change rate is estimated to be 0.5 per cent. The major reason given for the observed changes is that growth in wood stock increased more rapidly than wood cuttings and other removals of biomass. Changes in land use from marginal agricultural areas to reforestation and natural regeneration of tree

Table 1.3a Wood growing stock, by European country group

Region	*Total growing stock in forest (million m^3)*				*Annual change rate (1990–2010)*	
	1990	*2000*	*2005*	*2010*	*Million m^3*	*%*
Russian Federation	80,040	80,270	80,479	81,523	74.2	0.09
North Europe	6,702	7,509	7,892	8,114	70.6	0.96
Central-West Europe	6,826	7,764	8,184	8,364	76.9	1.02
Central-East Europe	7,111	8,281	8,772	9,533	121.1	1.48
South-West Europe	1,722	2,222	2,332	2,484	38.1	1.85
South-East Europe	3,176	3,613	3,868	4,198	51.1	1.40
Europe	105,577	109,659	111,527	114,216	432.0	0.39
Europe without Russian Federation	25,537	29,389	31,048	32,693	357.8	1.24
EU-27	19,143	21,874	23,067	24,132	249.5	1.16

Source: FOREST EUROPE, UNECE and FAO 2011: 23

Table 1.3b Carbon stock in forest biomass, by European country group

Carbon stock in forest biomass, in million tons (MT C), 2010

Region	*Above-ground biomass*		*Below-ground biomass*		*Total biomass*	
	(MT C)	*%*	*(MT C)*	*%*	*(MT C)*	*%*
Russian Federation	26,000	56.4	6,500	14.1	32,500	70.5
North Europe	2,565	5.6	550	1.2	3,115	6.8
Central-West Europe	2,655	5.8	754	1.6	3,410	7.4
Central-East Europe	3,185	6.9	803	1.7	3,988	8.6
South-West Europe	835	1.8	247	0.5	1,082	2.3
South-East Europe	1,595	3.4	443	1.0	2,038	4.4
Europe	36,835	79.9	9,297	20.1	46,133	100.0
Europe without Russian Federation	10,835	23.5	2,797	6.0	13,633	29.5
EU-27	7,878	17.1	2,023	4.4	9,901	21.5

Change in carbon stock in forest biomass, by European country group, in million tons (MT C), 1990–2010

Region	*Carbon stock in biomass (MT C)*				*Annual change (%)*	
	1990	*2000*	*2005*	*2010*	*1990–2005*	*2005–2010*
Russian Federation	32,504	32,157	32,210	32,500	–0.06	0.18
North Europe	2,666	2,882	3,011	3,115	0.86	0.69
Central-West Europe	2,625	2,985	3,232	3,410	1.54	1.10
Central-East Europe	2,934	3,398	3,627	3,988	1.57	1.99
South-West Europe	773	972	1,014	1,082	2.07	1.35
South-East Europe	1,549	1,743	1,846	2,038	1.28	2.07
Europe	43,051	44,137	44,940	46,133	0.29	0.53
Europe without the Russian Federation	10,547	11,980	12,730	13,633	1.38	1.42
EU-27	7,806	8,782	9,317	9,901	1.29	1.25

Source: FOREST EUROPE, UNECE and FAO 2011: 27

cover of abandoned areas may be an additional explanation. Particularly in former socialist countries, reforestation of agricultural land was a long process.

1.1.3 Wood growth and wood harvesting

Net annual increment (NAI) is a critical indicator for assessing the potential of wood production under a sustainable wood-harvesting regime. The basis for its calculation is the gross increment of forest stands of different species under different climatic, soil and growing conditions from which natural losses (e.g. from drought, storms or disease) have been subtracted. NAI can be removed, through annual felling, or accumulated as standing volume, thereby increasing the total wood growing stock. The annual felling volume comprises the removal of wood, whether used by the landowner or sold in markets, plus the logging residue left in the forest.

Table 1.4 Net annual increment, annual felling and felling rates in Europe, 2010

Region	*Net annual increment (NAI)*		*Felling*		*Felling rate (%)*
	million m³	*m³/ha*	*million m³*	*m³/ha*	
Russian Federation	852.9	1.3	170.0	0.3	19.9
North Europe	237.2	4.6	181.1	3.3	70.9
Central-West Europe	261.0	7.8	172.4	5.0	65.0
Central-East Europe	98.3	5.6	114.2	3.6	57.2
South-West Europe	78.4	3.3	29.3	1.4	42.1
South-East Europe	23.9	5.9	16.9	2.7	46.9
Europe	1,551.7	1.8	683.9	0.8	38.9
Europe without Russian Federation	698.8	4.2	513.9	3.5	62.4
EU-27	619.7	4.7	469.3	3.7	64.2

Source: FOREST EUROPE, UNECE and FAO 2011: 52, 53

NAI in European forests is estimated at close to 1.6 billion m^3, of which 853 million m^3 (55 per cent) comes from the Russian Federation, 237 million m^3 (15 per cent) from North Europe and 261 million m^3 (17 per cent) from Central-West Europe. The forests of Central-East Europe (98 million m^3), South-West Europe (78 million m^3) and South-East Europe (24 million m^3) together contribute another 13 per cent in net annual wood increment (see Table 1.4). With 620 million m^3, the EU-27 countries have 40 per cent of the net annual wood increment of Europe. The annual area productivity (NAI) per hectare of forestland varies between 1.3 m^3 in the Russian Federation and 7.8 m^3 in the Central-West country group. North Europe (4.6 m^3), Central-East Europe (5.6 m^3) and South-East Europe (5.9 m^3) are in a middle range; the countries of South-West Europe (3.3 m^3) show a lower wood production potential.

The total European annual wood felling volume in 2010 amounts to 683 million m^3. Regions with an annual wood production of more than 100 million m^3 are the Russian Federation (170 million m^3, 25 per cent), North Europe (181 million m^3, 26 per cent), Central-West Europe (172 million m^3, 25 per cent) and Central-East Europe (114 million m^3, 17 per cent). South-West Europe (29 million m^3, 4 per cent) and South-East Europe (17 million m^3, 3 per cent) have a considerably lower production level. More than two-thirds of European wood production in 2010 (469 million m^3, 69 per cent) came from the EU-27. Several factors may explain differences in annual wood production at regional level: the biological productivity of the prevailing forest ecosystems, the physical site conditions (which determine logging and forest management conditions), demand (influenced by local habits and cultural traditions), technology in wood processing, production costs and competition in national and international markets.

A comparison between NAI and annual wood felling shows that only part of the production potential is currently used. In all regions, the felling rate (i.e., the ratio of harvest, or removals, to NAI) for 2010 was below the annual growth potential. North Europe reached a felling rate of 71 per cent and Central-West

Europe used close to two-thirds of the current wood increment. In the EU-27 countries, the felling rate reached 64 per cent of the annual growth rate. Elsewhere, the felling rate ranged from 57 per cent in Central-East Europe to 42 per cent in South-West Europe. The difference between potential removals and annual wood harvesting is particularly marked in the Russian Federation, where NAI in 2010 was estimated at 853 million m^3 and actual felling was 170 million m^3.

Reasons for the unused production potential include high costs for harvesting roundwood, inadequate market organisation, unsatisfactory logistics and insufficient processing capacity, and lack of demand for specific roundwood assortments and processed wood products. Other factors include long transport distances and lack of investment for sufficient infrastructure in remote areas. Because the ratio between the potential yield of wood increment and wood harvesting volume varies by country and region, more detailed analyses at the national level are needed to identify the precise reasons.

1.1.4 Forest vegetation and tree species

According to the global ecological zoning system used by FAO, Europe's forest vegetation mainly consists of temperate coastal and continental forest, boreal coniferous forest and, in tundra regions, scrub vegetation. Other vegetative forms include mountain forests in the temperate and boreal climate zones. In the southern part of Europe, Mediterranean and partly subtropical forest ecosystems are important.

Five broad zones of vegetation can be distinguished (Ellenberg 1996: 23–4):

– the Arctic zone, with vegetation consisting of treeless dwarf shrubs, grasses and tall shrubs;
– the boreal zone, with evergreen coniferous forests;
– the temperate zone, with deciduous forests that are green in summer;
– the vegetation in the area close to the Mediterranean Sea, with evergreen dry (sclerophyllous) woodlands; and
– the Pannonian-Pontic-Anatolian zone, with forest steppes, steppes and semi-desert areas.

The deciduous forest zone extends over Western, Central and Eastern Europe. It partly includes mountain forests in Southern Europe. Mixed oak forest is widespread in the Atlantic and sub-Atlantic lowlands, in the British Isles and on the continent from north-western Spain to Denmark and southern Scandinavia. It is found as well in sub-continental and continental lowland areas in Central and Eastern Europe. Mixed forest with beech and fir is common in lowland areas of Western and North-Central Europe, in the southern part of Central Europe and in adjoining regions to the south. At higher elevations, fir is often found in mixed forests. The Iberian Peninsula's thermophilic mixed oak forest comprises deciduous and evergreen oak species.

Each of the species of trees and shrubs that colonise different areas has its own ecological significance in those vegetation associations. Species forming frequent and extensive forest stands (Pott 1993: 104–5) include beech (*Fagus sylvatica*), spruce (*Picea abies*), fir (*Abies alba*), pine (*Pinus sylvestris*), pedunculate (English) oak (*Quercus robur*), sessile oak (*Quercus petraea*), hornbeam (*Carpinus betulus*), common birch (*Betula pendula*) and black alder (*Alnus glutinosa*).

Other frequent or locally predominant species that belong to this group are ash (*Fraxinus excelsior*), sycamore and field maple (*Acer pseudoplatanus* and *A. campestre*), mountain ash (*Sorbus aucuparia*), aspen (*Populus tremula*), wild cherry (*Prunus avium*), pubescent birch (*Betula pubescens*), brittle willow (*Salix fragilis*) and in mountainous locations larch (*Larix decidua*) and Swiss stone-pine (*Pinus cembra*). Rarer and locally occurring species include wych elm (*Ulmus glabra*), European white elm (*Ulmus laevis*), smooth-leaved elm (*Ulmus minor*), Norway maple (*Acer platanoides*), broadleaved and small-leaved lime (*Tilia platyphyllos* and *T. cordata*), white willow (*Salix alba*), black poplar (*Populus nigra*), wild apple (*Malus silvestris*) and wild pear (*Pyrus pyraster*), wildservice tree and whitebeam (*Sorbus torminalis* and *S. aria*), yew (*Taxus baccata*), dwarf pine (*Pinus mugo*) and mountain pine (*Pinus uncinata*).

1.1.5 Development of forest vegetation

Forests form a highly varied landscape mosaic in which natural and semi-natural associations of woodland species alternate with stands that have been intensively reshaped by human intervention (Ellenberg 1996: 38–9, 111–12). The spread of plant associations is determined by the different tree species' growth and site requirements, as well as by climatic vegetation zones and altitude. Important factors include geology and morphology, mean annual temperature during the growing season, thresholds for temperature, humidity and drought, the supply of nutrients and the water balance in soils. Forms of management have a strong influence on the spread and variety of species and on the naturalness of forest ecosystems.

The composition of forest vegetation in Central Europe today goes back to the effects of the Ice Age and subsequent processes of return and colonisation by flora and fauna (Lang 1994: 14–17). The Pleistocene Epoch – beginning approximately 2 million years ago – was marked by severe climatic variations. Colder periods (glacial, or cryomeric) alternated with warmer periods (interglacial, or thermomeric). During the ice ages, glaciers developed over large areas, covering Fennoscandia and the British Isles in the form of the Nordic inland glaciations. The glaciers spread into the Pyrenees, Alps and Carpathian mountains, as well as higher hilly areas. The glacial ice was as thick as 2,000–3,000 metres in some places.

The alternation of ice ages and interglacial periods led to far-reaching changes in the vegetation. When Central and Northern Europe was almost completely covered with glacial ice or with treeless tundra and steppe, the forests were pushed back into the South and South-East regions of the continent. Not all of the diverse species of woody flora that had been widespread in Europe before the start of glaciations were able to survive the displacement process and migrate back to their earlier range after the shrinking of the glaciers. Various evergreen hardwood trees were lost; conifer species that disappeared included Douglas-fir (*Pseudotsuga*), hemlock (*Tsuga*) and redwood (*Sequoia*).

The expansion of tree species following the most recent ice age led gradually to today's vegetation pattern. When one examines the development from treeless tundra and steppe to modern vegetation, typical phases can be distinguished (Küster 2003: 56–7). The results of pollen analysis in Central Europe show, for instance, the appearance of juniper and willow species and a gradual increase in pine and birch at the end of the Ice Age, between 12000 and 8000 BC (Mantel 1990: 41–2). The term *arctic* for this period indicates forest and brush vegetation similar to that on today's forest edges in Norway, Sweden and Finland. After this, birch and pine forests developed, with an increasing spread of hazel (8000–6000 BC). This was followed by development towards today's coniferous and deciduous species, as well as mixed oak woods (6000–400 BC). Overall, the various stages of development of the vegetation (boreal, Atlantic and sub-boreal) are typical for the change from a drier and more continental climate to warmer – and later warm and humid – climatic conditions. From 400 BC onwards, pollen analyses show a development towards various mixtures of beech, fir and spruce forests.

The natural developmental conditions of the vegetation make it clear that without human utilisation and intervention, large areas of Western and Central Europe would be covered with deciduous forest. This would correspond to the natural climatic conditions, prevailing soil conditions and distribution of tree species that developed following the Ice Age. With the exception of extremely wet or dry locations, beech has the strongest growth in sub-Atlantic climatic regions. The spread of hornbeam and oak species increases towards the east. Spruce, fir and other conifers are widespread in the mountains.

1.1.6 Influence of human settlement

The effects of prolonged, continuous and intensive human intervention are immensely important for the present forest vegetation in intensively used and managed landscapes (Konold 1996). At certain periods, such interventions consistently pushed the forest back. At other times, changes in the intensity of land use released agricultural areas from cultivation, leading to natural regeneration and afforestation. Today's distribution of forests and open areas is the result of alternating periods of forest clearance and regrowth. The contradictory effects of human activities on forest vegetation are due to economic and social changes interacting with the given natural preconditions, such as climate, topography and soil quality. Forests are cleared in locations with favourable conditions for settlement, agriculture and pasture; forest vegetation returns where the conditions for settlement and agriculture are not advantageous. The traces of earlier settlement and abandoned agricultural areas in forests are evidence that land use undergoes dynamic changes. Some landscapes still show their natural vegetation structure very clearly, whereas in others it can be recognised only indirectly.

The various stages of forest clearance and regrowth were of great importance for the distribution of open fields and forests even up to present times (Hasel and Schwarz 2006: 34–69; Mantel 1990: 58–70). In Germany, Austria and Switzerland, for instance, the medieval periods of forest clearance began in the eighth and ninth centuries and reached their climax in the twelfth and thirteenth centuries. At the end of this period and following the processes of population decline because of the plague, for example, large areas were again abandoned to forest. The distribution of forests and fields remained largely unchanged up to the beginning of modern history. Population decline due to wars, particularly the Thirty Years' War in Germany in the seventeenth century, reduced the need for areas of agricultural production.

A new period of forest clearance began at the end of the eighteenth century, promoted by liberalisation of land use and sale of state-owned land. Other important drivers were improvements in transport infrastructure, in particular from newly constructed canal and river networks. The Adrianople Treaty with Turkey opened the trade with cereals along the Danube River and wheat cultivation increased forest clearance. For instance, between the end of the nineteenth century and the middle of the twentieth century, more than a million hectares of forest disappeared in Romania. The expanding railway system brought forests and wood products closer to the increased prosperity and spread of cities. Almost at the same time, farmland was released for large-scale afforestation projects. The introduction of indoor feeding of livestock at the beginning of the nineteenth century, and slightly later the declining profitability of sheep farming due to imported wool, led to the abandonment of production areas. In the second half of the nineteenth century, imports of grain were another reason for a decline in the profitability of cultivating marginal land, which was consequently afforested or abandoned to natural succession.

With some interruptions, particularly during the periods of the First and Second World Wars, this development has continued to the present day. There has been an increasing concentration of agricultural use in locations where it is easy and profitable, with expansion of forests in hilly areas and mountainous regions. Increased agricultural production, open markets for agricultural commodities and competitive advantages in using large economic production units favour long-term average increases in forest areas in many countries of the EU. This process is particularly notable in mountainous regions, with changes in the distribution of forests and open fields. Altogether, the repeated alternation of clearance efforts and reforestation processes has led to the development of widely differing landscapes (Küster 1999). In regions of intensive agriculture, as well as in large cities and growing urban settlements, trees, woodlots and forests now occupy only a small part of their original area. In mountainous regions and in the Alps, by contrast, forests have remained a decisive structural part of space; these areas can still be described as genuine forest landscapes.

1.1.7 Private and public forestland ownership

The property rights structure in the forests of European countries was largely established during the course of the nineteenth century, when forestland was surveyed, mapped and entered in land registries. Continuity and increase of wood supply required considerable private and public efforts and investment, but long-term investment could not be obtained without security of tenure. The formal clarification of forest ownership rights is probably the most significant contribution of forest laws adopted during the nineteenth and twentieth centuries. Generally, the laws had a tendency to restrict or abolish usufruct rights and to transform collective tenure into clearly defined private and public landownership. Private property rights were legally registered, and forests still under collective tenure were divided among the users. In other cases, communal and state forests were confirmed or newly created. Quite often a combination of private and public tenures developed, characteristic of the prevailing forest ownership pattern in many European countries. The laws defined the landowner's wood production and management rights in using the forest as a productive asset for generating profit and income. They determined responsibility for maintaining collective uses in the public interest, such as access to forests and protective values in the mountains, which were important to a large part of the population. The distribution of property has changed substantially since then – both as a result of forest sales, new afforestation or forest clearance processes, and through political decisions and constitutional changes.

At the national level, there are large differences in the origins and current distribution of forest property, as well as in the regulation of use rights. In several regions, the majority of the forests are privately owned by farmers and other landowners, or by large industrial companies involved in the forestry and wood industry. In other regions, the forest is mainly communal property, owned by cities, rural local authorities or other public bodies. The characteristic form is a mixture of different types of property, with various proportions of forest being in private, corporate or state ownership. In Central and Eastern Europe, restitution of forest property that was nationalised before or after the Second World War to its earlier owners has led to extensive property changes since 1990 (Bouriaud and Schmithüsen 2005).

Forest soil and forest stands are production factors that may be used and managed by the owners, as determined by the existing regulations. Under a sustainable forest management regime, constitutionally guaranteed property rights and the principles of market economy give forest owners the primary responsibility for maintaining, managing and using forestland according to their needs and goals (Schmithüsen 2004a). They may carry out wood harvesting within the limits of an established annual allowable cut and perform the necessary silvicultural measures, such as replanting, tending and thinning, either by themselves or by external operators on the basis of use arrangements, forest management contracts or forest land leases. In Eastern European countries, forest owners' management rights are closely supervised by the forest authorities (Bouriaud *et al.* 2011).

Both private and public forest owners have an interest in wood production yields and harvests for generating revenue and profits from using forestland as a renewable economic resource. Owners in both categories also have a range of other interests and goals related to nonwood products, wildlife management and, generally speaking, other forest benefits. Public forest owners usually have concrete objectives as well as obligations to manage their forests to generate benefits from forest ecosystem services for their community and to the public in general. They may be engaged in extensive measures aimed at protecting development in mountainous areas, public infrastructure, such as roads and communication lines, or clean water resources; in providing recreational, sport and leisure facilities in cities and peri-urban forests; and in preserving valuable and rare biotopes and forest landscapes. Balancing wood harvests for material and energy markets and provision of other community services has been a goal of forest management in Europe for a long time. But the importance of all the roles of public forestland and the public's demand for a growing range of ecosystem services increased greatly during the second half of the twentieth century (Terrasson 1998).

In Europe, outside the Russian Federation, private forests predominate (Schmithüsen and Hirsch 2010). By contrast, the Russian Federation reports only public forest ownership, although usage rights for private individuals and companies exist and further developments in ownership distribution are anticipated. Table 1.5 shows the distribution of private and public forest in several European

Table 1.5 Forest ownership in selected European countries, 2010

Country	*Forest area*	*Private forest*		*Public forest*	
	1,000 ha	*1,000 ha*	*%*	*1,000 ha*	*%*
Austria	3,340	2,482	74	858	26
Belgium	678	377	56	301	44
Bulgaria	3,831	423	11	3,408	89
Czech Republic	2,657	616	23	2,041	77
Denmark	563	424	75	139	25
Finland	22,088	15,389	70	6,699	30
France	15,954	11,841	74	4,113	26
Germany	10,991	5,283	48	5,708	52
Greece*	3,752	845	23	2,907	77
Hungary	2,027	849	42	1,178	58
Iceland	30	22	73	8	27
Ireland	737	337	46	400	54
Italy	9,149	6,076	66	3,073	34
Latvia	3,290	1,635	50	1,655	50
Liechtenstein	7	1	14	6	86
Lithuania	2,150	784	36	1,366	64
Luxembourg	87	46	53	41	47
Netherlands	365	181	50	184	50
Norway	10,250	8,800	86	1,450	14
Poland	9,319	1,658	18	7,661	82
Portugal*	3,436	3,382	98	54	2
Romania	6,495	2,097	32	4,398	68
Russian Federation	882,310	0	0	882,310	100
Serbia*	2,476	1,224	49	1,252	51
Slovakia	1,807	827	46	980	54
Slovenia	1,253	962	77	291	23
Spain	18,172	12,836	71	5,336	29
Sweden	28,605	20,941	73	7,664	27
Switzerland	1,243	354	28	889	72
Turkey*	10,740	10	0.1	10,730	99.9
United Kingdom	2,881	1,922	67	959	33

* 2005 data
Source: FOREST EUROPE, UNECE and FAO 2011: 322

countries. Countries with a high proportion of private forests include the Nordic countries as well as Portugal, Austria, France, Spain, the United Kingdom and Italy. Countries with a more balanced distribution of private and public forest ownership include Belgium, Serbia, the Netherlands, Germany, Slovakia and Hungary. In Switzerland, the Czech Republic, Greece, Romania, Poland and Bulgaria, public types of ownership prevail. Turkey represents a special case, with practically the entire forest area being listed as public property.

Information on the categories and extent of forest ownership by world region is comparatively scarce; available data cover 2005. Table 1.6 illustrates characteristic differences in the distribution of forest property. At a continental scale, public ownership of forestland prevails. State ownership of forestland exists in various forms either directly managed by governmental forest services and other state agencies or used via forest concessions, forest land leases, timber licences and logging permits by private companies, small and medium-sized entrepreneurs and the local population. Other forms of public forest ownership comprise, for instance, communal, district and city forests used and managed by public entities, such as village and city councils. Customary and tribal forestland, usually under a framework of public regulations, is another example that falls under the category of public forestland. A recent international report (FAO 2011c) concludes that over the past 20 years, formal forest tenure arrangements in several regions of the world have been subject to important changes, with a significant move towards the devolution of ownership and management rights to households, smallholders, local communities, indigenous groups and other entities. This more diversified tenure system can contribute to improved forest management and secure local livelihoods.

1.2 Forest resources management

1.2.1 Renewable natural resources

A major step on the path towards a more precise understanding of sustainability as a comprehensive worldwide process has been initiated by the United Nations Conference on Environment and Development (the 'Earth Summit'), held in Rio de Janeiro in 1992. Precautionary and long-term measures and careful treatment of the available natural resources potential should become a fundamental element of behaviour and an independent value in our culture. Production and consumption cannot be separated from people's responsibility for their effects and consequences. The present economic value of benefits compared with the envisaged future disadvantages resulting from forest destruction, overuse and loss of biodiversity cannot be systematically reduced to the yardstick of the present day.

Forests are renewable natural resources, like the fertile soil layer, water, flora and fauna (Deegen 1997; Endres and Querner 2000; Neher 1999), with a capacity for self-organisation, interconnections with other natural resources, an ability to adapt to changing environmental conditions, highly complex ecosystem structures and functional variation and productivity (Newman 2000). Actual and potential uses of forests are determined, on the one hand, by economic needs and benefits,

Table 1.6 Forest ownership by world region, 2005

Region	*Information availability*		*Forest area by ownership*					
			Public		*Private*		*Other**	
	Number of countries reporting	*% of*	*1,000 ha*	*%*	*1,000 ha*	*%*	*1,000 ha*	*%*
Africa	49	97.0	634,571	94.6	25,710	3.8	10,487	1.6
Asia	46	100.0	475,879	81.5	107,520	18.4	640	0.1
Europe	45	100.0	897,463	89.6	101,817	10.2	1,847	0.2
North and Central America	22	99.4	432,306	61.7	222,799	31.8	46,040	6.6
Oceania	13	99.7	121,316	61.9	72,677	37.1	2,088	1.1
South America	13	96.5	641,505	75.3	180,602	21.2	29,552	3.5
World	188	98.6	3,203,040	80.0	711,125	17.8	90,654	2.3

* unknown and disputed ownership
Source: FAO 2010a: 122

social and political demands, and local, regional and worldwide requirements; and on the other hand, by multiple interactions among the flora, fauna, soils, water regimes and climate of the dynamically changing ecosystems (Dengler *et al.* 1990, 1992; Ott *et al.* 1997). Important aspects include the spatial differentiation of forests, the variety of plants and animals they contain and their ability to survive and adjust in a changing environment. Utilisation of the forest's natural potential by human beings gives rise to economic and cultural developments. In turn, human intervention, use and management have far-reaching and multiple influences on forest composition, vitality and resilience.

Forests are important to people for environmental, economic, social and cultural reasons and can be preserved, used and managed in many ways. As an economic activity, sustainable forestry has developed a utilisation regime for natural renewable resources that can be practised for extended periods of time, even over several generations, if the nature and extent of human interventions do not endanger the natural potential of the forest ecosystem.

To those who work cropland, pasture and forest, it is obvious that only as much can be sustainably produced and consumed as the existing resource potential allows. Caring for the soil, water, trees and forests and investing in increased productivity are prerequisites for sustainable land management. Careful use and management of forests is undertaken when the owners feel responsible for them. And it is only when landowners, users and concerned stakeholders shape their land management responsibly that sustainability in wood production and multiple forest uses can be achieved. This demands an understanding of the complexity of ecosystem processes and a consensus that today's consumption of benefits must account for future needs, benefits and values.

Where land use and development of land are at their most intensive, long-term regulation and political decisions determining sustainable production processes and social standards are most needed. Sustainable forest resources management requires investment and re-investment to maintain or create forest productivity and benefits, and it demands an adaptation of the intensity of uses to the natural potential of the forest ecosystem. Political and economic frameworks need to be created to allow conflict resolution among divergent interests of landowners, land users and other concerned stakeholders. Table 1.7 provides an overview of the many private and public interests in forests as a sustainable economic and social resource, a fundamental environmental resource, and an integrative part of the landscape. Forests are a remarkable cultural heritage for present and future generations.

Sustainable forest management is determined by specific economic, technological and political factors ensuring care of existing forest stands. This involves, in particular, reforestation and natural regeneration after wood harvesting, silvicultural measures of tending and thinning, and planning of long-term production processes based on an annual allowable cut. Precise economic goals, compatible with prevailing social norms and cultural values, and measures of interventions and monitoring of results need to be established so that the forest's contribution to social and economic welfare, in both the short and the longer term, can be determined.

Table 1.7 Private and public interests in forest conservation and preservation

Resource structure		*Type of interest*	*Examples*
Economic resource	Business and/or individual economic considerations	Products: lumber, other raw materials, food and agroforestry products	Raw timber, sawnwood, veneer wood, furniture production, Christmas trees, brushwood, tanning agents, forest fruits, nuts and seeds
		Products: wood for commercial use, industrial development and personal requirements	
	Direct and indirect economic considerations	Direct: jobs, added value from wood products, effects on foreign exchange balance	Economic sectors, trade, companies, enterprises
		Indirect: protection of infrastructure, recreation and tourism, contribution to regional development	Traffic routes, mountain regions, trade, commerce
Environmental resource	Protection against erosion and natural hazards	Soil, water and avalanche protection	Barriers against avalanches and mudflows, protection afforestation, torrent barriers, water production areas
	Regulator of water, air and climate	CO2 storage, CO2 sequestration	
Nature and landscape resource	Nature conservation, landscape conservation	Protection of biotopes and variety of species, maintenance of natural and near-natural landscapes, creation of ecological compensation areas	Near-natural forest cultivation, nature reserves, forest reserves, hiking trails, scenic lookout points, sites for open fires, fitness paths
	Biodiversity		
	Recreational and leisure uses	Areas of local recreation and tourism	
Cultural and social resource	Home country	Well-being, orientation, commemoration and attachment	Forest festivals, historic routes, traces of former settlements, ancient monuments, traces of earliest forest uses, forest colleges, guided forest walks, conservation and care of cultivated landscape
	Cultural monuments		
	History and fable	Free space, place for retreat, personal reflection and discoveries	
	Personal and social identity	Social integration, personal identification and tradition	

The principle of sustainability that shapes today's forest ecosystem management in Europe, North America and other continents is the decisive aspect involved in using forests as a lasting renewable resource. It presupposes that not only the extent of today's resource consumption but also the options and scope for future action must consistently influence decision making and entrepreneurial action. Which specific course of action can be regarded as sustainable in a particular case needs to be assessed in context. New economic and social demands as well as persistent cultural values determine which management options may be implemented now, and which options should be kept open for future generations.

1.2.2 Local forest uses

Already during the middle age and until the twentieth century, European woodlands and forests were used as a local resource available and accessible to the local population (Hasel and Schwarz 2006: 197–213; Mantel 1990: 89–90). Intensive and diversified uses of the forest were necessary for everyday life as an important source of food and an indispensable part of the rural economy. The forest represented an extension of agricultural production and an indispensable resource when food was scarce. Substantial income came from trade in products derived from the forest. Energy uses for wood always played a central role. Research on forest and environmental history, as well as many influences from earlier times still visible in the landscape, shows how important forests were and how their use changed with the growing needs of the population, new economic opportunities and progress in land management practices. Some changes took place within short periods of time and their effects on forest vegetation could be observed rapidly. Other interventions – often the more severe ones – could be assessed only over longer periods.

The supply of firewood and building materials at first came from forests close to villages, but more distant areas gained in importance with the growing demands of increasing population and expanding cities. Stands of deciduous trees, particularly species that sprout from stumps and could be regularly cut, were favoured. Sayings such as 'wood and weeds grow for everybody' or 'wood and suffering grow every day' refer to collecting firewood but also reveal the necessity of wood for daily uses. When wood became increasingly difficult to find, towns acquired logging rights and property titles to forests in the surrounding countryside or contracted for delivery of the large quantities of firewood and construction timber that were necessary every year.

Other forest products were collected on a large scale. Hazelnuts, wild fruits, berries, mushrooms, beech mast and acorns were widely harvested. Roots, leaves, bark and branches were used in pharmacopoeia or as dyes, as well as in the manufacture and cleaning of household utensils. Wood, hard or soft and from many species, was used by households and local artisans. Many people knew precisely the utility of diverse products from many different tree, shrub and herbaceous plant species. Collecting honey from wild bees and beekeeping in the forest took place to an extent that is difficult to imagine now. Used in food and drinks, honey was the only sweet substance available before the introduction of cane sugar and, later, sugar beets. Beeswax was necessary to fabricate candles and as raw material for manufacturing writing tablets, seals and other products. Beekeepers favoured species such as the lime-tree (linden) and willow as well as mixed stands of pine, oak, beech, aspen and hazel.

The practice of fattening pigs in the forest on acorns and beech mast was important in many regions for local food supply and for generating cash income. Its economic importance is demonstrated by the formerly widespread distinction of trees as fructiferous (*ligna fructifera*) or barren (*ligna infructifera*). The first group included oak species and beech, whereas the second group comprised mainly softwood species. In oak and beech stands, trees with large crowns promising rich fruit were systematically protected. The estimated annual fruit supply determined the number of pigs allowed to be driven into the forest in the autumn. Years with rich seed harvests were described as full mast years and augured well for winter food supplies. Years with only average or low seed production meant that farmers had to worry about how to survive the winter. In some regions, pig fattening in forests gained so much importance that the earnings resulting from it became a more important measure of its value than the earnings from wood use.

The intensive use of forests for pasture quite often led to soil compaction and caused long-term changes in forest sites. With the extent of the great forest domains reduced in favour of more profitable sheep rearing and with mountain forests transformed into cattle pastures, the foundation was laid for economic wealth and widespread foreign trade. Large-scale pasturage explains patterns of scattered forests, open pastures with copses or isolated trees, and even of the disappearance of forest vegetation over entire regions. One use of trees widespread in the Middle Ages, particularly in the mountains, that persisted until modern times was the harvesting of fodder by plucking leaves by hand or lopping with a billhook. Repeated over several years, this led to the formation of pollards. Impressively large ash trees with stumpy branches, sometimes seen in hedgerows and along streams, bear witness to their earlier use as sources of fodder.

Contrary to today's structured landscape, with its clear legal boundaries and distinct land uses, in the past the borders between forests, fields, meadows and pastures were often vague and shifting. Presumably, it would have been difficult for villagers and city dwellers to tell where the forest ended and where open land began. Did the woody vegetation where one gathered fruits and berries represent forest or fallow field? Were the cattle grazed in an open forest or a wooded pasture? Could one separate the forest from the fields when agriculture and forestry alternated regularly? The answer might have been that it was more important to separate the intensively used areas, such as home gardens and fields, from the common land, which was accessible to the community and where the villagers had a say in use and management (De Moor 2011).

The separation of agricultural and forestry production systems took place at the beginning of the modern period, reflecting efforts made by agricultural reformers – as early as the eighteenth century – to achieve higher yields in agricultural production by intensifying the management of arable land. These developments were encouraged on the forest management side, with efforts to limit damage to forest stands and create better conditions for increased wood production. Particularly in the case of agricultural land, but in forests as well, biotopes with a rich biodiversity that had flourished under less intensive land management systems disappeared or were reduced in size. Overall, the separation of arable land, pasture and forests was one of the most important factors that led to landscape changes. In mountain areas, and particularly in the Alpine region, there are still extensive areas where pasture and open woodland mingle, with areas of pasture featuring clumps of trees and individual trees. Because of centuries of grazing, the tree line visible in the Alps is lower in many places than would be the case in natural conditions. The responsibility for land-use decisions shifted from the communal level to higher, collective levels, such as governmental agencies and public forest services, in accordance with domestic economic and social development opportunities. In France, for instance, the Forestry Code of Colbert, adopted in 1669, had a considerable influence on launching extensive reforestation and management projects for providing timber for the navy and wood energy for pre-industrial commercial undertakings. Large land restoration projects were undertaken to prevent erosion and flooding.

1.2.3 Early industrial wood uses

Over the course of the centuries, various groups have influenced the way in which the forests' economic potential has been exploited. Severe conflicts arose between the local population and the landlords and sovereigns who laid claim to the forest for commercial and financial purposes. The conflicts were already evident in the late Middle Age and persisted right up to the nineteenth century, as seen in prolonged disputes over utilisation and property rights.

A decisive factor for pre-industrial uses was how the forest could be developed and accessed. Resin working, potash production and charcoal burning were activities that could be carried out in remote regions. Glassworks, saltworks, mines and metallurgy required at least a rudimentary infrastructure for gaining access to the forest. Roads were also necessary for commercial businesses and builders to harvest the large quantities of firewood and construction timber required for the expansion of the cities. The competition among the users of wood was influenced by logging and transport costs, the level of value added in individual products and the facilities for raft transport on rivers (Hasel and Schwarz 2006: 54; Mantel 1990: 209–29).

The production of charcoal was probably the most common use of wood as an energy source. Weighing only a quarter or a fifth of the wood from which it was made, charcoal was relatively easily transported from forests to cities and factories or to the nearest navigable water. It was used for cooking and heating and was indispensable for industry – mining, forges, metallurgy, saltworks, brickyards, lime kilns, potassium production and glass factories. During the nineteenth century, the use of mineral coal as well as the increased value of wood for new products made charcoal production uneconomical, though it survived in some remote areas to the twentieth century.

Tapping trees for gum was particularly common in the spruce forests of mountainous regions and in eastern pine forests. Resin and pitch were important trade goods for distant and overseas trading, used primarily in shipbuilding. For the inhabitants of remote regions, tapping was one of the few opportunities to earn money. The damage caused by tapping was enormous, however, and the increase in wood demand brought about by the growing population led to restrictions on tapping in the more accessible forest areas. In remote areas, tree tapping continued up to the First World War.

Large amounts of wood were burned to produce potash, which was used for textile bleaching, soap production and, above all, glassmaking. Potash production was common until the eighteenth century and did not lose its significance until the nineteenth century, when it became possible to develop the potash deposits. The ratio between raw material weight and product weight made potash production, like resin tapping, one of the first uses in virgin forests. In more densely populated areas where wood could be used more profitably, potash production was forbidden or restricted.

Extensive forest was the prerequisite for setting up glassworks. The glassmakers competed with the charcoal burners and the potash producers and migrated to other places when the forests wore out or when logs for firewood and lumber could be rafted downriver. After the Thirty Years' War, landlords encouraged the establishment of large-scale commercial glassworks to develop new sources of capital from their forests. Because the concentrated demand of such facilities caused the clear-cutting of thousands of hectares of forestland within just a few decades, glassworks are known in the history of forest uses as xylophages – 'wood-eating industries'. In the second half of the eighteenth century, glassworks gradually closed, for economic reasons. A decisive factor was recognition of the detrimental effects on forest stands and the disadvantages of this kind of resource exploitation.

The saying 'no wood, no boiling' indicates that salt production required a continuous supply of large amounts of wood: for heating the boiling pans, for barrels to pack and handle the salt, for the construction of pipelines, for brick and lime kilns and for installations related to salt mining. The rights for salt production were held by sovereigns as regalia and were exploited by them or conceded to entrepreneurs. The sovereigns, in turn, ensured the supply of wood by expanding forest property and use rights and by granting wood supply contracts to private entrepreneurs.

The amounts of wood required by mining and metallurgy were similarly enormous. Wood was used to shore up pits and galleries, to activate the machines and to process the ore. Before gunpowder was available, wood was needed for blasting: rock was heated and then shocked with cold water until it cracked. Wood and charcoal were used as reducing agents for smelting and for energy production in smelters, furnaces and in hammer works.

The constantly growing demand for wood for early industry led to more and more intensive prospecting for usable forests and to systematic exploitation of newly opened forest stands (Mantel 1990: 209–10). The heavy demand for wood from saltworks and metalworks in particular led to changes in forest vegetation. Deciduous and mixed forests declined, beech was replaced by spruce and the areas of distribution of other tree species, such as oak, pine and fir, were substantially affected. Complete clearance and inadequate regeneration practices had immense consequences for the forest. The reactions of independent observers, campaigns by local inhabitants and descriptions by users reporting cleared areas and overused forests are witnesses to these developments. Large-scale tree felling not only altered the areas exploited but also affected the structure and composition of those forest stands that developed in reforested areas or through natural regeneration.

In the seventeenth century, it became clear that the demand for feeding saltworks and the mining industry could no longer be met by expansion into new forest areas. The rapid growth in regional and international trade in roundwood and sawnwood led to increased demand and higher wood prices, with effects in many European forest regions. The sustainable forest management we know today can be traced to the importance of wood as an energy source and as a raw material for commercial and industrial development. The effort to meet the demand from the mining and smelting industry and to ensure the supply of building timber and firewood led to the introduction of forest inventories and to more efficient utilisation practices.

1.2.4 Origins of sustainable forestry

Local management customs and regulations aimed at preserving the forest as a local resource are found at an early period (Mantel 1990: 151–2, 164–5). The *Sachsenspiegel*, common law from *c.* 1330 consolidated in northern Germany, mentions the principle that woodcutting in the forest should be moderate and carried out without causing devastation. Similar requirements appear in the rules adopted by villages, towns, communal land associations and monasteries. Specific measures for regulating use included a ban on felling fruit trees and tree species that were important for local food supplies. Forests near settlements were reserved for local wood supply and were divided into coupes (rotation areas) to be used annually. Following use, the areas were to be protected from grazing until their regeneration was assured.

A typical form of firewood management was the coppice forest, based on regular cuttings of sprouting hardwood species like beech and oak. Coppice forests with standards made possible the simultaneous production of firewood from sprout shoots plus timber for construction from trees retained over several cycles of firewood harvests. Reports from the fourteenth to the sixteenth centuries indicate that regeneration was carried out, particularly of planted oak, and that first sowings with conifer seeds were undertaken.

The conditions needed to ensure long-term forest management were created in the seventeenth and eighteenth centuries in Germany, the Alpine countries and particularly in France (Grober 2010). Scientifically based models of wood production were developed that adapted the intensity of forest use to the long-term production capacity of forest stands (Zürcher 1965). Step by step, policy and law introduced principles of renewable natural resources use as we understand them today. During the course of three centuries, starting around 1700, forestry and wood processing became a productive sector of the economy, using a renewable resource in a sustainable manner as the basis of business activities (Schmithüsen 1998, 2008).

The term *sustainable* was used as early as 1713 by Hans Carl von Carlowitz, who worried about maintaining mining activities and wrote:

> The greatest art, science, diligence and institution of these countries will rely on the manner in which such conservation and growing of wood is to be undertaken in order to have a continuing, stable and sustained utilization, as this is an indispensable cause without which the country in its essence cannot remain.
>
> (Von Carlowitz 1713: 69; translation by the author)

In 1795, Georg-Ludwig Hartig formulated the principle of sustainable forestry in its classic intergenerational perspective, remarking in his textbook *Taxation [Assessment] of Forests*,

> It is not possible to think and expect sustained forestry if the wood allocation from the forests is not calculated according to sustainability [. . .] Any wise forest direction consequently needs to tax (assess) the woods as accurately as possible, but aiming at using them in a way that the descendants can draw at least as many advantages as the now-living generation appropriates.
>
> (Hartig 1795; translation by the author)

In 1841, Carl Heyer referred to the technicality of sustainable wood production in pointing out that sustainable forest management implies regeneration of logged over stands and maintaining the soil under forest cover.

During the twentieth century, the meaning of sustainable forest management expanded from wood production to include other forest uses and values. In a definition oriented towards modern business management (Speidel 1984), sustainable forestry means the ability of forest enterprises to produce wood, infrastructural (environmental) services and other goods for the benefit of present and future generations. It means maintaining and creating the entrepreneurial conditions necessary for a permanent and continually optimal fulfilment of economic and extra-economic needs and goals. Sustainability addresses the time perspective (permanent and continuing), the kinds of activities (maintaining and creating), the objectives (needs and goals) and the qualifying criteria (optimal fulfilment).

The long move to sustainable forest uses has led to a system of natural resources management that has kept its exemplary value. It is based on scientific models that adjust harvesting intensities to the long-term potential of forest sites, species composition, age classes and forest stand structures. The principle of sustainable wood production was implemented by applying these models over large areas and eventually in all forests. In regions where oak and beech forests dominated, the coppice-with-standards system was a typical example of systematic management on a large scale; in use since the sixteenth century, it remains an important method of management and is still used in France. In Germany and Switzerland, the numerous forests where the system was once practised were converted into high forest from the mid-nineteenth century onward.

Most important, however, were the regeneration of forests over large areas and the management of uniform stands. In the plains and lower mountains, the introduction of sustainable wood production during the nineteenth century quite often favoured an organisation of stands by predetermined periods of rotation, allowing regeneration of clear-cut areas. Seeding of conifers and large plantations of spruce or pine permitted afforestation of exploited and devastated land where natural regeneration was unlikely. In general, conifers were systematically planted because they corresponded to the economic aims of the time: the thinning and final felling of even-aged stands allowed a rapid increase in wood production. In the Alps, and to a lesser extent in other mountains of Central Europe, selective logging was practised with natural regeneration. These practices have since evolved towards various forms of close-to-nature silviculture based on natural regeneration, such as selection forest harvesting.

The expanding use of mineral coal by the mid-nineteenth century and of fossil fuel during the twentieth century had major consequences. The diminishing pressure on wood as an energy source radically modified the conditions under which forests would be used for industrial and economic expansion. It was a decisive element in the passage from locally regulated logging to a modern forestry sector based on the principle of sustainability, in which the intensity of felling is adjusted to the long-term production potential of forest stands and sites. Silvicultural techniques to ensure regeneration by plantation or sowing, natural regeneration, tending and thinning of young stands, and species selection according to prevailing site conditions have advanced progressively. A modern forest economy, which has developed in successive stages, thus provides an increase in wood production, maintains or increases soil fertility, maintains biodiversity and provides protection and recreation services in various combinations.

Methods of regulating sustainability included an area allotment system (*Flächenfachwerk*) that divided the forest into sections for annual wood harvesting. To balance different ratios of wood supply by area, the volume allotment method (*Massenfachwerk*) was then introduced. In this method, the usable total growing stock was divided according to the planned rotation period. More modern methods include management regulations based on the annual increment of forest stands and procedures such as the control method, in which the sustainability adjustment is based on periodic assessments of accumulations of growing stock. The decisive aspect of the transition from local management regulations to sustainable large-scale forest management was recognition that forest areas could be used permanently as renewable resources for efficient commercial or industrial economic production. The industrial success story of modern forestry and wood industry development begins with the ability to secure a sustainable supply of raw material while maintaining or increasing the productive capacity of the forest resource. This process illustrates how similar problems arising in the management of other renewable resources can be solved.

1.2.5 Sustainable wood production

Sustainability of wood production is the foundation of forestry and a central principle for entrepreneurial forest activities. It means the establishment of annual harvest quantities in relationship to the yield capacity of forest stands. This depends, in particular, on annual increment, available volumes of growing stock, soil fertility, tree species composition and age structure. Sustainable production requires ensuring forest regeneration, tending, thinning and complying with the conditions required for maintaining stable, healthy and productive forest stands. For forest owners and companies, earned income and profit, financial balance and liquidity, and maintenance of the company's business assets represent critical management control data. Of particular importance are the volume and value of the growing stock, variety of tree species and future production and management options. From a macroeconomic point of view, secure jobs, added value, export earnings and maintenance of the necessary infrastructure are important.

Today's definition of sustainable wood production adds the principle that the management of this renewable natural resource should have a largely neutral production and consumption cycle in terms of carbon dioxide (CO_2) emissions. That is, forestry should make a specific and important contribution to a reduction of greenhouse gases (GHGs). Compared with fossil energy sources, the use of wood to produce energy has the advantage that during the burning process only as much CO_2 is released as was bound to the wood substance by assimilation during the tree's prior growth. By increasing the rotation period or increasing the average volume of growing stock over longer periods of time, CO_2 from the atmosphere can be bound in the form of wood, leading to carbon storage. In the case of forests that are already heavily stocked, only limited additional storage is possible. The decisive element here is that the growing stock and growth can be used sustainably.

Wood used as a highly versatile raw material has a high substitution effect in comparison with construction materials produced with large inputs from fossil energy sources (e.g. steel, ferro-concrete, aluminium, plastics). As a system based on largely closed energy and material cycles, sustainable wood production needs to be assessed above all in terms of environmental and renewable resources consequences. The production of wood from sustainably managed forests is making a noteworthy and tangible contribution to sustainable development, and it will do so to an increasing extent in the future (Söderlund and Pottinger 2001).

Since the beginning of the nineteenth century, when the long period of forest overuse came to an end, growing stocks and annual increment in Europe have been constantly increasing, thanks to highly developed and efficient forestry practices. Compared even with a century ago, a considerably larger volume of timber and wood energy can now be used annually. European forest management is characterised by forests in which relatively small logging areas are managed in an increasingly natural way. The aims pursued and the procedures used take account of local conditions, the potential of native tree species and the development of the prevailing forest cover. This type of management maintains mixed forests that correspond to natural species occurrence and offers multiple long-term options for wood production.

European forestry – based on comparatively long rotation cycles and proven silvicultural practices: both replanting and natural regeneration – can use its competitive advantages in marketing sustainably produced wood and the products manufactured from it. The demand for processed forest products is determined by technological and price competition in national and international markets. Decisive factors in the sales of Europe's processed wood products are entrepreneurial innovations, rationalisation, product diversification and integrated production and marketing chains.

Worldwide, roundwood production, as recorded in international FAO statistics, increased steadily by around 40 per cent, from 2.5 billion m^3 roundwood in 1964 to 3.5 billion m^3 in 2011 (see Figure 1.2a). About half the world's roundwood production is used as wood fuel, including wood for charcoal.

Annual roundwood production in Europe, including Russia and the former Soviet Union, increased by close to 90 million m^3 between 1964 (692 million m^3) and 1990 (778 million m^3), or by about 10 per cent (see Figure 1.2b). During the following years, production slumped to less than 500 million m^3, primarily because of restructuring in the economic and market system caused by the dissolution of the Soviet Union (World Bank 1997: 41–2, 185–6). Roundwood production in the Russian Federation fell dramatically between 1991 and 1996, from ca. 300 million m^3 to ca. 100 million m^3. Following a period of stabilisation, Russian production gradually recovered and increased – to 143 million m^3 in 1999 and to 207 million m^3 in 2007 – but moved down again in 2009 to 151 million m^3. However, there is considerable uncertainty about Russian removals statistics, which are based on reporting by forest management units and not on independent monitoring data.

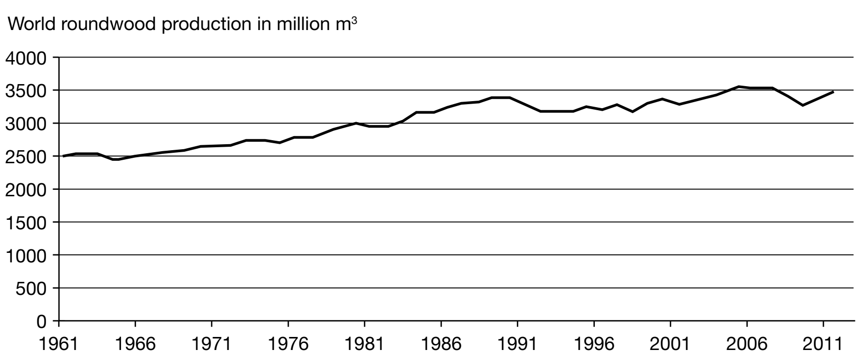

Figure 1.2a World roundwood production, 1961–2011

Source: FAOSTAT 2011

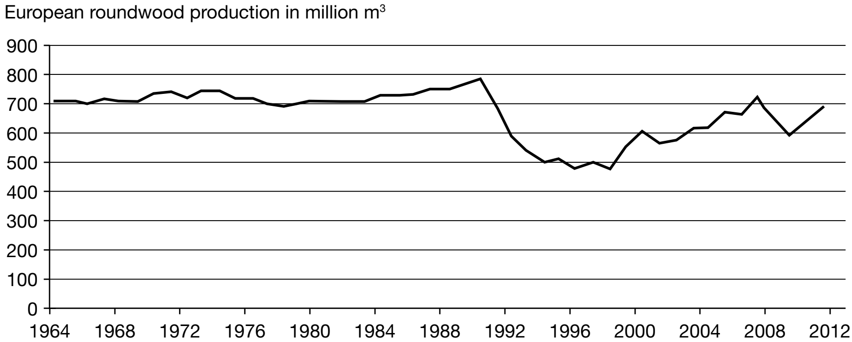

Figure 1.2b European roundwood production, 1964–2011

Source: FAOSTAT 2011

For Europe as a whole, roundwood production returned to earlier production levels. For 2007, production in Europe including Russia was reported at 720 million m^3, followed by a reduction to 597 million m^3 in 2009. In 2011, it had reached again close to 700 million m^3 (see Annex A.1). Around three-quarters of the annual European production (80 per cent in 2007, 76 per cent in 2009) is industrial wood for sawn and veneer logs, pulpwood and other industrial purposes.

1.2.6 Multifunctional forest management

Sustainable development is the overarching principle and the benchmark for judging to what extent the forest sector and forest management, like other land management sectors, contribute to economic and social welfare and to an environment that benefits present and future generations. The implications are far-reaching: one has to understand the regionally and locally differentiated interactions between society and forests, the dynamically changing social and cultural meaning of forests, their physical potential for providing different combinations of goods and services, and the political and economic conditions for maintaining stability and biodiversity under alternative management systems.

Today's dynamic conception of sustainability in forest management is multifunctional – that is, it is related not only to wood production but to all forms of uses and their effects on forest ecosystems. Wood production remains a focus of forestry, but managers must also maintain the forest's protective effects on settlements and communication routes; provide forest benefits for recreation, leisure and tourism; protect biodiversity and soil fertility; prevent soil erosion and natural calamities; and protect groundwater and water catchment areas. Several important management objectives overlap, requiring a management approach that takes into account multiple production and preservation goals at different geographical scales. Cultural values of forests and traditional knowledge of forest uses are other important aspects of using and managing forests (IUFRO 2006).

The principle of multiple-use management makes high demands on the professional abilities and foresight of forest owners and land managers. It involves balancing often-contradictory interests in forest resources protection and conservation with the production of goods and services. Forest management practices need to be flexible and adaptive to social preferences resulting from changes in demand, new needs and values, prevailing production costs and new technologies.

The concept of priority functions determining alternative management strategies in using a particular forest area allows for a more specific approach. Distinguishing priority functions is necessary whenever several important user interests overlap and consequently lead to conflict in natural resources management. It allows prioritisation of forest management measures that need to be undertaken, limits or prohibits interventions that are incompatible with the established land-use priorities, and provides, for instance, transparent evidence of performance in preserving stability and resilience of protection forests (Frehner *et al.* 2005). Priority functions may be assigned to entire landscapes and watersheds, to specific units – such as terrain divisions, drainage slopes, forest sites and biotopes protected by environmental law – or to classified areas under a specific land-use and management regime.

Forestry is a complex interplay between the potential of today's forest areas and the changing requirements and needs of forest owners, other users and stakeholders and the public in general (Kant and Berry 2005a; Kant *et al.* 2008). This dynamic, along with new economic and technological conditions, is determined by landowners' objectives and by other private and public interests in the use of the forest. Forests have importance as a renewable economic resource for the production of timber and other forest products, as a valuable environmental resource, as a natural and landscape resource and as a cultural resource. Several interest groups thus seek to influence forest management, often with conflicting expectations and requirements and with different views regarding the value of the associated social benefits. For forest owners and inhabitants of rural areas, trade and industry, timber production, financial returns and jobs are important. At the national level, production levels and competitiveness are decisive for the wood-processing industry. For residents in mountainous regions, forests, above all, represent protection from natural dangers (risk reduction) and potential for tourist development. For the inhabitants of cities, the forests primarily represent open spaces for recreation, leisure activities and relaxation.

1.2.7 Forest ecosystem management

Sustainable forest management, as practised today in European countries, has a strong foundation in forest ecology (Dupuy 2005). Close-to-nature forestry practices are used as a land management strategy, allowing adaptation to changing societal values. Favouring flexible and long-term production cycles and relying to a considerable extent on natural site factors, these practices contribute to preservation of biodiversity, varied ecosystems and diversified landscapes and leave options for alternative uses and new developments. Acknowledging economic necessities and multiple social and environmental demands, multifunctional and close-to-nature forest management offers a flexible range of land-use options for the future (Anderson *et al.* 2004). By the end of the twentieth century, Europeans and North Americans had embraced multiple-use forestry to meet the complex demands of their societies. Both continents are now revisiting forest management because the economic, political and social context has changed (Le Master and Schmithüsen 2008; Sample and Anderson 2008). The knowledge gained from different approaches to forest management in Europe and the United States helps explain forestry development in other regions, especially in the context of the world's boreal forests.

More than a century ago, Europe and the United States approached forest management quite differently. Europe's degraded forests were being replanted and managed for sustained yields of timber through strong forest protection laws and conservation programmes imposed by authoritarian governments. In the north-eastern part of the United States, where most of the population lived, large parts of the forest had been cleared for agriculture. The western part of the country still had vast tracts of untouched timber. In the country's democratic capitalist culture, conservation movements were gaining importance and beginning to have an effect. Preserving of large tracts as wilderness was inspired by a new appreciation for the uniqueness of untouched nature as the origin of human civilisations and by a 'land ethic' in which wilderness preservation was an important goal in itself (Leopold 1949). Two different kinds of conservation concepts developed. One favoured the preservation of 'wilderness', and the other sought the sustainable production of timber resources as well as soil and water protection. An important pillar of the developing land and nature preservation movement was the creation of the national park system starting with the foundation of the Yellowstone national park in 1872 and the establishment of the national park service in 1916.

The concept of sustained-yield forest management was transferred from Europe to the United States at a time of national concern over the possibility of a timber famine. However, the underlying assumptions of European sustained-yield wood production did not fit American circumstances at the time (Pinchot 1998). Neither land nor timber had been scarce, even if transport distances from forests to the north-east were becoming longer. To what extent demand for wood would grow was not known, and standards for forest management were uncertain. On the other hand, in the middle of the nineteenth century, wood was the principal construction material and energy source in the United States, and large forest areas were being cleared in a kind of forest mining, with no thought to reforestation. Local timber shortages were becoming increasingly frequent. A real concern was whether a regional or national timber shortage would limit economic growth. Sustained-yield forest management addressed that concern: if it were applied, its proponents said, timber supply would not be a problem.

A second pillar for the protection, management and sustained use of United States federal forestland was the 1891 creation of the forest reserves. In 1905 the administration of the federal forest reserves was transferred from the secretary of the Interior to the Secretary of Agriculture, and the US Forest Service was established, with Gifford Pinchot as its chief. In 1907 the forest reserves were renamed the national forests. In less than 20 years, through several incremental changes in policy, forestry in the United States had taken a significant turn towards sustained-yield forestry as practised in Europe (Le Master and Schmithüsen 2008: 285). Management of the national forests was largely custodial until the mid-1940s. In the country's West, control of wildfire on national forests was a major – and largely successful – activity. In the East, the challenge was reforesting cutover forest and abandoned farmland that had been acquired by the federal government. During the first half of the twentieth century, the science of forestry developed in the public sector and expanded to the private sector; professional foresters' silvicultural and management planning expertise increased. A prevailing notion was that by maintaining a continuous supply of timber and protecting the basic productivity of the soil, a broad set of forest values would become available.

The Multiple-Use Sustained-Yield Act of 1960 (74 Stat. 215) marked a major change in management of the national forests in the United States. It determined that equal and active consideration be given to five renewable surface resources, namely (in the order they appeared in the statute) outdoor recreation, range management, timber, watershed and wildlife and fish. The Act directed that these resources be 'utilized in the combination that will best meet the needs of the American people' (sec. 4(b)). The national forests were to be actively managed for multiple-use objectives. Further, the Act stipulated that the five renewable surface resources produce high yields that could be sustained in perpetuity without impairment of the productivity of the land. National forest planning processes served to sharpen the debate over sustainable forestry. Biological expertise was necessary, but planning also required economic viability and social responsiveness. Hence, national forest plans had to take into account local economic and social systems to gain public support and reduce land-use conflicts. Three characteristics of sustainable forest management were identified: it had to be ecologically sound, economically viable and socially responsible.

Another transition occurred in the 1990s, when multiple-use, sustained-yield management evolved into ecosystem management. One essential difference between the two strategies is that the former is oriented largely towards resources while the latter is based on ecosystem structure and functioning. A second difference is ecosystem management's greater emphasis on protection of biodiversity. A third is the application of adaptive practices in managing ecosystems based on monitoring and research. Sustainable forest management in the United States, as in Europe, means using the forest in such a way that a variety of needs, benefits and values can be taken into account, maintaining natural, stable and productive forests and allowing protective effects, wood production and recreational use in various combinations. Forms of management that ensure preservation of biodiversity and genetic resources are fundamental for the ability of forests to adapt to changing environmental conditions and for effective protection of nature and the countryside (EEA 2008).

Several terms have been used over time, each putting a particular emphasis on the meaning of sustainable forestry (Le Master and Schmithüsen 2008: 298):

- Forest management: the practical application of biological, physical, quantitative and qualitative information required for implementing managerial and political principles related to the use and regeneration of forests to meet specified economic goals and social objectives, while maintaining the productivity of the resource.
- Sustained-yield: managing a forest to achieve and maintain a balance between timber stock, growth and cutting.
- Multiple-use, sustained-yield forest management: a strategy focusing on sustained production of multiple resource outputs as determined by economic demands and social values to best meet the needs of landowners, forest users and the public.
- Forest ecosystem management: a strategy guided by explicit goals, executed by policies, protocols and practices, and made adaptable by monitoring and research based on the best available understanding of interactions and processes between human activities and forest ecosystems necessary to sustain the composition, structure and multiple functions of forests over the long run.
- Sustainable forest management: the practice of meeting forest resource needs and values of the present without compromising the similar capability of future generations.

The term *forest ecosystem management* was coined in North America and is now readily accepted in Europe and used in a general manner at world scale. Its definition, as adopted by the Society of American Foresters (1998), follows the broader system definition of the Ecological Society of America. It represents the comprehensive and integrative concept for what is meant when speaking of multifunctional and lasting uses and preservation of forests. It places the meaning of sustainable forest management and sustained wood production as it has developed in Europe into the overall perspective of maintaining the natural resource base in a holistic understanding of different land-use alternatives and the broader context of forest landscape ecology (Li *et al.* 2011). It emphasises the overall goal of protecting the environment and improving the quality of life for present and future generations. It encompasses meaningful and comprehensive research and captures more closely the interactions among man, his natural resource base and his physical and biotic environment.

Ecosystem management is in fact the central theme of enduring and wise use of forests, building on the legacy of the past and providing opportunities for the future. It stimulates an integrative approach to gaining more knowledge about the interactions among individual decision making, markets and economic value creation, and social and political systems on the one hand, and ecosystem processes and global environmental change on the other (Barbour and Skog 1997; Peterson and Maguire 2005).

A report of the Ecological Society of America on the scientific basis for ecosystem management provides a comprehensive overview of the dimensions involved (Christensen *et al.* 1996: 665–6):

- Sustainability: the intergenerational maintenance and preservation of the variety and productivity of ecosystems.
- Setting of goals: specification of the processes and outcomes that will ensure sustainable ecosystem management.
- Sound ecological models and understanding: relevant scientific research at all levels of ecosystem organisation, functions and patterns.
- Complexity and connectedness: the biological diversity and structural complexity that strengthen ecosystems against disturbance and maintain their genetic resources, allowing adaptation to long-term change.
- Dynamic character of ecosystems: recognition that change and evolution are inherent in ecosystems and that management should avoid any particular state or configuration in dealing with specific ecosystems.
- Context and scale: the wide range of spatial and temporal scales at which ecosystems operate, and the behaviour of an ecosystem at a given location as affected by surrounding systems. There is no single appropriate scale or time frame for any form of ecosystem management.
- Human influences as ecosystem components: the importance of human influences and decisions that help achieve sustainable management goals.
- Adaptability and accountability: the provisional nature – incomplete and subject to change – of current knowledge on ecosystem functions, and the necessity of research and monitoring.

As we move from concepts to implementation of sustainable ecosystem management practices, the following steps need consideration:

- Sustainable strategies for the provision of ecosystem goods and services start with an assessment of the levels of commodities and amenities that are compatible with the physical and biological potential of the particular ecosystem.
- Because management jurisdictions are different from ecosystem boundaries, sustainable ecosystem management must be based on a consensus among stakeholders and use coordinated decision-making processes.
- Whereas goal setting and implementation processes occur on a short- or medium-term temporal scale, ecosystem management processes require long-term perspectives in planning and commitment.
- Successful ecosystem management requires adaptive planning and implementation processes for dealing with uncertainty. Democratic principles, scientific analysis, education and institutional learning increase the understanding of ecosystem processes and the consequences of management interventions. They contribute to improving the quality of data required for planning and monitoring of results.

The different approaches to natural resources conservation and management of forests, wildlife, water and soils in the United States during the twentieth century shared some common aspects (Meffe *et al.* 2002: 59–63). Traditional utilisation of renewable natural resources emphasised commodities and extraction, sought equilibrium between utilisation rates and resource potential and used concepts of carrying capacity and logistic growth models. It focused on specific resources, areas and sites, employed predictable and controllable utilisation strategies often conceived by public resource management agencies, aimed at resolving factual conflicts between alternative utilisation options and mediated social and political conflicts among controversial stakeholder interests. Ecosystem problem analysis and management strategies, on the other hand, seek a balance among commodities, amenities and ecological integrity. They are more systematically concerned with the dynamics and resilience of the ecosystems; adopt a contextual view taking into account uncertainty, dynamic evolutions and flexibility; work towards solutions through discussions and exchange of reasoned arguments among stakeholders; and privilege consensus building, multiple issues settlement and partnerships.

During the past 50 years, both North American and European forestry have evolved towards integrating the fundamental elements of ecosystem science in their strategies and policies through silviculture, management planning and forest utilisation. The concept of ecosystem management, with its comprehensive perspective of time and space, now underpins forest and landscape management practices. Sustainable uses of renewable natural resources require continual integration of the ecological context with its physical elements, processes and structures; the socioeconomic context, determined by social values, interests and responsibilities; and the institutional context, determined by law, policy and a public regime for solving problems at local, national and international levels (Meffe *et al.* 2002: 66–9).

Looking at the pressing problems worldwide and at the continental level, we see the imperative of bringing together the sciences of sustainable forestry and of ecosystem management so that we can benefit from an exchange between scientific knowledge and research experiences. Another important point is that land managers and policy makers need to think in terms of multiple ecosystems, rather than single forest ecosystems. Forest management is no longer concerned only with forests, but with cross-boundary effects, such as nitrogen deposition, influx of marine nutrients into forested systems through salmon migrations and the effects of forest clearance on coasts and inshore fisheries.

1.3 Wood-processing industry

1.3.1 Structure of the sector and development of consumption

Throughout the world, some 800 to 1,000 species of trees are exploited commercially and industrially, although the number of frequently used species is more limited, perhaps 30 to 50 (Begemann 1994; Sell 1997). Production and processing outputs include products made of solid wood, composite wood products and pulp, paper and paperboard. (For relevant literature on major wood product groups, see Bodig and Jayne 1993; Kurjatko *et al.* 2006; Lohmann *et al.* 2007; Morén *et al.* 2010; Niemz 1993, 2008; Society of Wood Science and Technology 2008;

Teischinger *et al.* 2010; U.S. Forest Service 2010; Wagenführ 1999; Wagenführ and Scholz 2008; Walker 2007; Walker *et al.* 1993.)

Wood processing is an important sector of the economy that encompasses production areas, trade channels and small and medium-sized enterprises as well as large, intercontinental and global companies. Activities involved in wood production and processing can be classified according to the material flow along the value-added chain. There are marked differences among the European countries in terms of both production of timber and processed wood products. In understanding the role of national wood product markets, the international trade flow involving exports and imports of large quantities and value of wood-based products need to be taken in account.

Figure 1.3 illustrates the structure of the material flows in the wood-based forest sector and the consecutive steps from roundwood production and wood-based industrial processing to final sales markets with end-consumer products.

Sustainable wood production by forest owners and forestry enterprises includes a range of silvicultural measures, forest management planning, wood harvesting and transport to processing units.

Wood for industrial processing and for bioenergy production (fuelwood), in many specialised assortments and dimensions, is delivered to roundwood markets by forest owners and specialised forestry enterprises. Wood particles and wood fibre from residue produced in intermediate processing stages are sold and used by other industries.

Primary areas in industrial utilisation of industrial roundwood are the production of coniferous and nonconiferous sawnwood; wood-based panel production providing technically homogeneous working materials; and wood pulp for paper and paperboard, produced through thermal and chemical transformation processes in large industrial units. Bioenergy, wood fuel and charcoal producers and, increasingly, new production technologies of wood chemicals are another important segment of the industry.

A second processing level for delivering wood products to industry, artisans and do-it-yourself shops involves production units such as planer mills for further processing of sawnwood, impregnating factories, producers of building components, producers of structural laminated wood, parquet makers and window and door manufacturers.

The third output level is the manufacture of products for final consumption, such as producers of writing and sanitary paper; furniture makers; wood packaging and pallet producers; manufacturers of wood articles and kitchen installations; joiners and carpenters; home renovation companies; wood component makers; parquet layers; and roofing enterprises.

Heat, electricity and biofuels are other products sold in end consumer markets. Textiles and food and cosmetic additions for which wood cellulose, hemicellulose and lignin and other wood chemicals extracted by distillation from solid wood may be used are to be considered as well.

Trading and sales companies intervene at every stage of the value-creation chain. They form a complex network of distribution channels between different

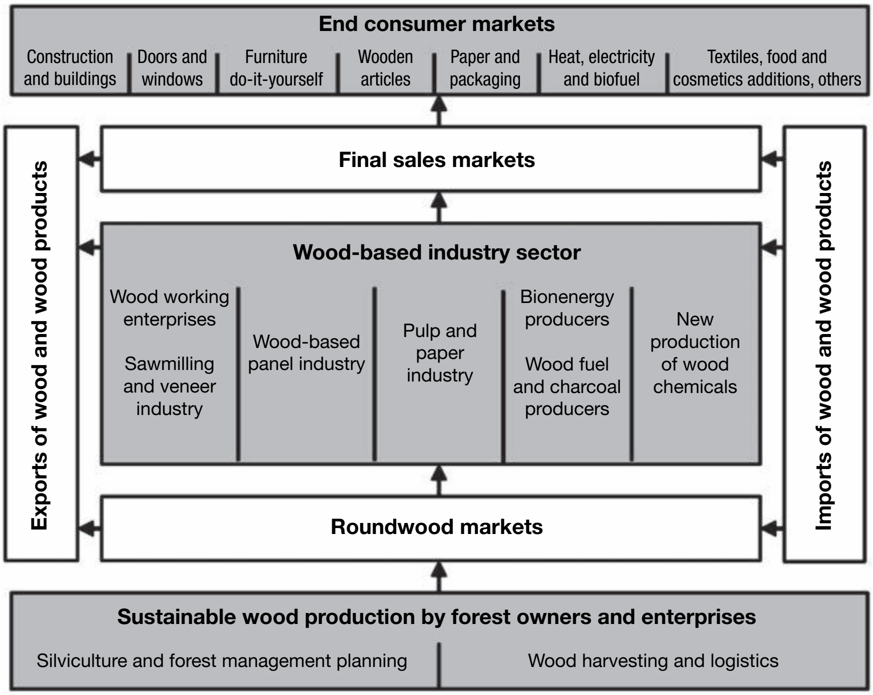

Figure 1.3 Material flows in the wood-based forest sector

industrial production lines or delivering final products and services to the end consumer.

Wood's natural polymers (i.e. cellulose, hemicellulose and lignin) and chemicals are other components for creating value added in the wood-based sector. A considerable proportion of tree biomass is lignin, a complex natural substance that binds tree fibres together. Lignosulfonates recovered from sulphite pulping liquor and its derivates are used in considerable quantities in cleaning compounds, insecticides, cement, ceramic products and cosmetics. Other wood chemicals with useful properties are derived from tree species containing specific substances; turpentine, for example, is recovered from resinous raw materials. Some wood chemicals are products or by-products from wood pulping. Others can be extracted through distillation processes from solid wood. Another possibility of value added is the recovery of chemical applications in composite processed materials or in recycling post-consumer products. Applied research and development from specialised scientific institutes is needed to make full use of wood at an industrial scale, develop innovative production processes and create marketable new products.

Notable differences among the main wood products groups have occurred in the past half-century. The worldwide development of consumption over time in the main branches of the wood-processing industry is shown in Figure 1.4.

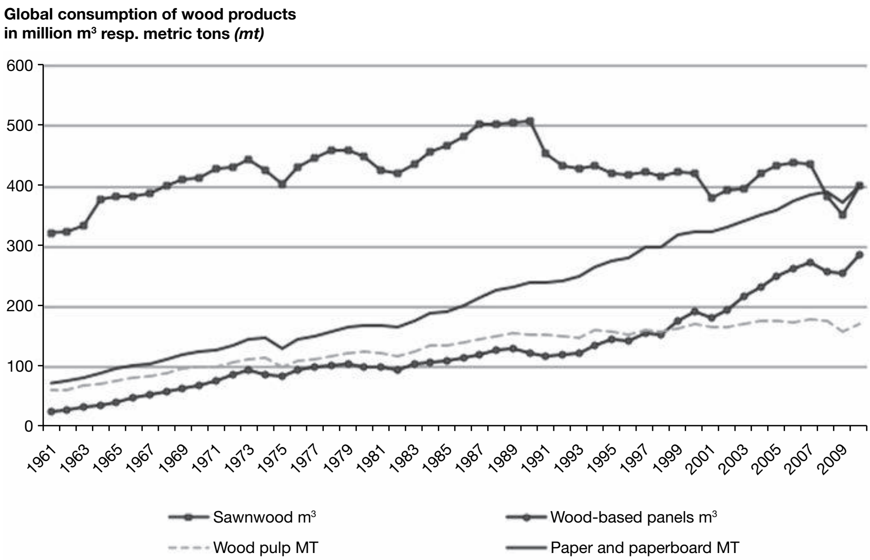

Figure 1.4 Consumption by processed wood product groups, World, 1961–2011

Source: FAOSTAT 2011

Worldwide, sawnwood consumption increased by more than 50 per cent, from around 320 million m^3 in 1961 to a peak of 508 million m^3 in 1990. The slump starting in 1991 to 400 million m^3 (1992–2003) was largely due to economic problems in Eastern Europe, particularly in Russia, following the collapse of the planned economy there. From 2004 to 2007 sawnwood consumption went up to 440 million m^3 and dropped in 2009 by around 20 per cent (to 354 million m^3) because of the economic crisis and its effects on the building industry. In 2011, annual sawnwood consumption recovered and reached 400 million m^3.

Quite a different development took place in the wood-based panel products group. World consumption increased from 38 million m^3 in 1964 to 274 million m^3 in 2007, went down to 257 million m^3 in 2009 and came back to 288 million m^3 in 2011.

In wood pulp consumption, there was an increase from 74 million metric tons (MT) to 180 million MT in 2007, followed by a decrease to 160 million MT in 2009 and recovery in 2011 to 171 million MT. The rapidly increasing use of recycled paper has become an important second resource in the forest products production process. It needs to be taken into account in understanding the actual stabilisation in fresh wood pulp production. Recovered paper consumption worldwide in 2011 is at 208 million MT.

The consumption trend in paper and paperboard, both in index-linked terms and in relation to the increase in total volume, has followed closely the growth rate of gross domestic product (GDP). Consumption increased more than four times, from

92 million MT in 1964 to 392 million MT in 2008, showed a modest decrease to 374 million MT in 2009 and reached again the level of 400 million MT in 2011.

1.3.2 The European forest-based sector

Consumption development in Europe has followed worldwide trends (UNECE/FAO 2005), but annual growth rates have been lower than world averages. The continent's starting point in the 1960s needs to be taken into account – in particular, the level of gross national product and per capita income. Again, the consumption trends by main wood product groups show remarkably different courses (see Figure 1.5).

With comparatively small variations, European consumption of sawnwood remained at the same level for nearly 30 years, from 1964 (190 million m^3) to 1990 (198 million m^3). Because of massive declines in Eastern Europe, sawnwood consumption fell to an average level between 120 million and 130 million m^3 in the space of a few years. After 2000 it stayed around 120 million m^3 and reached a one-year peak of 130 million m^3 in 2007. It fell to 93 million m^3 in 2009 and came back to 109 million m^3 in 2011.

By contrast, consumption of wood-based panels increased steadily, from 17 million m^3 in 1964 to 83 million m^3 in 2007 – a close to fivefold increase. In 2011, wood-based panel consumption amounted to 73 million m^3. The consumption of wood pulp more than doubled, from 22 million MT in 1964 to 55 million MT in 2007, and was at 50 million MT in 2011. Recovered paper consumption in 2011 was at 46 million MT in the same year. Paper and paperboard consumption increased about fivefold, from 21 million MT in 1964 to 105 million MT in 2007, and was at 95 million MT in 2011.

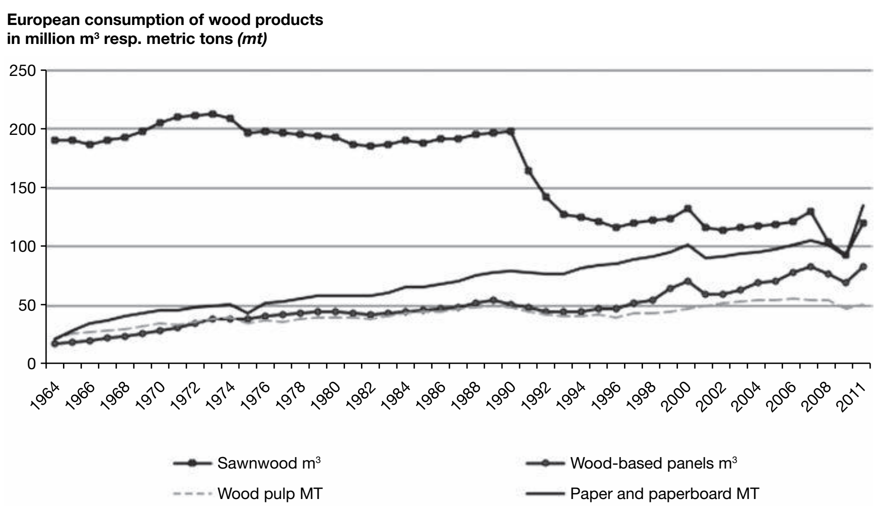

Figure 1.5 Consumption by processed wood product groups, Europe, 1964–2011

Source: FAOSTAT 2011

With a population of 502 million in 2011, the European Union is one of the largest and most dynamic world markets for processed wood products. Current data for the forest-based sector in the EU-27 refer to the year 2009 (European Union 2011: 49–56). Wood fibre production in 2009 consisted of 392 million m^3 roundwood, 48 million m^3 wood chips and particles and 39 million m^3 wood residues, of which around 8 million m^3 was pellets. Close to 80 per cent of the roundwood production (309 million m^3) was industrial roundwood and 83 million m^3 was fuelwood. The high proportion of coniferous industrial roundwood (242 million m^3, or 78 per cent of total roundwood production) in the EU-27 is notable. Sawnwood production amounted to 91 million m^3, and wood-based panel production, 57 million m^3. Wood pulp production was at 35 million MT. Total paper and paperboard production in 2009 was 88 million MT, with high proportions of graphic papers (39 million MT) and packaging materials (38 million MT). Altogether, in 2009 the EU-27 countries produced the following proportions of the European forest-based production: two-thirds of roundwood and industrial roundwood, 75 per cent of sawnwood, 81 per cent of wood-based panels, 80 per cent of wood pulp and 86 per cent of paper and paperboard.

Average wood consumption per capita for Europe in 2010 was 1.2 m^3, and for the EU-27, 1.1 m^3 (Pepke 2011: 129–30). Per capita consumption was highest in the North country group, amounting to 3 m^3 per capita. The Central-West follows, with 1.5 m^3; annual per capital consumption in the South-West was 1.1 m^3, and in the Russian Federation, 1.0 m^3. Consumption was lower in the Central-East (0.8 m^3) and South-East (0.7 m^3). (For the regional classification of European country groups, see Section 1.1.2.)

Wood consumption has changed over time. The North country group shows a dynamic development, with a 60 per cent increase in consumption per inhabitant – from 1.9 m^3 in 1990 to 3 m^3 in 2010. In the countries of the Central-East group, annual per capita wood consumption has doubled, rising from 0.4 m^3 in 1990 to 0.8 m^3 in 2010, indicating improving prosperity with the transition to market economies. The South-East country group showed an increase during the same period from 0.5 m^3 to 0.7 m^3. Annual per capita wood consumption in Central-West Europe increased by 5 per cent and in South-West Europe by 17 per cent. In the Russian Federation, consumption fell by 10 per cent, from 1.1 m^3 in 1990 to 1.0 m^3 in 2010.

National and local differences in building with wood are an important reason for the considerable variations in per capita consumption. Wood-framed construction, both residential and non-residential, is more common in the Nordic countries than in other European regions. The environmental benefits of using wood in construction are getting attention, and green building based on greater use of wood in structural, insulation and decorative applications boosts wood consumption. Another factor behind increasing consumption of wood is the rapidly rising demand for wood-based energy.

Gross value added of the European forest-based sector has macroeconomic importance and contributes to GDP through forestry jobs and manufactured wood and paper products (Lebedys 2011: 112–17). Data for 1990, 2000, 2005 and 2008 (the most recent available year) have been converted into a common currency unit (Euro €) and aggregated for Europe and European regional levels. Nominal figures not adjusted to inflation have been used. Only the forest-based sector's direct contribution to GDP has been taken into account. Other associated economic activities, such as forest-based tourism, wood energy, furniture making, specialised wood-processing equipment and trade in forest-based products, are not included but would increase the contribution of the forest-based sector to GDP.

For the whole of Europe, gross value added by forestry, wood-processing industries and the pulp and paper industries in 2008 was €127.3 billion, or 1 per cent of total GDP, of which 20 per cent resulted from forestry management and harvesting activities, 40 per cent from wood manufacturing and another 40 per cent from pulp and paper production. Regional differences are considerable, however. The sector's GDP contribution is twice as high in North Europe (2.2 per cent) and in Central-East Europe (1.6 per cent) as in the other regional country groups. Three regions accounted for about 80 per cent of the European forest sector's value added in 2008: Central-West Europe, with €59.9 billion; South-West Europe, with €21.0 billion; and North Europe, with €20.9 billion. The EU-27 countries contributed €108.9 billion, or 91 per cent of total value added.

Value added in the wood-based sector is most important in the North Europe and South-East Europe country groups, accounting for about one-third of the sector's contribution to GDP. In Central-East Europe, South-West Europe and the Russian Federation, the wood-processing industry contributes to about half of the sector's value added. In Central-West Europe, value added is concentrated in the pulp and paper industry, which accounts for half of the sector's gross value added. At country level, the forest sector is particularly important, with a 3 per cent to 4 per cent contribution to GDP in Finland, Latvia and Sweden; 2 per cent to 3 per cent in Austria, Belarus and Estonia; and 1.5 per cent to 2 per cent in the Czech Republic, Lithuania, Poland, Portugal, Romania and Slovenia.

The yearly forest sector value added of the EU-27 and the European Free Trade Association (EFTA) countries combined, representing about 90 per cent of Europe's GDP, ranged from €108 billion to 123 billion per year during 2000 to 2008. Annual figures varied within 10 per cent of this average. The global economic recession showed its effects starting in 2008, with a further decline close to 20 per cent in 2009. In 2010, gross value added increased again but was still below its previous peak, in 2007. Overall, the European forest sector's value added increased by 7 per cent between 2000 and 2008. In real terms (deflated by GDP deflators), however, this nominal growth means a drop of around 10 per cent, mainly due to the marked decline in the pulp and paper industry. At the same time there has been a shift in the regional distribution of the forest sector's value added. The shares of Central-West Europe and North Europe gradually decreased from 52 per cent to 47 per cent and from 19 per cent to 16 per cent, respectively. The share of Central-East Europe and the Russian Federation increased from 8 per cent to 16 per cent, respectively. A strong and competitive raw material base, technological innovations and increasing trade liberalisation and expansion in the EU single market have contributed to maintaining economic growth and value added.

The work force (Kastenholz 2011: 123–6) of the European forest-based sector in 2010 was close to 4 million people. Around 800,000 of these workers, or 20 per cent of the total, were in the Russian Federation. Within the European forest-based sector as a whole, 739,000 workers (19 per cent) were employed in forestry activities, 1,979,000 (50 per cent) in the wood products industry and 1,234,000 (31 per cent) in pulp and paper production. Close to 2.6 million people (65 per cent) of the total European work force were employed in the EU-27 countries, of which 478,000 (19 per cent) were employed in forestry, 1,397,000 (54 per cent) in the wood products industry and 701,000 (27 per cent) in the pulp and paper industry. Sector employment is high in Central-West Europe and Central-East Europe, with 925,000 and 879,000 workers, respectively. Total sector employment is lower in the South-West (582,000 workers) and South-East (406,000). The lowest employment figure occurs in North Europe, with 346,000 workers.

Considerable differences exist in the regional distribution of sub-sector activities, and the reasons for them need a thorough and critical interpretation. In Central-West Europe, for instance, 88 per cent of the work force is engaged in industrial wood processing and pulp and paper production, compared with 12 per cent in forestry activities. This indicates a strongly developed and diversified sector. In the North Europe country group, however, the industrial employment rate (72 per cent) is lower because of particularly high productivity levels. The Central-East Europe country group shows a similar rate of industrial work force requirements (70 per cent), but this is the result of a gradual restructuring in the transition to a market economy. Differences exist as well between the industrial manpower rates of South-West Europe (84 per cent) and South-East Europe (75 per cent), which can be explained by current developments in wood processing and forest management.

1.3.3 The sawmilling industry

The sawmilling industry processes roundwood and markets sawnwood and by-products to other branches of the wood industry. Its raw material requirements are medium-size and large logs and, increasingly, large quantities of small sawlogs (Lohmann *et al.* 2007). Sawnwood is used in the building industry, furniture manufacturing, modern industrial and residential buildings, the prefabricated housing industry and traditional woodworking crafts. In structure and size, sawmill companies differ widely from country to country. The location of sawmills sometimes indicates the industry's earlier dependence on local raw materials and water power. More recently established sawmilling companies look for locations with logistic advantages, particularly in relation to long-distance transport and cheap electricity.

The sawing of softwood is carried out in full-length log-cutting sawmills or in mills processing exclusively standard lengths. Modern sawmills with large processing capacities are equipped with chipper canter technology. Long-timber sawmills with cutting lengths of 6 to 12 metres mainly produce list-ordered construction timber and special products for building components. Sawmills cutting standard lengths (4 metres) have been mainly located in Nordic countries but are now important in other regions as well. Processing of standard lengths has increased with the development of more efficient gluing techniques, such as finger jointing, large-surface gluing and manufacturing of glued mouldings. Further processing sub-categories are known as small-timber and heavy-timber lines. The former produces squared timber, planks and narrow goods, and the latter floorboards, planks, sawn log stock and list-ordered construction timber. In hardwood sawmills, categorisation is mainly by wood species. For example, some mills specialise in sawing beech and oak, other native hardwood species or tropical species. There are differences in production techniques between edged and unedged goods, with an increasing proportion of the former. The EU-27 data for 2008 (European Union 2011: 36) indicate about 35,000 sawmilling and planer production units with a total of 273,000 employees.

Annex A.2 presents figures for production, imports, exports and consumption of conifer sawnwood in 2011. A comparison among world regions shows that Europe, with a production volume of 130 million m^3, and North America, with 83 million m^3, were the most important players in the market. Together the two regions contribute around 70 per cent of the world's production. North America (73 million m^3), Asia (81 million m^3) and Europe (96 million m^3) shared close to 90 per cent of the world's conifer sawnwood consumption. For Europe, the trade in sawn softwood has reached an export surplus in both quantity and value. At the country level, exporters of more than 1 million m^3 per year are Austria, the Czech Republic, Finland, Germany, Norway, Romania, the Russian Federation and Sweden. Traditional softwood importers are Austria, Denmark, France, Germany, Italy, the Netherlands, Spain and the United Kingdom.

The major producers of sawn hardwood (see Annex A.3) are in Asia, which had an annual production of approximately 56 million m^3 in 2011; of that volume, more than 60 per cent originated in China, India, Indonesia and Malaysia. Production totals for sawn hardwood amounted to 17 million m^3 in North America and 22 million m^3 in Latin America and the Caribbean. Notable exporters were Brazil, Cameroon, Malaysia, Thailand and the United States. Among the European countries, France, Germany, Italy, Poland, Romania, the Russian Federation and Spain are significant producers of sawn hardwood. Europe is a net importer, with major importing countries being the Czech Republic, France, Germany, Italy, the Netherlands and the United Kingdom.

A comparison between the two product groups shows that worldwide conifer sawnwood production amounts to around 70 per cent of total sawnwood production. The proportions vary from region to region and within countries. For example, sawn softwood production in Europe represents around 90 per cent of total production. In Asia, Latin America and the Caribbean, the ratio between the two product groups is around 50 per cent.

New sawing technology since 1970, particularly in softwood sawmills, has induced and accelerated structural changes and new processing techniques in the wood-processing sector (Fronius 1989). Roundwood is not only sawn, using gang saws, band saws and circular saws, but often given an initial milling step. New chipping and profiling techniques have changed sawmilling technology (see Figure 1.6). The chipping technique generates side cuttings and wood chips that have become an important sawmilling by-product, sold to other processing units along the value-added chain of the forest-based sector. There are no longer bulky leftover pieces – side-cuttings, slabs and splinters – that have to be removed from the machinery. Products resulting from this accelerated working process are square-edged stem segments, plus easily separated and transported shavings and chippings.

Another technological innovation involves profiling. At least four sets of machines prepare the log for the next step by milling a right angle out of the trunk profile at each corner. Profiling roundwood logs in squared dimensions avoids awkward and bulky by-products and makes sawing more efficient by reducing waste. In high-quality systems, the horizontal and vertical distances between the milling devices can be variably adjusted, allowing optimal use of log diameters with minimum adjustment times. One of the characteristics of the technological transformation with chipper canter aggregates in the sawmilling lines is the rate of feed – that is, the speed at which the logs are transported through the chipper canter line. Since 1970, for example, the rate of feed in combining chipping and profiling technique in metres per minute has advanced as follows:

- 1970: 25 to 50 m per minute;
- 1980: 37.5 to 75 m per minute;
- 1990: continuously adjustable up to 160 m per minute; and
- 2000–2010: continuously adjustable up to 200 m per minute.

Technological innovations coupled with an increase of productivity mainly affect softwood production and have prompted important changes:

- Demand behaviour in the sawmilling industry shows a clear trend towards smaller logs, largely because the maximum opening diameter of most chipping and profiling machines is 45 cm.

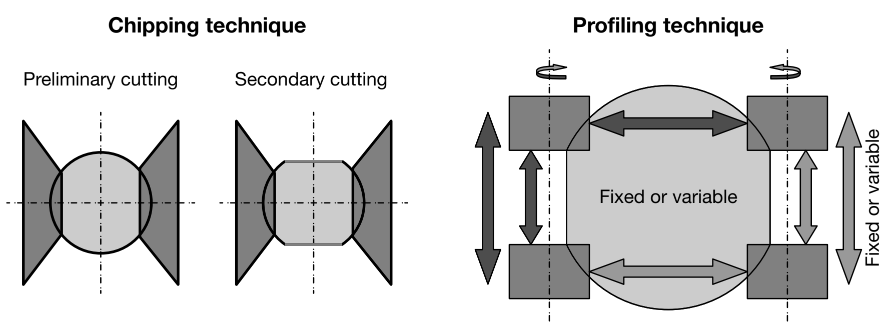

Figure 1.6 Wood chipping and profiling techniques

Source: EWD 2000

- For the processing of large-diameter sawlogs – characteristic of timber from mountain forests in Central European countries – specialised production systems equipped with band saws are needed. Such combined production lines are economically efficient.
- For sawmill by-products such as chips, sawdust and other residue, both supply and demand are leading to competition among the panel industry, the pulp and paper industry and, increasingly, wood energy producers.
- New technologies have made the sawmilling industry highly productive during the past 20 years, but the yield of the primary sawnwood products has declined, from 60 per cent with gang saw technology to 40 per cent with chipper canter machines.
- High levels of investment needed for the complex sawing technology are encouraging expansion of the production capacity at existing mills and concentration in the sawmill industry.

The number of companies and small sawmills has markedly declined. In Central Europe in the 1970s, for instance, companies with an annual sawing volume of 10,000–20,000 m^3 of roundwood dominated the market. There are now more mills with capacities exceeding 50,000 m^3. Some sawn softwood mills in Germany, Austria and Switzerland have achieved output of several hundred thousand and even 1 million m^3 in annual sawnwood production. These are industrial scales comparable to those of Scandinavia and North America.

Another trend is towards value-added products, achieved by integrating additional processing and finishing steps in the sawmilling industry. An important first step is the change from air drying of lumber to automated drying in kilns according to precise technical schedules. Additional production units – planer mills, impregnation facilities and production units for structural laminated wood – are being incorporated. Manufacturing of list-ordered lumber for construction and gluing and finger-jointing are other value-added steps that allow companies to capture new positions in the market by achieving more horizontal or vertical integration. A typical company with an annual cutting output of approximately 200,000 m^3 of softwood and hardwood may have chipper canting machines combined with gang or band saws, impregnation equipment and a planer mill; such a company can produce sawnwood in standard dimensions, planed goods, structural laminated timber, solid panels and components for the construction of prefabricated houses.

1.3.4 The wood-based panel industry

The wood-based panel industry produces veneer, plywood and panels made from layered wood chips and fibres formed into homogeneous materials (Deppe and Ernst 2002; Dunky and Niemz 2002; Maloney 1993; Paulitsch 1998; Soiné 1995). Important sales markets include the building industry, the furniture industry and do-it-yourself stores. Wood-based panel manufacturing is one of the most automated areas in wood processing. The capacity of current production units is between 1,000 and 2,000 m^3 per day (often in the upper range). According to EU-27 data for 2008, some 4,500 enterprises with 120,000 employees, a turnover of €25 billion and value added of close to €5.5 billion operated in the wood-based panel product group.

Veneer and plywood: Sliced veneers are used as facing in the furniture industry, for interior decoration and for door manufacturing. The raw materials come from Europe (domestic hardwood species such as oak, beech, birch and ash, and softwood species such as spruce, fir and pine), North America and the tropics. Peeled veneers from hardwood species are manufactured for plywood production using beech and birch, tropical species from Africa such as *Okoumé* and *Limba*, and Asian species such as *Meranti* and *Lauan*. Production of veneered laminated wood from softwoods for the construction industry has become important. Several large complexes for producing plywood have been built in South America, each with an annual capacity of around 500,000 m^3.

Chipboard (particle board): Chipboard is produced usually in presses from glued wood chips superimposed layer by layer. Three-layered boards have larger chips in the middle layer and finer chips in the two outer layers. Chipboard is used in furniture manufacturing and interior decoration. Recycled wood is increasingly being used for conventional chipboard manufacturing. Oriented-strand board (OSB) is a further development of chipboard. It is made from longer chips, or 'strands', usually fresh wood from the forest, with a vertically oriented middle layer and horizontally oriented chips in the two outer layers. Compared with regular chipboard, OSB has greater stability and can be used in construction, prefabricated housing and packaging.

Fibreboard: Fibreboard is manufactured from wood chips that have been defibrated using special machinery (defibrators) and applying heat and steam. The fibres are pressed in the same way as in chipboard technology. There are several types of fibreboard. Hardboard and insulating board are produced using wet processes; medium-density fibreboard (MDF) and high-density fibreboard (HDF) involve dry processes. MDF has a more homogeneous gross density profile than chipboard, is easy to mould and paint and can be processed into facings for furniture. In the construction industry, large-format solid wood boards and glued composite elements of solid wood, allowing a high degree of prefabrication, are becoming important.

In 2011, about 90 per cent of the world's wood-based panel production came from Asia (149 million m^3), Europe (74 million m^3) and North America (41 million m^3). The three regions also account for most of the wood-based panel consumption. Large European importing countries are Denmark, France, Germany, Italy, the Netherlands, Poland, the Russian Federation, Sweden and the United Kingdom. Large exporting countries are Austria, France, Germany, Poland, Romania, the Russian Federation and Spain (see Annex A.4).

1.3.5 Secondary wood processing

Secondary wood-processing activities are undertaken by companies ranging in size from local enterprises and artisans to large, internationally integrated corporations. In the EU-27 in 2008, the reported number of enterprises active in parquet flooring, carpentry and joinery work and wooden container production was about 100,000; these firms employ more than 600,000 workers (European Union 2011: 36).

Woodworking craft: Besides cabinetmakers and restorers, this sub-sector includes joiners and carpenters, whose skills are employed not only in traditional roof timbering but also in constructing modern residential and industrial wooden buildings. Woodworking artisans and enterprises are increasingly organising into retail cooperatives or receiving their supplies from such cooperatives. Medium-sized family companies are giving way to larger commercial units with an industrial profile. Materials of constantly high quality are required, which, when combined with craft skills and custom design, form the basis of entrepreneurial success.

Prefabricated houses and utility buildings: Because modern wood materials can meet the structural requirements of building codes, manufacturers of prefabricated houses are now focusing on supplying wooden buildings for detached and semi-detached homes, as well as one-storey and multi-storey residential and industrial buildings. Some companies have emerged from the wood industry, while others have joined the sector as a result of their choice of materials. Multi-storey buildings are increasingly being built in wood (Kolb 2008).

Windows: Because of innovations in the plastics field, which responded to the growing scarcity of high-quality European roundwood assortments and concern over the use of tropical tree species, it appears that window makers are distancing themselves from the use of wood. Technical and product-policy innovations, appropriate species selection and high-quality wood assortments are a prerequisite for recovering market share.

Parquet flooring: This industry depends on overall construction activity and homeowners' renovation work. Parquet is manufactured from solid wood produced from oak, beech and other tree species and is laid in both residential and public buildings. Multi-layered parquet is being used to reduce moisture-related deformation. Products made of thin chipboard or HDF boards and coated with several layers of synthetic resin are marketed in competition with textile floor coverings.

Insulation material: Wood-based insulating materials are manufactured for the building industry. Boards are produced in a wet process, and insulating materials of thermoplastic fibres are used as a binding agent in a dry process. With increasing use of wood in the building industry, particularly for new detached and semi-detached houses, and the increase in renovation and refurbishment projects, competitive marketing chances exist. Further stimulus comes from energy policy measures requiring better insulation during renovation of buildings.

Packaging and pallet manufacturing: Innovations in logistics have led to dynamic developments in the packaging industry and wood has become a prominent material. In the 1980s, a limited number of production units manufactured specific types of packaging for niche markets and special transport purposes. Today the container revolution in maritime and land transport worldwide, the enormous increase in world trade of goods, and multi-modal transport and logistic systems all favour wood packaging and pallet production.

Furniture: The furniture industry is a strong branch of the economy. In 2008 there were 130,000 furniture-making enterprises in the EU-27 employing 1.2 million workers with a turnover of €115 billion and value added at factor cost of €35 billion (European Union 2011: 36); 25 per cent of value added resulted from office and shop furniture, 15 per cent from kitchen cabinetry and 60 per cent from other furniture production. The furniture industry uses different assortments of wood and is an important client of sawnwood and wood-based panel producers. It also uses large quantities of other materials, such as leather, metal and textiles. Industrial furniture manufacturing requires fairly small wood dimensions and, following new trends, shows rapidly changing demands in its procurement markets.

Furniture manufacturers are often sited near their customers, in densely populated regions and urban areas. For example, the most populous state in Germany, North Rhine–Westphalia, is a major centre of the furniture industry. In contrast, Finland and Sweden have furniture makers with resource-oriented site locations. Specific skills in design and market-oriented product development (e.g. in Italy and Denmark) are other factors that influence the location of furniture-making enterprises. The dominating role of China in the world furniture business indicates that competitive labour costs combined with modern fabrication technology are decisive production factors.

1.3.6 The pulp and paper industry

Wood pulp is a fibrous material made from pulpwood, wood chips, particles, residue or recovered paper by mechanical and/or thermo-chemical processes for further manufacturing into paper, paperboard, fibreboard or other cellulose products (FAO 2011b). Depending on the technological process, the wood pulp industry comprises several product groups:

- mechanical wood pulp, including thermo-mechanical and chemo-mechanical pulp, either bleached or unbleached, obtained by grinding or milling pulpood and residue into fibres;
- semi-chemical wood pulp, produced by a combination of mechanical and chemical treatments, either bleached or unbleached;
- chemical wood pulp, either bleached or unbleached, obtained from a series of chemical treatments including sulphate (kraft) wood pulp, soda wood pulp and sulphite wood pulp; and
- dissolving wood pulp, which is bleached chemical pulp made from wood of special quality, for uses other than papermaking.

Wood pulp is mainly produced using the sulphate pulping process; factories that use the sulphite process are gaining in importance. Long-fibre pulp is obtained from softwood species. Important producers are located in Canada, Scandinavia and the United States, followed by Australia, Chile and New Zealand. Short-fibre pulp is produced from tree species such as birch, eucalyptus and mixed hardwoods. The productive capacity of new factories exceeds 500,000 tonnes per year. With a yield of approximately 50 per cent, this means that a modern chemical pulp factory has an annual wood raw material requirement of around 2 million m^3. An important aspect of the pulp industry is the widespread vertical integration of forest ownership with industrial processing, particularly in the Nordic European countries and North and Latin America.

Annex A.5 presents basic data for 2011 on wood pulp for world regions and selected European countries. With 68 per cent of total production, Europe (47 million MT) and North America (70 million MT) together are the major players. The same is true for pulp consumption: Europe and North America together account for 63 per cent of the total world consumption. With around 14 million MT, the Latin America and Caribbean region is a net exporter; and with close to 25 million MT, Asia is a strong net importer. In Europe, Sweden (11.9 million MT), Finland (10.4 million MT) and the Russian Federation (7.4 million MT) lead in pulp production. Because they use the major part of their pulp production for further processing of paper and paperboard, they also have the highest consumption figures (Sweden, 9.2 million MT; Finland, 8.4 million MT; Russian Federation, 5.4 million MT). Typical importing countries include France, Germany, Italy, the Netherlands, Spain and the United Kingdom. Important pulp exporters are Finland, Germany, the Netherlands, the Russian Federation, Spain and Sweden.

Collection and reuse of waste paper and paperboard for pulp and paper manufacturing competes with fresh wood supply from forests. From 2001 to 2005, the worldwide consumption of recycled paper rose from 142 million MT to 164 million MT (FAO 2007: 180–1) and to 208 million MT in 2012. The value of worldwide imports rose from US$3.1 billion in 2001 to US$5.8 billion in 2005 and to US$12 billion in 2011. Asia (90 million MT), Europe (55 million MT) and North and Central America (50 million MT) together account for 92 per cent of reused paper and paperboard collected in 2011. Europe and North America are net exporters, while Asia is a strong net importer (see Annex A.6).

The recycled paper markets of selected European countries show considerable differences, which may be explained by factors such as population, gross national product, cultural habits towards recycled paper collection and location and technological development of the pulp and paper industry. Countries having a high per capita level of recovered paper consumption include Austria (0.275 MT), Germany (0.172 MT), Slovenia (0.217 MT), Spain (0.107 MT), Sweden (0.264 MT) and Switzerland (0.114 MT).

Paper and paperboard are products generally manufactured in strips or rolls with specified minimum standard dimensions (FAO 2011b). This aggregate product category includes the following:

– newsprint made from uncoated paper used mainly for the printing of newspapers;
– printing and writing papers made from a variety of pulp blends with various finishes suitable for printing and business purposes, writing and art;
– household and sanitary papers used for towelling, napkins, facial tissue, toilet tissue and disposable tissues;
– wrapping and packaging papers and paperboard for wrapping, packaging and manufacturing sacks and boxes; and
– other paper and paperboard used for construction and a wide range of specialised purposes.

The paper and paperboard industry is based on a highly developed technology that is in a state of dynamic transformation (Göttsching 2000). The market is shared by large global companies, several of which have their headquarters in Nordic European countries, Canada and the United States. Procurement and marketing, as well as forest ownership structures, are often integrated.

In the EU-27 in 2008, 185 enterprises were producing pulp and employing 16,000 workers; 2,158 enterprises were engaged in paper and paperboard production, employing 190,000 (European Union 2011: 36). Together they had a turnover of €80 billion and value added at factor cost of close to €16 billion. The figures for the total of enterprises producing articles of paper and paperboard are considerably higher. In round figures, the number of units was 18,000, the number of employees was 500,000, turnover was €96 billion, and value added was €25 billion. In addition, close to 130,000 enterprises with around 900,000 employees were engaged in printing and related service activities, relying for their raw material on the forest-based sector.

Data from 2011 for production, import, export and consumption of paper and paperboard by world region and in selected European countries are summarised in Annex A.7. By far the largest proportion (90 per cent) of the worldwide consumption of paper and paperboard, at 400 million MT, was in three regions: Asia (47 per cent), Europe (24 per cent) and North America (20 per cent). Total imports were 109 million MT; Europe accounts for 50 per cent, Asia for 21 per cent and North America for 11 per cent. Regional concentration in the paper and paperboard sector is particularly apparent in world exports (112 million MT); 58 per cent of world exports 2011 come from Europe and 21 per cent from North America. Seven European countries – France, Germany, Italy, the Netherlands, Poland, Spain and the United Kingdom – had a share of 67 per cent in European imports. Nine European countries – Austria, Finland, France, Germany, Italy, the Netherlands, the Russian Federation, Spain and Sweden – had a share of 73 per cent in European exports.

1.3.7 International trade in wood products

Wood products are an important international commodity that has a significant effect on the trade balance of many countries (Peck 2001). International trading relations have progressed to the extent that one can speak of largely unobstructed worldwide trade in raw material as well as in wood products and wood processing. The same is increasingly true of the final sales markets for investment and consumer goods. Total exports and imports, as compiled regularly in the FAO Forest Products Yearbook, indicate the relative importance of regions and different forest products. Direction-of-trade patterns by product groups are published for the ten largest trading countries in each product group and show the broad picture within the regions (FAO 2011b: 230–43), although many problems arise in filling data gaps and reconciling information supplied by importers with that supplied by exporters.

The scale and dynamism of worldwide trade in roundwood and processed wood products for 2001, 2005, 2009 and 2011 are shown in Table 1.8. The value of worldwide imports of wood and wood products increased in current dollars by more than one-third (36 per cent), from US$142.2 billion in 2001 to US$193.4 billion in 2005, levelled off in 2009 at US$192 billion and increased again in 2011 to US$234.7 billion. The commercial value of exports rose by more than one-third (42 per cent) between 2001 and 2005, from US$130.5 billion to US$185.7 billion, remained in 2009 at US$188.8 billion and increased again in 2011 to US$226.3 billion. The differences between worldwide imports and exports are explained by differences in the reporting of customs data used in the FAO Yearbook for wood and wood products. The import values include international transport and insurance costs (cost, insurance and freight, CIF). For exports, only the carriage-free price (free on board, FOB) of the goods from the port of loading is recorded. As a result, the value of FAO-reported world imports is higher than that of reported world exports.

Europe is one of the wood industry's leading world trading regions, accounting in 2011 for 44 per cent of world imports and 53 per cent of world exports. These figures include intra-European trade. The positive trade balance in the wood industry in Europe increased from US$1.0 billion (2001) to US$16.8 billion (2011), second to North America's net export balance of US$20.0 billion in 2011. Asia is currently the largest net importer, with domestic demand rising fast. The Asian trade deficit in wood and wood products increased from US$23 billion in 2001 to US$46.2 billion in 2011. Some semi-processed products, notably sawnwood, were re-exported in the form of final products, such as furniture or joinery; although not included in this calculation, this trade flow is significant.

Trade was rising within Europe until the 2008–2009 global economic and financial crisis (FOREST EUROPE, UNECE and FAO 2011: 131). It decreased in volume whereas value remained stable at the 2005 level. In 2010 and 2011 consumption and production of forest products stabilised and rose modestly in the UNECE region (UNECE/FAO 2011a). Table 1.9 presents data for the 2001, 2005, 2009 and 2011 trade balances of selected European countries. A notable feature is the strong export emphasis seen in Sweden, Finland and Austria. Germany changed in 2005 from being a traditional net importer to a positive trade balance in wood products. Net importing countries in 2011 have been Denmark, France, the Netherlands, Poland, Spain, Switzerland and the United Kingdom.

Table 1.8 Trade balance in roundwood and processed wood products, World

Country	*Trade balance 2001*			*Trade balance 2005*			*Trade balance 2009*			*Trade balance 2011*		
	Imports	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*
	(US$ billion)	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*
Africa	2.8	2.8	0.0	4.2	3.8	–0.4	6.9	4.5	–2.4	8.3	4.4	–3.9
North America	28.2	38.4	10.2	36.9	46.5	9.6	21.3	36.4	15.1	23.8	43.8	20.0
Latin America and Caribbean	6.3	5.3	–1.0	8.6	9.6	1.0	11.1	12.2	1.1	12.9	15.5	2.6
Asia	39.4	16.4	–23.0	52.1	22.9	–29.2	59.9	26.5	–33.4	82.9	36.7	–46.2
Europe	64.2	65.2	1.0	88.9	99.2	10.3	90.7	105.4	14.7	103.6	120.4	16.8
Oceania	1.6	2.4	0.8	2.7	3.7	1.0	2.3	3.8	1.5	3.2	5.5	2.3

Source: compiled from FAO 2007, 2011b; FAOSTAT 2012

Table 1.9 Trade balance in roundwood and processed wood products, Europe

Country	*Trade balance 2001*			*Trade balance 2005*			*Trade balance 2009*			*Trade balance 2011*		
	Imports	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*	*Imports*	*Exports*	*Balance*
	(US$ billion)	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*	*(US$ billion)*
Austria	2.2	3.9	1.7	3.1	6.0	2.9	3.5	6.4	2.9	4.5	7.5	3.0
Czech Republic	0.7	0.9	0.2	1.2	1.6	0.4	1.8	2.1	0.3	2.0	2.6	0.6
Denmark	1.6	0.3	–1.3	2.2	0.5	–1.7	2.2	0.6	–1.6	2.4	0.7	–1.7
Finland	1.0	10.1	9.1	1.8	12.1	10.3	1.3	11.1	9.8	1.9	14.1	12.2
France	6.9	5.2	–1.7	9.0	7.3	–1.7	8.1	6.2	–1.9	10.4	8.2	–2.2
Germany	11.5	10.1	–1.4	14.4	16.7	2.3	16.0	19.7	3.7	20.7	21.9	1.2
Hungary	0.7	0.4	–0.3	1.1	0.7	–0.4	1.3	0.9	–0.4	1.4	1.1	–0.3
Italy	6.9	2.3	–4.6	8.9	3.2	–5.7	8.8	4.7	–4.1	11.2	4.9	–6.3
Netherlands	4.2	2.5	–1.7	5.8	3.7	–2.1	5.7	3.7	–2.0	7.2	5.2	–2.0
Norway	0.9	1.6	0.7	1.3	1.9	0.6	1.2	1.7	0.5	1.5	2.0	0.5
Poland	1.4	1.0	–0.4	2.7	2.2	–0.5	3.5	2.5	–1.0	5.1	3.7	–1.4
Romania	0.2	0.5	0.3	0.6	0.9	0.3	0.9	1.0	0.1	0.8	1.6	0.8
Spain	4.3	2.3	–2.0	5.9	3.4	–2.5	5.3	4.3	–1.0	5.3	5.0	–0.3
Sweden	1.6	8.7	7.1	2.3	13.2	10.9	2.2	14.1	11.9	3.2	17.3	14.1
Switzerland	1.6	1.4	–0.2	2.2	2.0	–0.2	2.6	1.4	–1.2	2.1	1.7	–0.4
United Kingdom	9.0	1.9	–7.1	10.9	2.7	–8.2	9.1	2.4	–6.7	11.0	3.0	–8.0

Source: compiled from FAO 2007, 2011b; UNECE/FAO 2012

A study of integration in wood markets provides information about the development of the structure of international trading relations (Ollmann 2001, 2003). In 1963, the proportion of industrial wood production by volume, traded internationally, was just under 20 per cent; in 1973 it was 29 per cent and in 1983 around 30 per cent; in 1996 it had moved to nearly 50 per cent. Calculations for 1999 indicated that 57 per cent of the world's production of roundwood and processed wood products was traded internationally. It was estimated that more than half of the total world wood trade, by quantity, involved exchanges within the regions (intra-regional trade), while exchanges between regions (inter-regional trade) were slightly less than half. The study was based on a matrix representation from FAO for 15 important exporting countries and 25 important importing countries, supplemented with additional national data. Relative to world trade in wood, these countries shared around 70 per cent of the important wood product groups' import and export volumes.

A considerable part of European trade occurs among the countries of the EU, which because of the single internal market is estimated on the basis of production data, not measured as it crosses frontiers. In the EU-27, intra-trade in wood-based products rose from €62.6 billion (1999) to €73.9 billion (2009). Extra-EU exports increased from €18.0 billion to €26.1 billion, and extra-EU imports remained at the level of around €18 billion during the same period (European Union 2011: 57). The value of intra-EU trade of wood-based products in 2009 was 2.8 times as high as the value of extra-EU exports. The extra-EU trade surplus in 2009 amounted to €7.8 billion for wood-based products.

The past 50 years have seen remarkable shifts in the relative importance of the main forest-based wood product groups in international trade. Table 1.10 shows, for example, that the roundwood share of imports diminished from 14.5 per cent in 1963 to 8 per cent in 2011. A substantial decline was also seen in the share of sawnwood (26.3 per cent in 1963, 14 per cent in 2011). By contrast, the proportion

Table 1.10 Forest products groups in world trade, 1963–2011

Product group (% calculation based on import values in US$)	*1963*	*1973*	*1983*	*1996*	*1999*	*2005*	*2009*	*2011*
	%	*%*	*%*	*%*	*%*	*%*	*%*	*%*
Roundwood	**14.5**	**22.2**	**15.2**	**9.5**	**8.5**	**7.0**	**6.1**	**8.0**
Sawnwood	**26.3**	**24.8**	**22.3**	**18.7**	**17.9**	**17.5**	**13.5**	**14.0**
Coniferous sawnwood	22.1	19.7	16.7	13.3	12.9	12.0	9.6	9.8
Nonconiferous sawnwood	4.2	5.1	5.6	5.4	5.0	5.5	3.9	4.2
Wood-based panels	**7.4**	**10.4**	**9.0**	**11.6**	**12.3**	**15.3**	**13.3**	**13.3**
Wood pulp	**19.7**	**13.7**	**15.3**	**14.1**	**13.8**	**12.7**	**14.7**	**17.4**
Paper and paperboard	**32.1**	**28.9**	**38.2**	**46.1**	**47.5**	**47.6**	**52.4**	**47.2**
Newsprint	13.5	8.6	10.6	8.3	6.9	5.6	4.9	4.0
Printing and writing paper	3.6	6.0	10.3	15.3	19.5	21.3	23.0	19.8
Other paper and paperboard	15.0	14.3	17.3	22.5	21.1	20.7	24.5	23.4

Source: compiled from Ollmann 2001, 2003 for 1963–1999; FAO 2011b; FAOSTAT 2012 of wood-based panels increased substantially, from 7.4 per cent (1963) to 13.3 per cent (2011). Above all, the share in imports of paper and paperboard increased from 32.1 per cent in 1963 to close to 50 per cent in recent years. The paper and paperboard industry represents almost half the value of worldwide imports in wood products.

In summary, world trade in roundwood and processed wood products mainly takes place within and among three regions – Europe, North America and Asia (Figure 1.7). In 2011, 44 per cent of all imports by value (including intra-trade)

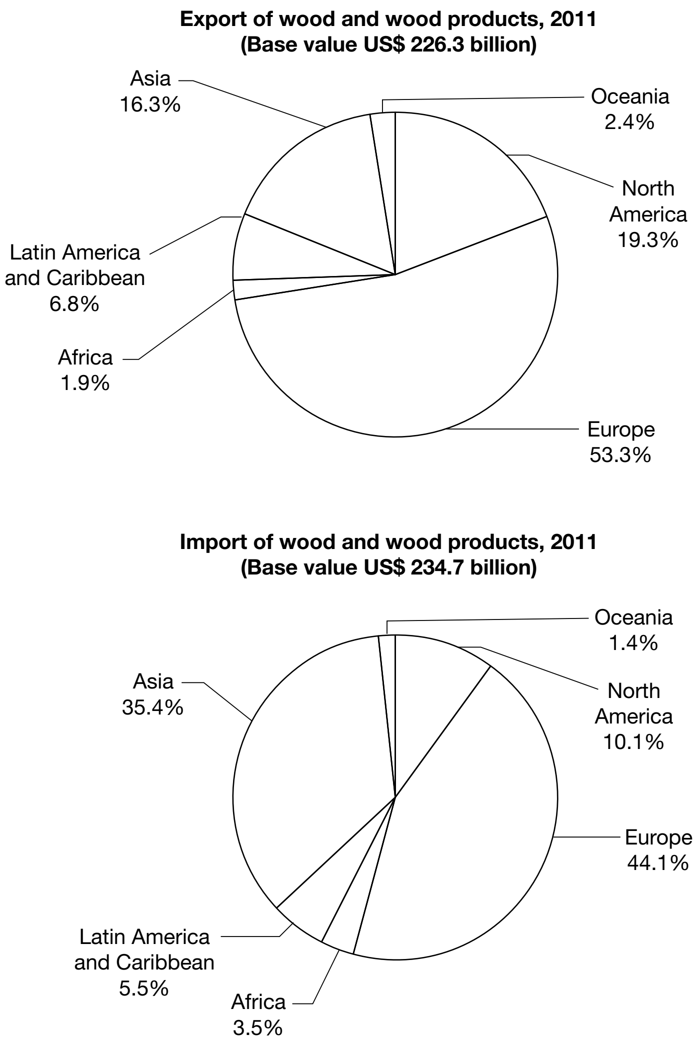

Figure 1.7 Import and export values 2011, including intra-trade, by world region

Source: FAOSTAT 2012

were accounted for by Europe, 35 per cent by Asia and 10 per cent by North America. The proportions of worldwide exports by value in 2011 were 53 per cent for Europe, 19 per cent for North America and 16 per cent for Asia. The comparatively small proportion of the Latin America and Caribbean region in terms of international export trade in processed wood products may be surprising, at least at a first glance.

Imports and exports have grown faster than production and consumption as international specialisation, comparative advantages in production and marketing, and vertical and horizontal integration in forestry and wood processing have led to a fast expansion of intra-regional and global trade. Looking at the proportions of the main wood products groups by volume between 1963 and 2011, we see that roundwood and sawnwood trade declined considerably, wood-based panel trade grew steadily, trade in wood pulp varied significantly over the years and trade in paper and paperboard rose approximately from one-third to almost half of world trade in wood products.

1.4 Wood energy

1.4.1 General considerations

Energy security, peak oil potentials, price volatility of fossil fuels and greenhouse gas emissions are economic, environmental and political issues. They are challenges that need to be addressed and solved for sustainable development. In this context, renewable wood fibre energy is of great importance as a source for green energy production (FAO 2008, FAO 2010c).

More than half of the world's roundwood production (1.9 billion m^3, 57 per cent in 2009) is used as wood fuel and charcoal, which remain highly important energy sources in many developing countries. Wood energy is the dominant source of energy for more than 2 billion people in both rural and urban areas (FAO 2010b: vii). Fuelwood and charcoal provide more than 14 per cent of the world's total primary energy. Social and economic scenarios indicate that steady growth of the demand for wood fuel is expected to continue for several decades. The importance of energy supply from forests is well demonstrated by the pattern of wood fuel and charcoal uses among world regions in 2009 (FAO 2011b: 14–21): 90 per cent is produced and consumed in Asia (771 million m^3, 42 per cent), Africa (602 million m^3, 33 per cent) and Latin America and the Caribbean (283 million m^3, 15 per cent). In Europe (141 million m^3, 8 per cent) and North America (43 million m^3, 2 per cent), production of wood fuel and charcoal is much lower. A large proportion (90 per cent) of the wood used for wood fuel and charcoal comes from nonconiferous species.

A rapidly growing energy source is wood co-products from sawmilling and wood-based panel production. Wood energy also comes from pulp and paper co-products, post-consumer wood and industrial and residential residue. Other important sources are short-rotation forest and agricultural crop plantations, tree stumps and logging slash (branches), trees and shrubs harvested from land outside forests and wood trimmings from landscaping activities – all gaining importance because of the need to produce energy from renewable resources. The feasibility of their use as fuel depends on the effects on ecosystem resilience, soil fertility, hydrology, biodiversity, landscape and social and cultural acceptability. In particular, reductions in soil fertility on already-poor soils can be a serious problem.

1.4.2 The European context

Woody biomass is an important source of renewable energy in Europe. Given its major role in the renewable energy sector, wood energy from wood-processing industries is expected to grow significantly in the coming decades (Prins 2011: 228–9). Additional wood fibre can be obtained from higher removals (notably of underused species and wood assortments) and increased use of harvest residue, from nonforest areas (landscape management operations, urban parks, infrastructure maintenance) and by expanding forest area and establishing short-rotation plantations. Improved recovery of post-consumer wood is another source of supply; it simultaneously reduces methane emissions from biomass that would otherwise be landfilled. Combinations of such measures have serious consequences for rural land use, ecosystem management, forest stand productivity and biodiversity conservation. Competition will increase between the competing demands for wood as a structural material for the wood-processing industry and for wood as a bioenergy source. Meeting the demand for woody biomass requires particular attention to small-scale forest owners' activities – for example, through targeted assistance and incentives, improved harvesting techniques and better forest-based infrastructure.

An enabling network for achieving higher wood mobilisation for energy uses requires adjustments of institutional and political frameworks. A major policy and management challenge is reconciling increased wood mobilisation with sustainable forest management (FOREST EUROPE 2010). Trade-offs are inevitable. The challenge is to find a compromise that is acceptable to the public and based on a process that involves stakeholder groups in forest management planning. Strong coordination between policies for forests, energy, climate change and environmental protection is essential. Wood energy supply and use should be organised for maximum efficiency, notably using wood as raw material in a cascade approach. Energy needs to be generated efficiently in modern, clean plants, with high combustion efficiency through combined heat and power installations and minimum release of fine particles and other emissions that affect human health.

1.4.3 Wood sources for energy use

Energy derived from wood largely slipped from view in Europe after the Second World War, except briefly during the energy crises in the 1970s and 1980s. Today's political concerns and rising oil prices have transformed the outlook for wood energy. The share of wood in the EU-27 countries in renewable energy production for the period 2004–2007 accounts, on average, for slightly more than 50 per cent of the gross inland energy consumption from renewable energy sources (Steierer 2010a). The importance of wood energy to the total primary energy supply varies greatly from country to country. An analysis of wood energy data from 14 countries, representing 46 per cent of the forest area in Europe (without the Russian Federation), indicated that wood energy increased by 22 per cent between 2000 and 2007.

Energy use also accounts for a major share of total wood fibre consumption. The Joint Wood Energy Enquiry (JWEE) of the UNECE/FAO 2009 indicates that in 2005 and 2007, energy applications accounted for 42 per cent of the entire wood fibre consumption in the EU-27 (UNECE/FAO 2009). Important producers in absolute terms were Finland, France, Germany, the Russian Federation and Sweden. In Sweden and Finland, for instance, wood energy is mostly produced in large-scale district heating installations, in combined heat and power plants in urban areas and in large industrial energy supply systems. Twenty-three European countries provided data on the origin of wood fibre for energy generation. Fresh wood fibre from the forest, other wooded land and trees outside forests were the most important source, providing almost 50 per cent of the woody biomass used for energy generation. Wood co-products and residue from wood-processing industries accounted for around 35 per cent, and post-consumer recovered wood, 10 per cent. Processed wood-based fuels – pellets, briquettes, charcoal and wood-based ethanol – contributed close to 6 per cent of wood energy generation.

Direct use of wood fibre for energy varies considerably among the European regions. For 2005–2007 it was lowest in North Europe (25 per cent), higher in Central-West and Central-East Europe (50 per cent) and significant in South-East Europe and the Russian Federation (75 per cent). Countries using more than 50 per cent co-products and residue from industrial processing units for wood energy included Austria, Finland, Lithuania, Slovakia and Sweden. The use of post-consumer recovered wood was highest in Germany, Ireland, Norway, Switzerland and the United Kingdom.

1.4.4 EU policy framework

In 1997 the white paper 'Energy for the Future – Renewable Sources of Energy' established an initial target of 10 per cent of energy to be derived from renewable sources by 2010 (Schmithüsen and Hirsch 2010: 52–3). In January 2007 the European Commission formulated a new target, 20 per cent by 2020. The EU 2003 Directive on Biofuels, the 2005 Biomass Action Plan and the 2006 Biofuels Strategy all have concrete goals for energy production from biomass, thus reinforcing the overall strategy of increasing the use of renewable fuel sources. In 2006 the European Council endorsed the Biomass Action Plan of the Commission and called on member states to develop or update plans, highlighting particular obstacles and bottlenecks. The Directive on the Promotion of the Use of Energy from renewable sources was proposed by the European Commission in 2008, confirming the overall binding target of 20 per cent of renewable resources in energy consumption and a 10 per cent binding minimum target for biofuels in transport, as well as binding national targets by 2020 in line with the overall EU target. This directive covers electricity, heating and cooling, and biofuels and includes national biomass action plans with sub-targets and measures. To comply, EU member states are developing action plans on how to meet the renewable energy standard targets.

Another important step followed with the adoption of Directive 2009/28/EC 9 of the European Parliament and the Council, promoting the use of energy from renewable sources. The Directive, which places wood energy in the broader context of energy from renewable resources, is an important driver for dynamic production and consumption changes in the energy sector as a whole. It provides country-specific targets for energy from renewable sources by 2020 and detailed guidance on reaching the goals. It calls for energy efficiency gains of 20 per cent to help reduce future energy consumption. But it does not provide information on the future gross inland energy consumption in the region or in member states. The EU forecast assumes that the overall gross inland energy consumption will be a result of achieving country reductions of 20 per cent or better.

The European Council had offered the objective of a 30 per cent reduction in greenhouse gas emissions by 2020 compared with 1990, provided that other parties would commit themselves to a comprehensive global agreement with comparable emissions reductions for the period beyond 2012, when the Kyoto Protocol would come to an end (Presidency Conclusions, European Council 8/9 March 2007). The targets for renewable energy adopted in the EU (by 2010, 12 per cent of primary energy consumption; by 2020, 20 per cent of primary energy consumption; and possibly a higher ratio at a later date) create new demands on wood resources. Within the limits set by sustainable management, the private forest sector can play a major role in supplying the resources needed for sustaining and expanding the raw material supply of the wood-processing industries, which at the same time face increasing competition for wood from bioenergy producers.

1.4.5 Sector-specific use of wood energy

Sector-specific uses of wood energy relate to industry internal use, private households, liquid biofuel and main activity producers (Steierer 2010b).

Industry internal use: The forest-based industries use co-products and solid residue from production units, notably for drying of finished or semi-finished products. Wood fibre consumption for internal energy use per m^3 of coniferous sawnwood, plywood and veneer is estimated to correspond to an additional use of around 0.15 m^3 solid wood. For nonconiferous sawnwood, fibreboard and particleboard production, the required wood residue for internal energy use may vary between 0.05 and 0.02 m^3. Liquid residue ('black liquor') is used to generate internal processing energy, and chemical and semi-chemical pulp production is a major energy producer. Heat generated from liquid residue is used to keep the pulping process running and helps recover pulping chemicals for recycling. In addition, pulp mills are important producers of electricity from wood biomass.

Private households: The JWEE of the UNECE/FAO (Section 1.4.3) provides information on fuelwood consumption by private households. Traditional wood stoves used in rural areas depend on the availability of sufficient forest resources. Fuelwood coefficients between forest area and rural population, calculated for nine countries in 2005 and 13 countries in 2007, show that at a ratio of 0.5 ha forest area per rural inhabitant, fuelwood consumption amounted, on average, to 0.1 m^3 per person; between 0.5 and 1.0 ha per inhabitant, consumption rose to around 1 m^3 per person; and at more than 1 ha per inhabitant, consumption increased to 2.5 m^3 per person. Studies from Germany showed a high correlation between the price of light heating oil and the use of wood energy.

Wood pellets and briquettes: These forms of fuel appeared on the market in the late 1990s. Stoves heated with pellets and briquettes are often automated and highly efficient, causing lower emissions of carbon monoxide and fine particles. Both energy products are commodities suitable for international trade and long-distance transport. JWEE indicates that about a third of global wood pellet production was traded internationally. Data from Austria, Belgium, Denmark, Finland, Slovenia and Sweden indicated that wood pellet consumption by private households has considerable growth potential. EUROSTAT has introduced wood pellets as a separate commodity in its 2009 revision of Combined Nomenclature. A wood pellets category will be in the next nomenclature revision of the Harmonized System 2012, improving data availability at global level.

Liquid biofuels: The International Energy Agency has stated that in the EU around 16 million MT equivalents could come from liquid biofuels. The EU wood report assumes that the necessary raw material will come primarily from woody biomass, though other fibre crops and grasses could be used as well. It further assumes that second-generation biofuels requiring large plants with large raw material procurement basins would be limited to countries with large forest areas.

Main activity producers: As defined by the International Energy Agency, main activity producers are primarily or solely engaged in energy production for the market in biomass power plants for heat and electricity. Producers co-fire wood in large-scale coal plants and in biomass plants that combine heat and power units. Incineration plants for treated wood are included when producing heat and power for the market.

Prospects of future demand for wood energy at EU-27 level: On the basis of the assumptions detailed in the methodology of the EU wood report, demand for wood fibre for energy generation is expected to increase by two-thirds in the EU-27 between 2010 and 2020 (Steierer 2010a). Wood consumption for energy generation would grow from 346 million m^3 (2010) to 573 million m^3 (2020). The underlying assumptions are that energy efficiency and renewable energy targets of the EU countries are achieved and that wood energy decreases its share in total energy production from renewable sources, from 50 per cent in 2008 to 40 per cent in 2020. Another assumption is that research and development support in the European Commission and member countries will encourage new renewable energy technologies that exploit the technological potential of solar heat and power, as well as geothermal, wind and hydropower.

The sensitivity analysis of the underlying assumptions for the demand estimates indicates that wood energy requirements could increase considerably if countries do not meet the energy efficiency targets set by the EU renewable sources framework. But demand for wood energy by 2020 could be lower if the efficiency of combustion units is further improved. Present model calculations show that a 1 per cent increase in combustion efficiency could save 7.5 million m^3 of fuelwood at the EU-27 level. Fuelwood demand would also fall if energy outputs from alternative renewable energy sources are higher because of improved technology, economic efficiency and greater private and public acceptance.

1.4.6 Wood processing co-products and residue

This category comprises wood fibre originating from the production of primary wood products, mainly sawnwood and wood-based panels: wood chips, sawdust and particles; sawmill slabs, edgings, trimmings and veneer log cores; and sawdust from wood-based panel manufacturing (Hetsch 2009). This kind of wood is suitable for pulping and particle- and fibre-board production, and also for wood energy uses. Co-products such as black liquor are produced in the pulp industry and valorised for chemical products manufacturing or energy production. The category excludes wood chips directly produced from roundwood and residue in the forest.

Wood processing co-products and residue are used directly in on-site integrated industrial processes or sold to other producers that use wood fibre for subordinated processing in the form of cascade production processes. Production costs and sales prices for alternative uses are the economic factors that determine whether co-products are used for manufacturing or as wood energy. The following example of cascade co-products use of wood serves for illustration (Steierer 2010c). Logs are transformed into sawnwood as the main product and into chips, sawdust and peeled bark as secondary co-products. The chips are used as raw material in manufacturing wood-base panels, and the residue from this production process is used for internal energy production or sold to the energy market. Or the sawmill chips are used in thermo-chemical pulping and the contained lignin and hemi-celluloses end up as black liquor used for the extraction of chemical substances, energy generation or both.

Based on model calculations and empirical information, the amount of industrial wood co-products and residue in the processing sector of the EU-27 could be as much as 188 million m^3 (Saal 2010). In the sawmilling industry the volumes and variety of by-products depend mainly on the recovery rate, the species sawn, the technology used and the quality and dimensions of the required wood assortments.

1.4.7 Post-consumer wood residues

Post-consumer wood consists of products available at the end of their final uses – wood and wood fibre from pallets and other packaging material, used paper and paperboard, recovered wooden furniture, lumber from building sites and construction and other wood pieces not otherwise usable (Leek 2010a). Primary sources of post-consumer wood are municipal solid wood waste, mainly from households, industrial and artisanal waste from production processes and waste from commercial activities. Cost-price relationships for collecting and processing determine to what extent post-consumer wood can be reused as raw materials or for bioenergy production. The often-high costs of alternative disposal – for example, dumping post-consumer wood in landfills – should be taken into consideration in economic calculations.

Total supply of post-consumer wood 2007 in the EU-27 has been estimated at 55 million m^3. Two-thirds, or 36 million m^3, of the collected post-consumer wood has been used for panel production and energy generation. Recovery rates vary by region, from 110 kg per capita per year for northern countries to 75 kg per capita for western countries, 60 kg for southern countries and 55 kg per capita for eastern countries. The remaining third, or 20 million m^3, of the estimated post-consumer wood supply went unused; the greater part of it was landfilled. The EU Landfill Directive 1999 sets targets for the amount of biodegradable municipal waste that each member country can deposit in landfills. The gradual implementation of the Directive will contribute to increasing the quantity of wood waste for recycling.

1.4.8 Wood biomass from land outside forests

Short-rotation plantations on agricultural land are established with fast-growing trees like poplar, willow, black locust and eucalyptus species and managed under intensive culture practices (Leek 2010b). Plantations with rotations of 10 to 15 years are mainly used for fibre production for the pulp and paper industry. For energy purposes, short rotations of two to four years are used under a coppice management system. Data on short-rotation plantations in EU countries are scarce because of inconsistent land-use statistics. A first analysis of literature made in 2007 on short-rotation coppice production suggests that the present area extends to around 30,000 ha.

Trees outside forests and wood from landscape care are an important source of primary wood biomass (Oldenburger 2010), produced during maintenance operations designed to keep trees and open spaces in a defined and desired stage. This source comprises wood produced from maintenance activities in private and public gardens; tree cutting and pruning in agriculture and horticulture; arboriculture activities in parks, urban green spaces, public areas and village surroundings; and maintenance work along roadsides and boundary ridges, rivers and waterways, railways, and electricity and communication lines. Substantial amounts of fresh roundwood, chips and branches are harvested from these sources, called ‘other wooded land’.

To calculate the wood potential from this source within the EU-27, biomass potential studies from France, Germany, the Netherlands, Slovenia and the United Kingdom have been used. Calculations of wood supply from other wooded land areas come from increment data from the State of Europe's Forests Report (MCPFE 2007). It was assumed that 75 per cent of the annual increment volume may be potentially harvested. The total potentially available wood volume per year was estimated at around 87 million m^3, of which an estimated 39 million m^3 could be used as fuelwood.

Wood available from horticulture is estimated at 16 million m^3, and the potential wood biomass available from urban areas is about 22 million m^3. Altogether, the landscape care and wood harvesting on non-forestland is an important primary biomass source. However, because procurement costs are in many cases high, a considerable proportion of the potential is not yet realised. Reductions in procurement costs may be achieved through improved harvesting, packaging and transport technologies and a better organisation of the collection chain that serves both bioenergy users and the wood-processing sector. Improvements of the cost-price ratio will determine the actual use of such wood as biomass.

1.5 Annex: Major wood product groups: World and selected European countries

A.1 Roundwood, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 m³	*1,000 m³*	*US$1,000*	*1,000 m³*	*US$1,000*	*1,000 m³*
World	3,469,378	129,192	18,735,854	122,662	16,542,402	3,475,908
Africa	703,481	567	123,690	3,418	1,257,828	700,630
North America	469,499	5,103	354,167	17,727	2,890,763	456,875
Latin America and Caribbean	508,217	241	33,458	1,520	201,859	506,938
Asia	1,032,706	65,420	12,998,854	6,463	3,061,306	1,091,663
Europe	685,900	57,842	5,220,208	73,682	6,492,424	670,060
Oceania (including Australia)	69,575	19	5,477	19,852	2,638,222	49,742
Selected European countries:						
Austria	18,696	8,252	872,443	1,082	126,703	25,866
Czech Republic	15,381	1,830	184,451	3,599	387,689	13,612
Denmark	2,583	829	82,667	793	70,028	2,619
Finland	50,767	5,823	464,199	731	82,741	55,859
France	55,041	1,513	196,276	7,228	479,932	49,325
Germany	56,142	7,657	748,514	3,652	417,841	60,146
Hungary	6,073	361	22,550	1,276	94,692	5,159
Italy	6,306	4,376	546,171	106	18,997	10,576
Netherlands	978	354	30,721	430	36,411	901
Norway	10,291	1,641	144,827	963	81,055	10,969
Poland	37,180	3,450	209,864	1,904	176,308	38,726
Romania	14,359	686	52,453	832	82,790	14,213
Russian Federation	197,000	1	285	20,700	2,000,160	176,301
Spain	16,648	3,566	152,314	2,044	145,325	18,170
Sweden	72,103	7,519	609,099	892	93,085	78,730
Switzerland	4,861	261	32,072	944	110,518	4,178
United Kingdom	10,021	613	95,967	724	51,867	9,910

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.2 Coniferous sawnwood, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 m^3	*1,000 m^3*	*US$1,000*	*1,000 m^3*	*US$1,000*	*1,000 m^3*
World	290,062	94,749	23,133,625	99,398	23,203,226	285,414
Africa	2,252	7,248	1,706,562	115	33,165	9,385
North America	83,402	16,388	3,180,325	26,755	6,308,926	73,035
Latin America and Caribbean	20,156	2,938	553,260	3,861	932,553	19,233
Asia	46,657	35,303	8,543,374	509	239,722	81,451
Europe	130,055	32,103	8,818,832	66,043	15,034,797	96,115
Oceania (including Australia)	7,540	769	331,272	2,115	654,063	6,195
Selected European countries:						
Austria	9,485	1,729	465,495	5,586	1,490,187	5,628
Czech Republic	4,153	530	102,048	3,084	366,898	1,599
Denmark	248	1,667	352,233	149	36,321	1,767
Finland	9,700	462	102,799	6,101	1,603,043	4,060
France	7,213	3,057	936,176	467	103,739	9,803
Germany	21,633	3,924	1,125,101	6,712	1,680,570	18,845
Hungary	122	371	80,338	33	7,256	460
Italy	750	5,002	1,279,069	123	49,415	5,629
Netherlands	169	2,350	666,524	230	54,781	2,289
Norway	2,271	904	339,850	467	117,587	2,708
Poland	3,946	654	207,873	380	112,338	4,220
Romania	2,900	14	2,950	2,324	568,728	591
Russian Federation	29,055	15	4,129	18,846	3,219,940	10,224
Spain	1,706	879	218,645	113	29,937	2,472
Sweden	16,700	337	115,535	11,656	3,475,287	5,381
Switzerland	1,251	409	182,235	203	47,635	1,457
United Kingdom	3,227	4,514	1,372,256	131	38,902	7,611

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.3 Nonconiferous sawnwood, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 m^3	*1,000 m^3*	*US$1,000*	*1,000 m^3*	*US$1,000*	*1,000 m^3*
World	116,125	21,109	9,750,271	20,330	7,921,829	116,904
Africa	5,739	1,460	472,940	2,177	792,624	5,022
North America	17,150	1,210	561,491	2,728	1,366,459	15,632
Latin America and Caribbean	22,251	1,005	267,256	1,139	578,169	22,117
Asia	55,969	11,659	4,979,274	7,226	2,459,939	60,402
Europe	14,086	5,660	3,348,256	6,899	2,648,563	12,847
Oceania (including Australia)	930	115	121,054	161	76,075	884
Selected European countries:						
Austria	151	213	156,137	142	107,259	222
Czech Republic	301	99	53,454	240	46,414	160
Denmark	124	341	85,218	274	26,702	191
Finland	50	31	36,298	13	7,729	68
France	1,462	342	279,952	375	192,249	1,429
Germany	996	478	320,346	612	355,606	862
Hungary	202	125	38,928	213	81,808	114
Italy	500	979	495,857	126	153,418	1,353
Netherlands	69	360	345,446	92	89,606	337
Norway	0	98	27,615	7	1,345	92
Poland	476	244	117,667	95	76,424	624
Romania	1,541	39	19,576	735	222,930	846
Russian Federation	2,637	19	15,291	746	164,828	1,910
Spain	456	224	146,057	83	32,923	598
Sweden	100	64	60,847	23	21,218	141
Switzerland	63	65	77,710	16	7,256	111
United Kingdom	52	410	371,114	32	27,551	430

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.4 Wood-based panels, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 m³	*1,000 m³*	*US$1,000*	*1,000 m³*	*US$1,000*	*1,000 m³*
World	287,719	70,695	31,327,197	70,735	32,718,735	287,680
Africa	2,711	1,948	1,053,020	578	539,255	4,082
North America	41,018	10,748	3,987,401	5,575	2,344,159	46,191
Latin America and Caribbean	16,460	2,778	1,435,371	4,257	1,655,078	14,981
Asia	149,426	22,438	10,235,295	25,989	12,076,314	145,875
Europe	74,232	32,131	14,234,736	33,165	15,623,355	73,198
Oceania	3,872	652	381,374	1,171	480,574	3,353
Selected European countries:						
Austria	3,335	792	493,469	2,753	1,551,520	1,374
Czech Republic	1,305	810	293,848	1,615	520,402	499
Denmark	456	1,316	252,405	177	52,138	1,596
Finland	1,352	422	228,942	1,047	691,098	728
France	5,765	2,385	1,267,796	2,427	996,416	5,722
Germany	12,092	5,005	2,382,076	5,638	3,280,221	11,458
Hungary	1,056	462	183,925	431	185,898	1,088
Italy	4,361	2,621	981,093	1,142	644,017	5,840
Netherlands	46	1,680	811,449	295	159,199	1,430
Norway	520	362	267,367	247	113,185	636
Poland	8,396	1,583	668,379	2,113	886,388	7,866
Romania	2,824	524	247,065	1,769	530,131	1,579
Russian Federation	11,857	1,438	676,401	2,208	1,142,767	11,087
Spain	2,993	958	447,818	2,125	791,288	1,826
Sweden	648	1,213	574,320	215	206,518	1,646
Switzerland	991	526	342,702	719	304,492	798
United Kingdom	3,384	2,827	1,348,821	546	206,210	5,665

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.5 Wood pulp, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 MT	*1,000 MT*	*US$1,000*	*1,000 MT*	*US$1,000*	*1,000 MT*
World	173,310	51,490	40,927,978	53,420	37,263,254	171,380
Africa	2,725	537	394,548	1,105	1,040,366	2,157
North America	69,729	5,776	4,001,224	18,516	13,385,748	56,989
Latin America and Caribbean	21,842	1,944	1,645,798	13,979	8,657,673	9,807
Asia	29,411	24,505	19,959,235	3,628	2,033,155	50,288
Europe	46,595	18,449	14,728,680	15,371	11,659,386	49,673
Oceania	3,008	279	198,493	821	486,926	2,466
Selected European countries:						
Austria	2,005	637	515,092	393	324,659	2,249
Czech Republic	700	145	127,029	328	244,648	517
Denmark	5	69	51,781	16	7,407	58
Finland	10,362	473	347,837	2,475	1,872,549	8,359
France	1,837	1,892	1,545,858	713	482,783	3,017
Germany	2,725	4,911	4,017,946	1,069	818,928	6,567
Hungary	1	110	86,343	5	4,274	106
Italy	386	3,448	2,446,372	35	26,335	3,798
Netherlands	80	1,567	1,280,869	944	724,105	704
Norway	1,912	44	37,193	590	568,920	1,366
Poland	1,102	717	546,914	38	27,989	1,781
Romania	0	72	52,184	4	2,518	68
Russian Federation	7,362	94	84,300	2,035	1,299,663	5,421
Spain	1,976	969	745,018	1,140	967,683	1,806
Sweden	11,858	470	367,381	3,151	2,776,079	9,177
Switzerland	142	295	224,507	8	3,271	429
United Kingdom	234	988	929,740	21	13,117	1,201

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.6 Recovered paper, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 MT	*1,000 MT*	*US$1,000*	*1,000 MT*	*US$1,000*	*1,000 MT*
World	210,681	56,455	14,198,948	59,488	12,045,165	207,679
Africa	1,724	47	12,788	178	42,784	1,593
North America	50,157	1,714	349,519	23,099	4,088,761	28,772
Latin America and Caribbean	10,249	2,076	634,280	921	172,549	11,404
Asia	89,950	36,650	9,430,843	8,286	1,937,467	118,314
Europe	55,239	15,965	3,770,091	25,388	5,496,335	45,816
Oceania	3,362	3	1,427	1,616	307,269	1,780
Selected European countries:						
Austria	1,443	1,388	332,739	386	79,193	2,445
Czech Republic	422	72	15,021	492	108,974	1
Denmark	619	134	31,178	751	143,826	1
Finland	583	46	12,716	168	31,098	461
France	5,066	867	200,338	2,920	611,658	3,014
Germany	15,262	4,088	1,067,028	3,384	680,611	15,966
Hungary	0	385	88,130	152	35,638	233
Italy	5,042	474	177,238	1,722	384,546	3,794
Netherlands	2,159	3,015	552,069	3,662	878,261	1,513
Norway	427	148	35,884	375	74,123	199
Poland	1,840	307	60,896	531	127,796	1,616
Romania	350	3	1,318	90	19,541	263
Russian Federation	2,100	2	520	292	61,695	1,810
Spain	4,723	1,154	316,005	783	177,684	5,094
Sweden	1,712	976	190,696	477	104,070	2,211
Switzerland	1,315	258	51,631	572	121,980	1,001
United Kingdom	8,036	177	54,644	4,479	957,718	3,733

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

A.7 Paper and paperboard, 2011: World regions and selected European countries

Region	*Production*	*Imports*		*Exports*		*Consumption*
	1,000 MT	*1,000 MT*	*US$1,000*	*1,000 MT*	*US$1,000*	*1,000 MT*
World	403,183	109,161	110,810,686	112,009	108,619,903	400,336
Africa	3,472	4,373	4,574,020	710	724,469	7,135
North America	89,493	11,930	11,712,908	23,005	17,486,370	78,418
Latin America and Caribbean	20,226	9,038	8,933,988	3,366	3,474,878	25,898
Asia	179,474	26,365	26,180,070	16,424	16,859,029	189,415
Europe	106,563	55,379	57,252,532	66,853	68,915,253	95,090
Oceania	3,955	2,076	2,157,168	1,651	1,159,904	4,380
Selected European countries:						
Austria	4,901	1,366	1,432,297	3,987	3,647,979	2,281
Czech Republic	755	1,236	1,156,845	683	856,512	1,329
Denmark	423	994	1,063,322	255	288,815	1,162
Finland	11,329	480	454,471	10,454	9,747,711	1,355
France	8,527	5,553	5,800,931	4,566	5,243,718	9,515
Germany	22,704	10,543	10,626,217	13,299	14,211,201	19,948
Hungary	696	747	843,685	581	633,381	862
Italy	9,130	5,020	4,811,937	3,123	3,650,977	11,027
Netherlands	2,748	2,874	3,178,229	2,484	3,131,623	3,138
Norway	1,492	432	492,754	1,321	998,473	604
Poland	3,756	3,134	3,182,373	1,967	2,118,440	4,922
Romania	297	444	411,230	81	80,757	660
Russian Federation	7,624	1,400	2,084,788	2,307	1,610,160	6,716
Spain	6,203	3,042	3,147,626	2,701	2,765,275	6,544
Sweden	11,298	853	907,835	10,451	10,600,808	1,700
Switzerland	1,376	866	1,155,028	894	1,040,934	1,347
United Kingdom	4,341	6,887	6,517,557	974	1,680,175	10,254

Source: compiled from FAOSTAT 2012 (for World data) and UNECE/FAO 2012 (for European data)

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2 Creating added value in companies and enterprises

2.1 Value-creation processes

2.1.1 Producing goods and services

Human needs and scarcity of available resources are the driving forces behind business activities. People have numerous and varying needs, some of which involve everyday goods and services and some of which are required in production processes. Only limited means are available to satisfy these needs. Decisions regarding the use of resources for production and consumption are based on an assessment of the value of goods and services for satisfying alternative demands. This fundamental economic challenge affects every entity making economic choices and decisions (Behrens 2004: 9): individuals and private households engaged in production and consumption, enterprises and companies of the private sector, and public entities at the local, communal, state, intergovernmental or supranational level. Companies and enterprises may be owned and managed by public bodies or operated with public capital participation under business law, such as state-owned corporations or enterprises operated by cities, regional communities and local municipalities.

In a market economy the means for satisfying private and public needs are generated when economic entities produce goods and services, which are exchanged on markets for other goods and services. Money serves as the universal unit of exchange and is the basis for economic transactions. By selling goods and services on markets, economic actors obtain income, which they use to satisfy their needs and accumulate assets. As a unit of exchange, money makes it possible to compare the value of different types of goods directly, and it is the standard of value for economic considerations (Spahn 1999: 26).

Enterprises and companies respond to demand from households and the state by producing goods and services and selling them in markets. Using the financial proceeds, they create the resources needed for further production by purchasing required labour, information and specialised knowledge in exchange for money, mainly from households in factor markets. Households thereby obtain income, with which they acquire the goods and services that they need in product markets. The state acts as both a source of demand and a producer of goods and services. It obtains the financial means required from tax revenue, duties and fees. Goods and services produced by the state contribute to an increase in the well-being of citizens, allow the functioning of public institutions and establish a framework for private and public initiatives. Many of the goods and services produced by the state are not traded in markets; rather, they are delivered directly to the public. Income from the various economic entities is used to meet demand – for example, for immediate consumption – and to accumulate assets. Conversely, goods for investment or consumption are obtained not only through income but also from stock of assets and property.

The processes in exchanging money flows in an economy can be represented in a simplified model of the circulation of income. Figure 2.1 illustrates the interconnections in demand for and production of goods and services. The model shows the economic entities that are involved in a closed economy – that is, enterprises and companies, private households and the state in which the demand for goods and services arises. In an open economy – the most common type today – demand and supply from abroad have a large and growing influence on a country's economy. International economic relationships are conducted through imports and exports.

The *circular flow model* shows, in a simplified form, the basic relationships among companies, households and the state. The real exchanges in an economy, however, are based on complex processes and transactions involving highly ramified networks among multiple economic entities. These appear simultaneously as producers and consumers of goods and services. In a market economy, networks of this type are organised by economic entities expressing their preferences for

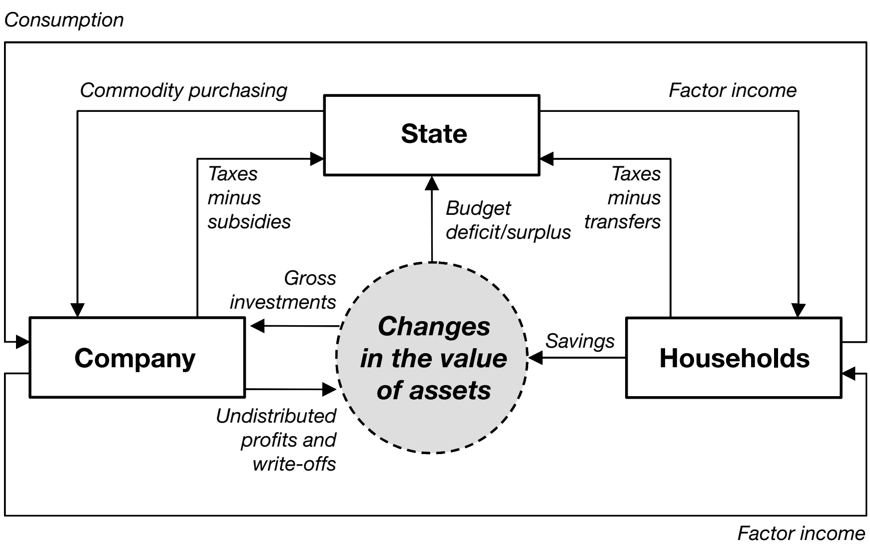

Figure 2.1 Cycle of income in an economy

Source: Spahn 1999: 24

goods and services in demand, and by business units producing goods and services for existing or assumed market preferences.

The International Standard Industrial Classification (ISIC) assigns all enterprises to a specific branch of the economy in one of three economic sectors, depending on their principal business activity (see Table 2.1). In this classification, forestry is assigned to the primary sector, companies in the woodworking and wood-processing industry to the secondary sector and trading enterprises to the service, or tertiary, sector.

Table 2.1 Assignment of branches to the three sectors of the economy

Primary sector	– Agriculture, hunting and forestry
	– Fishing
	– Mining and quarrying
Secondary sector	– Manufacturing
	– Electricity, gas and water supply
	– Construction
Tertiary sector	– Wholesale and retail trade; repair of motor vehicles and motorcycles
	– Hotels and restaurants
	– Transport, storage and communications
	– Financial intermediation
	– Real estate, renting and business activities
	– Public administration
	– Education
	– Health and social work
	– Other community, social and personal service activities
	– Private households with employed persons
	– Extra-territorial organizations and bodies

Source: International Standard Industrial Classification, ISIC

The assignment of companies to economic sectors is based on a conceptual model in which economies show a transfer of value creation and employment from initial production in the primary sector, through industrial production, to the delivery of services (see Figure 2.2). However, the institutional demarcation between sectors does not fully capture reality, since many services are produced and marketed in the primary and secondary sectors as well (Meffert and Bruhn 2006: 10).

2.1.2 Creating value added

Economic considerations for the production of goods and services are based in principle on two variables: the prices that can be obtained, through which income is generated, and the costs of production, for which income is used. The motivation to produce goods and services is based on the level of profits that can be achieved in satisfying existing or anticipated market demand. This is the case when the combination of factors of production in the relevant markets is worth more than the aggregated value of the factors of production used for the purpose. The increase in

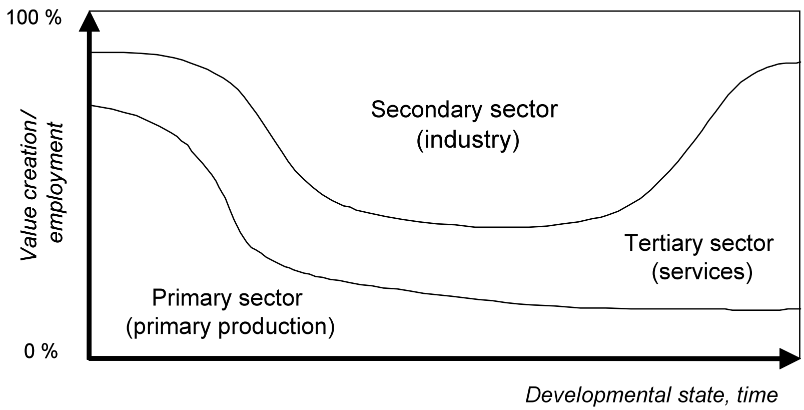

Figure 2.2 Path of development in an economy

Source: adapted from Frey 1997: 74

the value of goods and services achieved through commercial production is known as *value added.*

The aggregates involved in creating value added are explained in Figure 2.3. The *gross value of production* is the result of the market value of all goods and services produced. Subtracting the intermediate input from other companies gives the *net value of output.* This corresponds to a company's *value added to gross earnings.* To simplify, it is assumed here that a market value exists and can be determined for everything that an enterprise produces. In reality, it may be difficult to value a company's internal work or determine the value of inventories.

The sum of value added in all branches of the economy is the *gross domestic product (GDP) at market prices.* GDP is an important indicator of a country's economic capabilities. The *net domestic product at market prices* results when depreciation of assets is considered in the calculation. When the calculation is adjusted for state influences on market prices or factors of production – for example, indirect taxes such as fuel oil tax and production-related subsidies – the result is the *net domestic product at factor costs.* In the *circular flow model of income* this variable corresponds to the combined asset and labour income of households. The basis for calculating operational value creation is the turnover actually achieved. Value creation refers here to the value added by companies and enterprises producing goods, processing goods and providing services (Thommen 2008: 669; Thommen and Achleitner 2006: 849). It is calculated from the difference between turnover and costs of purchased goods and services. The sequence of entrepreneurial activities leading to economic value creation can be presented as a *chain of economic value added*, or more briefly, a *value chain.*

The *value chain model* by Michael Porter describes how value is created inside a company (see Figure 2.4). A distinction is made between primary and support

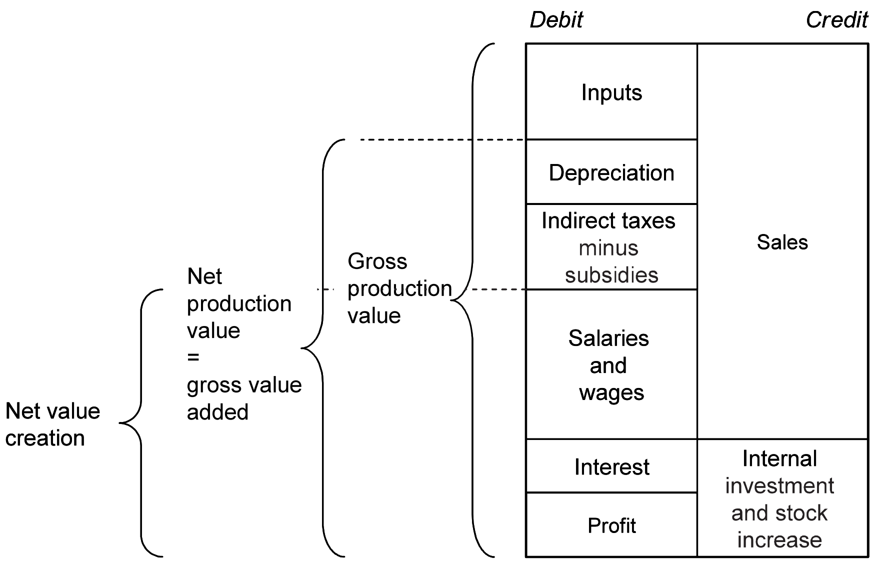

Figure 2.3 Aggregates of value creation

Source: adapted from Spahn 1999: 14

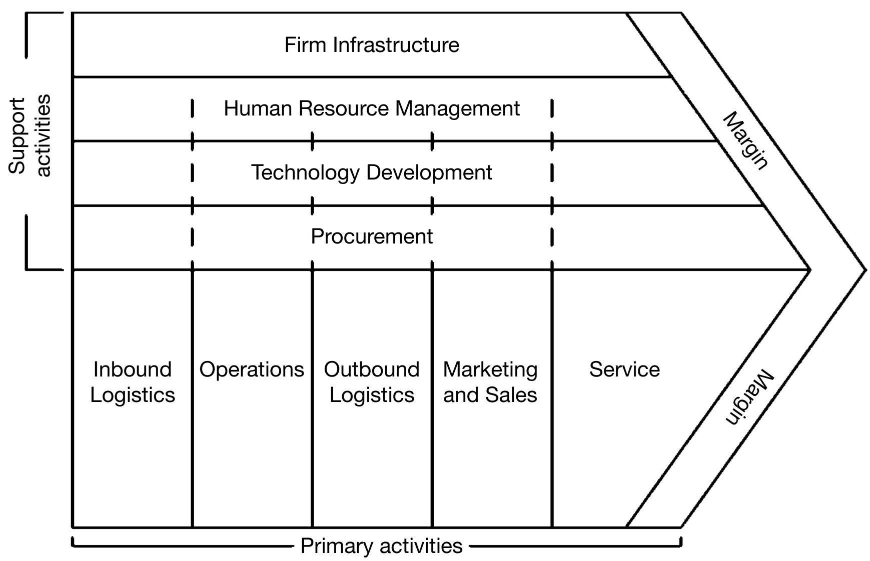

Figure 2.4 The generic value chain

Source: Porter 2004a: 37, Figure 2.2. Reprinted with the permission of Free Press of Simon & Schuster, Inc, from *Competitive Advantage: Creating and Sustaining Superior Performance* by Michael E. Porter.

activities. *Primary activities*, such as inbound logistics, operations, outbound logistics, marketing and sales and consumer services, contribute directly to value-creation processes. *Support activities* relate to infrastructure, human resources management, the development of technology and procurement. Support activities contribute to added value indirectly and give rise to costs that need to be added to those incurred through primary activities.

The referential framework for representing value creation can be extended. For example, the processes from the regeneration or afforestation of forest stands to wood harvesting, transport of roundwood, wood processing and eventual marketing of final products can be presented as a sequence of value-creating and mutually supportive activities. If several companies are involved in the process, then interlocking value chains in forestry and wood processing can be defined. In this sense, the whole network of economic relations in value creation – be it by a group of enterprises, by a local or regional cluster of industrial activities or in a particular industrial branch – can be understood as a sequence of operational value chains. In this sense one may, for instance, speak of a wood-based value chain integrating roundwood production and industrial wood processing. This representation reveals critical points of contacts and interfaces between the aggregated parts of value chain network. The links and points of contacts depend on the specific activities and business goals as well as on the typical form of organisation of the enterprises that constitute the network.

Looking at the value-creation processes in this manner allows analysing, improving and controlling a sequence or cluster of value-creation activities. The more effectively these complex networks and value clusters are cooperating, the lower the combined arising costs can be, and the more efficient the actual operational performance. This tends to become easier the more closely the partial processes are linked to each other in both time and quality management. Tight organisational linkages require a systematic optimisation of information flows and logistics at the interfaces of different value-creation processes.

2.1.3 Value chain in wood processing

Value creation achieved in monetary terms in the wood-based sector takes place in complex, integrated output processes and exchanges between forestry and the wood-processing industry. Analysis of the wood value chain as a whole is important for improving efficiency and effectiveness. Factors to be taken into account include the entrepreneurial forms of enterprises, their business goals and their established structures of cooperation. It is necessary to examine the willingness and opportunities of the actors to communicate and identify ways to improve the economic outputs. The challenge for entrepreneurs is to avoid focusing exclusively on their own production and marketing goals instead of exploring opportunities for optimising the value chain as a whole.

Primary forestry activities form the starting point of the forestry and wood-processing value chain. These are followed by diversified industrial processes that use wood as a versatile raw material. Semi-final and final products are produced as investment and consumer goods. Depending on the type of processing, intermediate branches, such as the sawmilling or veneer industry, may participate. Other branches, such as the paper and paperboard industries, deliver products for end users and form terminal points in value creation. There is competition between wood products delivered to intermediate industrial or artisanal markets and those sold directly to end users. Competitive production satisfying demand at intermediate stages or of end users requires different approaches in customer-oriented sales and marketing strategies.

At the same time, the forest and wood-processing value chain is an important source of bioenergy production. This is the case with wood assortments used for heating homes and public buildings, and increasingly for producing both heat and electricity in large power generators. Industrial sawmilling, wood panel production, pulp and paper production and secondary woodworking units create large amounts of wood by-products, a considerable part of which is used to produce heat and power for the industrial installations of the producing companies; some of this biomass is also sold to intermediate wood energy-producing enterprises and local and regional end users. Figure 2.5 presents an overview of the value chain for wood as a material and energy source in European industry. It starts with sustainable roundwood production and leads to processed wood products – sawnwood and veneer, wood-based panels, fibreboard, various categories of pulp, paper and paperboard.

Efficiency in the wood chain requires an analysis of the connections between forest owners and forest enterprises on the one side, and between wood-processing and woodworking enterprises on the other side. Considerable structural differences

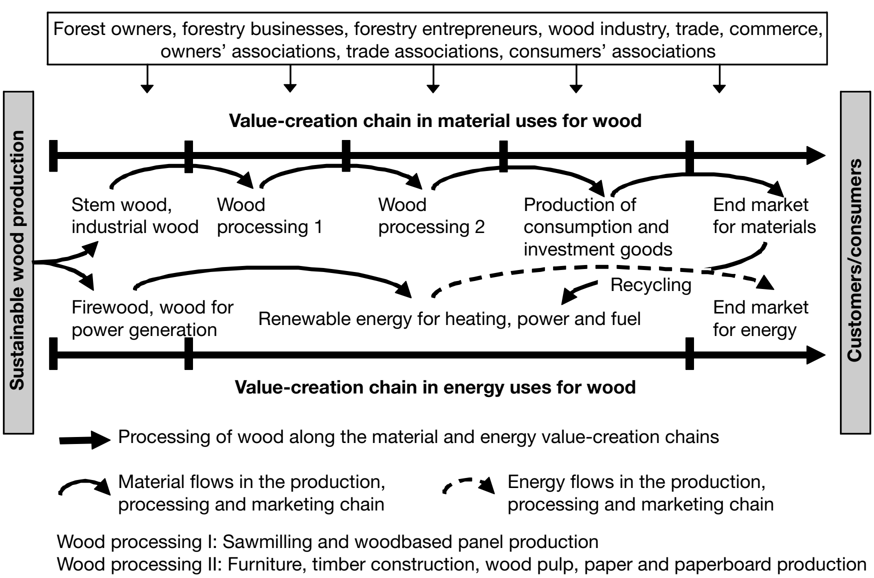

Figure 2.5 Value chain in wood processing

exist locally, regionally and among countries. Multiple interruptions in the chain and problems at organisational interfaces can incur additional costs, but many examples demonstrate that forest operations, wood processing and production of consumer goods can be linked by a regular exchange of information and by supply and delivery agreements. In countries with many small and medium-sized forest ownerships, such as Finland or Austria, forestry associations play an important role in ensuring effective and efficient coordination along the wood chain.

Various forms of vertical integration exist between forestland ownership and industrial wood processing. Sales contracts, for specified wood assortments at roadside or for standing trees to be harvested by the wood-processing companies, are one way to link wood production and wood processing. Contractual agreements regulating forest management and utilisation are another way of organising the value chain of roundwood delivery. Integration between forestland ownership and wood-processing companies can be achieved when landowners operate their own processing plants or when processing companies acquire forestland to secure a supply of raw materials. Figure 2.6 shows options for organising the interface between forestry and wood-processing activities as the result of combining different steps in forest management and wood harvesting.

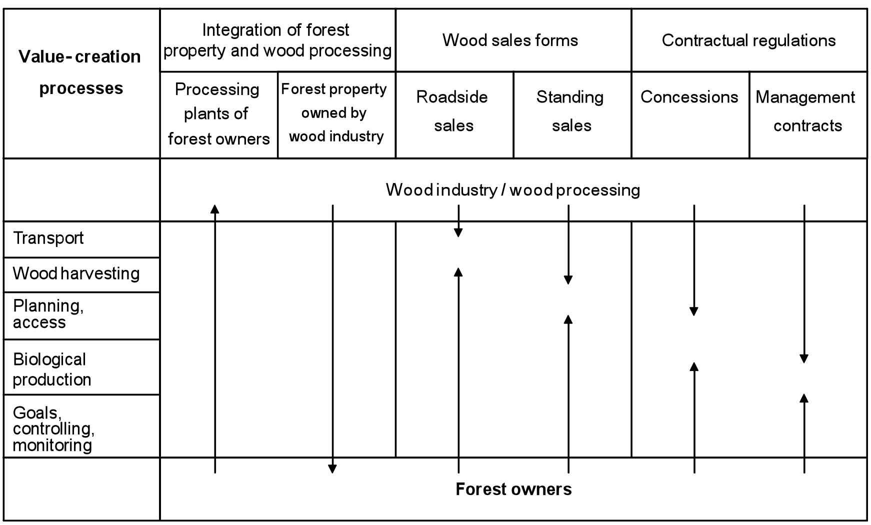

Figure 2.6 Interface between forestry and wood industries

Source: Schmithüsen 1969: 16 (modified)

2.1.4 Wood-processing networks

The business environment of forestry and wood processing is shaped by internationalisation and capacity concentration, new product developments and improvements in production technology. The relations between various production activities and economic branches can be assessed by using input–output tables or input–output effect models (Eder 2000; Peter *et al.* 2001). Rationalisation in core entrepreneurial skills and extension of the value chain among companies and allied economic sectors has altered the relationships between wood production and wood processing. What used to be a more or less linear sequence of processes has become a comprehensive network of value-creation activities. An example of connections between forestry and wood industries and important activity nodes is shown in Figure 2.7.

Forestry production and customers in intermediate and end-user markets are the established reference points of wood-processing networks. Relations between them require regular and thorough assessment to prevent tensions, unnecessary delays and lost opportunities. All along the wood-processing value chain, new approaches, challenges and opportunities are appearing:

- In Central Europe, debarking, measurement and classification of roundwood assortments graded were traditionally performed by forest owners, who sold their timber along forest roads. Now, debarking, electronic measurement and classification are carried out at the sawmilling processing site.
- Harvesting technology available in the Nordic countries and Central Europe uses full-tree harvesters with built-in electronic measurement capabilities. This allows felling, debarking and electronic data entry for each tree in one operation. The data are transmitted directly to the managers of forest operations and processing plants. Performance rate, harvested volumes, assortment

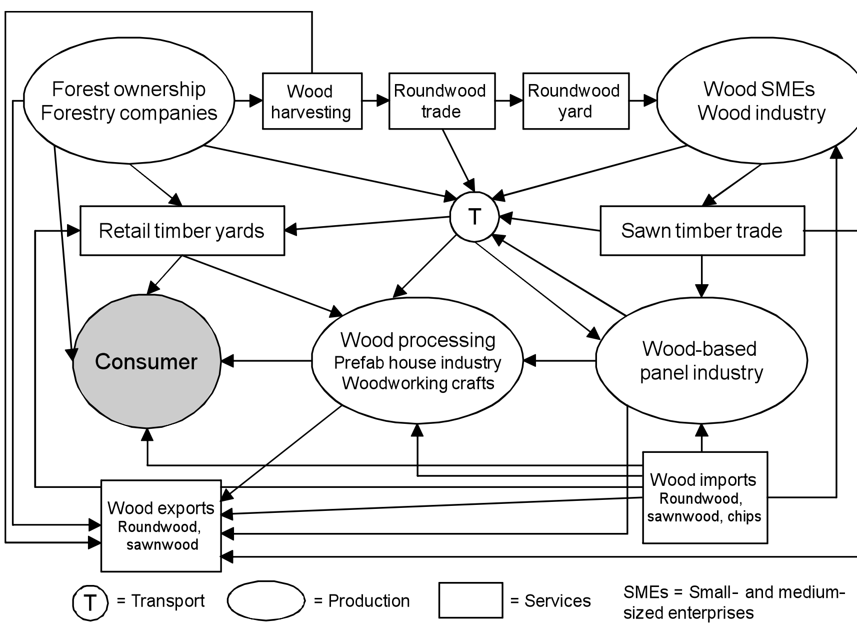

Figure 2.7 Wood-processing networks

classification and even quality grading are available at the end of each workday.

- Suppliers and customers of roundwood used to have contact mainly at the local level, often on individual felling sites, and the relationships were cultivated largely on a personal basis. Today, supply agreements covering several weeks, a full logging season or several years are an established practice. The expansion of trade relations in a national and international context requires new electronic communication structures and highly trained people in dovetailed production and marketing planning. The reliance on local supply arrangements at local and regional levels is still of value but less important because of increased processing of standardised roundwood assortments.
- Full-tree processors, skidding machines and other machinery for wood harvesting and hauling require greater initial investment. This leads to a different cost structure with higher fixed costs, promotes larger processing units and favours concentration among forestry enterprises. Associated with this trend is the development of new business activities, such as service companies and forest contractors engaged in logging, skidding and roundwood transport.
- Wood is now more often sold on the stump, with subsequent wood harvesting operations by purchasers or industrial contractors. Roundwood transport – which used to be a routine matter between suppliers and customers – has become a highly specialised part of the processing sequence and increasingly an independent branch of the industry. Air drying of sawnwood, which required time and tied up capital, is being replaced by kiln drying.
- New storage strategies with faster throughput time and lower stock levels are improving the efficiency of the interface between forestry and the wood industries. They increase the dependency between links within the wood value chain as well as the risks of production interruptions, in particular from seasonal weather effects, with consequences for contractual roundwood supply agreements. Special problems occur when roundwood supply comes mainly from a large number of small and medium-sized forest ownerships.
- Roundwood assortments as well as wood-processing co-products and residues are in demand from several branches of the industry. Market competition in raw material procurement thus extends to sawmilling, wood-based panel production and the pulp and paper industry. In addition, demand for forest bioenergy competes with the demand from industrial wood processing. This implies the need for close coordination between supply, production and marketing strategies.

The German wood-based industry cluster in 2008 (see Table 2.2) illustrates, for instance, the large number of players involved in wood-related processing networks and the need to cooperate to dovetail production circuits with efficient and effective market results. It incorporates roundwood-producing forestry enterprises; processing industries of semi-finished solid wood products, pulp and

Table 2.2 Employment in Germany's wood-based sector cluster, 2008

Industries (NACE), sub-sectors, cluster aggregates*	*Employees 2008 (1,000)*	*(%)*	*Employees per enterprise*[4]
Forestry (02)	18.0	2	3.9
Solid wood sub-sector			
Wood products (20)	*136.4*	*16*	*6.9*
Sawmilling (20.1)	29.0	3	8.0
Wood-based panels (20.2)	15.4	2	53.9
Wood construction (20.3)	61.5	7	5.6
Wood packaging (20.4)	11.2	1	14.4
Misc. wood products (20.5)	19.3	2	4.8
Furniture (36.1)	*136.8*	*16*	*11.7*
Wood crafts (45x)[1]	*115.4*	*13*	*3.0*
Carpentry (45.22.3)	52.1	6	4.4
Joinery (45.42)	58.4	7	2.5
Parquet laying (45.43.1)	4.9	1	2.2
Wood trade (5x)[2]	*12.1*	*1*	*3.4*
Subtotal	*400.7*	*47*	*6.1*
Cellulose sub-sector			
Paper products (21)	*131.5*	*15*	*48.2*
Paper productions (21.1)	54.3	6	85.7
Paper articles (21.2)	77.2	9	37.1
Publishing, printing (22)	*306.9*	*36*	*12.1*
Publishing (22.1)	134.7	16	14.0
Printing (22.2)	172.2	20	11.5
Subtotal	*438.4*	*51*	*15.6*
Cluster total	857.2	100	8.6
Cluster, in production industries[3]	*827.0*	*96*	*8.5*
Cluster, excluding publishing, printing (22)	*550.3*	*64*	*7.4*

Notes:
* Nomenclature of Economic Activities in the European Community

1. Aggregate, not part of NACE.
2. Aggregate, includes 51.53.2 wholesale of wood, 51.53.3 wholesale of wood products, 52.44.6 retail sale of wood.
3. Excludes NACE 02 and 52x.
4. Relates to the number of enterprises as of the value-added tax statistics 2007.

Source: Kies *et al.* 2010: 237

paper; and downstream manufacturing industries providing finished wood and paper products to end consumer markets. The industrial units engaged in complex networks along the wood value chain maintain a close relationship to their common raw material base and reveal high connectivity along regional supply chains. In the official Nomenclature of Economic Activities in the European Community (NACE), forestry and wood-based industries are allocated to separate statistical sections. Since no uniform class is available, wood production and processing activities had to be constructed as a collection of various industry classes, sub-sectors and selected cluster aggregates.

Measured in labour input, the cluster shows the importance of employment in the German wood-based sector in the economy and the different weight of jobs in the sector's major employment aggregates. For the year 2008, the cluster employed about 857,000 people. Although forestry accounted for only 2 per cent of the total labour force, it plays an essential role in establishing the actual resource base for the industrial cluster as a whole. The solid wood sub-sector (401,000 workers, 47 per cent) and the cellulose sub-sector (438,000 workers, 51 per cent) employ the biggest proportions of the labour force. Sawmilling, wood construction, furniture production, carpentry and joinery are important job providers in the solid wood sub-sector. Paper products provide 15 per cent and publishing and printing, 36 per cent, of the cluster's total labour force. Without the printing and publishing aggregates, the cluster's employment amounted to 550,300 persons.

2.1.5 Environmental benefits and social services

Other value-creation processes relate to the environmental benefits and social services that result from maintaining and managing forests (Cesaro *et al.* 2008). Economic, social and political demands for adding value through multifunctional forestry practices, landscape protection and nature conservation and preservation have gained importance during recent decades. Methods and instruments to assess the value of public goods and services have been developed by environmental economists. Practicable evaluation methods and studies of the monetary value of protective and recreational services derived from forests and forestry activities are required (Bergen *et al.* 2013). For an overview of the multitude and diversity of social and environmental services and the synergies and conflicts in social, ecological and economic interactions, see IUFRO (2011).

Multifunctional value-added processes relate to nature and landscape management activities and help preserve biodiversity and rare forest ecosystems. The demand for recreation, the role of forests in human health and the interactions between an increasingly urban population and the environment are of importance (Hug *et al.* 2008; Nilsson *et al.* 2011). In urban and peri-urban forests and in popular tourism and holiday areas, forest management needs to be carried out in accordance with special-purpose management plans that include accommodation and information for the public (Konjinendik *et al.* 2004, 2005). Particularly in forests belonging to municipalities and other public entities, close-to-nature forestry practices are an important and often overriding management goal. Forest visitors are increasingly interested in nature and biodiversity. Educational activities relating to forests and the environment for both adults and younger people are being developed by municipalities, educational institutions and environmental associations.

The combination of different production and management goals to be achieved depends on the prevailing types of forest ecosystems to be used or preserved, and on the socioeconomic context in which management decisions are made (see Figure 2.8). The achievement of multiple goals while generating different combinations of goods and services means inevitably that a change in one strand leads to changes throughout the system. The attitudes of landowners towards their forests and how they should be managed have become much more nuanced.

In the Alps and Pyrenees, forest management contributes to protecting rural and urban settlements, tourism facilities, roads and railways, electricity supply lines and other communication routes. Specialised and costly silvicultural regimes for managing these protection forests are required. Protection from natural disasters, achieved through systematic regeneration and tending that increases the stability and resilience of critical forest areas, is both demanded and appreciated by the population (Schmithüsen *et al.* 2000b). Risk management and safety provisions, in particular in regions with avalanche threats, are a precondition for maintaining and expanding economic and social activities (Wilhelm 1997). Empirical surveys have shown that the significance of the forest and the efforts of managing it sustainably are regarded by the public as a positive contribution to the quality of life (Wild-Eck 2002).

Comparative studies for several European countries show that environmental benefits and social services are important to both the local population and forest visitors (European Commission 2009; Rametsteiner and Kraxner 2003). The

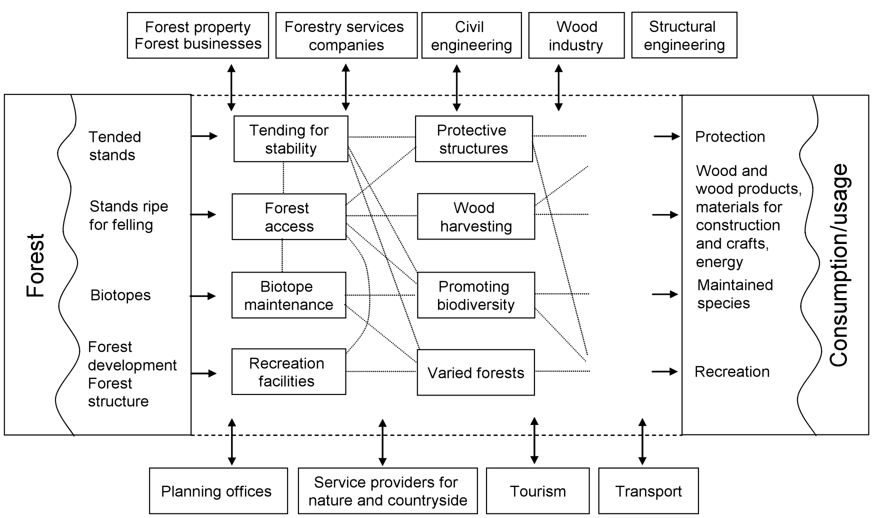

Figure 2.8 Combination of forest production and management goals

results, based on empirical data, show that the public largely approves of the goals and practices of multifunctional forest management. It strongly supports policies to protect forests as part of the natural heritage. People agree that forests meet their demands for protection of nature and human beings, allow varied forms of recreational uses and provide economic benefits from sustainable wood production. A similar message results from two representative sociocultural inquiries examining the meaning of forests to the Swiss population, in 1997 and 2010 (BUWAL 1999; Hunziker *et al.* 2012). Ecology, protection, recreation and wood production were identified as the principal forest functions in both studies.

2.1.6 Cluster analysis in the forest-based sector

Cluster analysis is a research approach for assigning a set of objects or features to groups based on their similarities. The analysis is useful, for instance, in plant ecology research and social network analysis. Groups of profit-seeking actors with synergistic, reciprocal linkages may be defined as economic clusters, the development of which is a long-term process. Industrial clusters evolve from economic, social and political forces, which in turn may be determined by history and geography. This means that each cluster has its own characteristics. It is essential to understand the origins and factors that cause industrial clusters to emerge, evolve, grow and eventually stagnate or decline, and to analyse how they are constructed, how they contribute to innovation and how they can be promoted (Sölvell 2009).

Forest cluster analysis has become an important methodology for evaluating the socioeconomic networks in which sustainable roundwood production, woodworking and wood processing contribute to economic efficiency and sector innovation. It provides specific information and data on flow of resources, markets and development potentials and highlights limitations and development constraints in utilisation, processing and marketing. It can identify positive trends and opportunities relevant to strategic decision making in both business and public policy. Information on the self-organisation potential in forestry and wood processing helps improve communication and cooperation among the cluster stakeholders. Showing the interconnectivity of different activities along the value chain in a spatial context makes visible the interdependencies of joined and contradictory interests among business partners and between the private and public sectors.

Understanding the importance of the forest cluster enables enterprises and companies to become aware of the complex economic and technological networks in which they operate (Mrosek and Schulte 2007). It enhances their ability to understand actual and potential business opportunities and benefit from knowledge transfer in a particular technological or geographic cluster. Cluster analysis is also a tool for policy makers seeking to enhance competitiveness and innovation through, for instance, industrial and trade policies, regional development policies and reforms that improve the efficiency of small and medium-sized industries. It may also help the public sector support high-level technology development, establish and support cooperative networks in using joint information systems and promote human resources development regarding specialised labour and management abilities.

Empirical socioeconomic cluster analysis brings together in a common analytical frame the multifunctional aspects of sustainable forest management and the complex network of entrepreneurial activities along the wood value chain (Mrosek *et al.* 2009). It identifies common and divergent interests between different business units and enterprises and identifies links among stakeholders, producers and consumers engaged in wood-based industries. Cluster analysis focuses on competitive advantages and innovative surveys in determined geographical areas. It uses quantitative methods, such as input–output analysis, graph analysis and correspondence analysis, as well as qualitative methods based on case studies. Networks of production, strengths and weaknesses of particular resource areas, inter-industry knowledge flows, value chains and networks of production, and systems and networks of innovation are typical research subjects. Figure 2.9 provides an overview of economic branches and agents engaged in the production and processing of wood and nonwood forest products and in providing environmental services that may be the subject of different combinations in forest cluster analysis.

Forest cluster research has been taken up, for instance, in the United States, Sweden, Finland, Austria and Germany (Lammi 1996; Vitamo 2001: 23–38). Innovation clusters in the pulp and paper industry show that industrial networks and structures are strongly determined by large companies and their affiliates and rely on universities, research institutes and scientific networks. Important factors are patents for innovative technologies, such as specialised machinery, materials and software; specialisation of consulting companies in strategic and operational management; and exhibitions and professional conferences demonstrating advancements in forestry and wood industries. The dynamics of consumer demand for paper and packaging are also relevant.

A prominent example using cluster analysis for geographically determined units is the study on regional foundations of United States' competitiveness (Porter *et al.* 2001: ix–xix). Its assumption is that in flourishing regions, competitiveness and innovation are concentrated in clusters. Interrelated industries act as regional hubs of competitiveness and innovation within the country. Five regions were selected to provide diversity in size, economic maturity and perceived economic success. Performance indicators were employment growth, rate of unemployment, average wages and wage growth, cost of living and exports. Innovations were assessed in terms of patents, establishment formation, venture capital investments, initial public offerings and fast-growth firms. Empirical information was based on cluster mapping data, selected input and output measures and extensive survey and interview data. The researchers investigated economic performance, composition and evolution of regional economies, business and innovation environment, competitiveness of selected regional clusters and the implications for the regional agenda.

Findings from this study regarding important factors influencing the regional business environment were as follows:

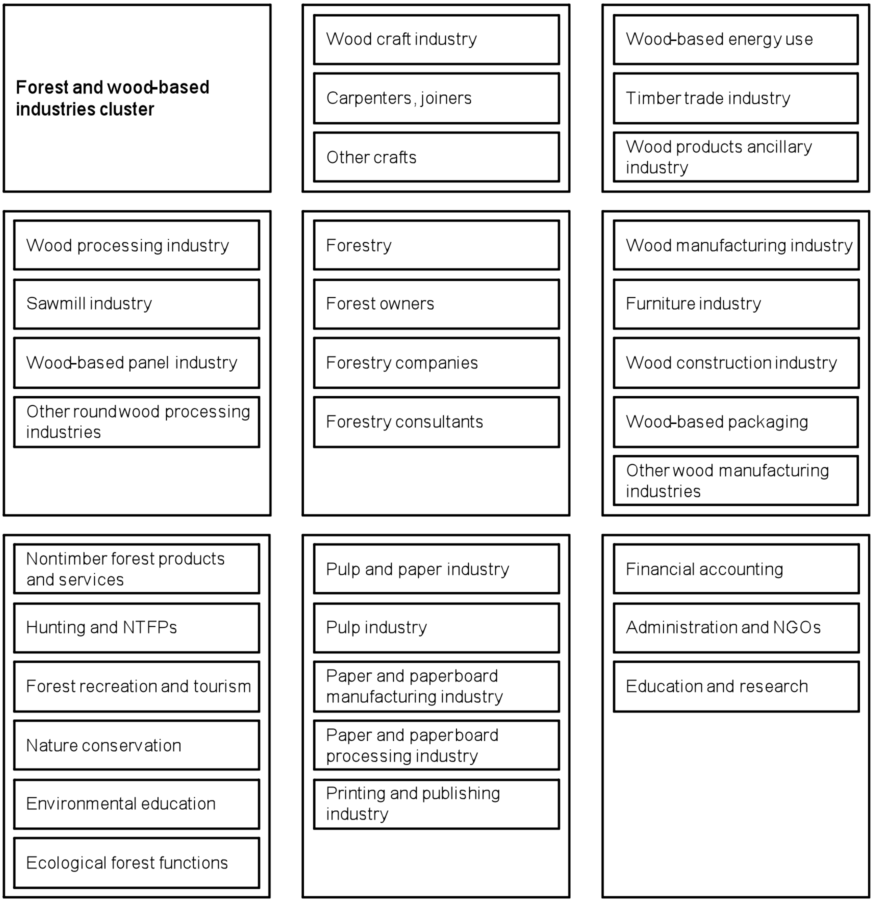

Figure 2.9 Forestry and wood-based industry clusters

Source: Mrosek *et al.* 2009: 54

- A strong physical and information infrastructure is a major condition for a prosperous regional economy.
- A performing educational system is a prerequisite for developing local talent and attracting outside talent.
- Universities and specialised research centres are a driving force behind innovation.
- Specialised talents and targeted training are more important than abundant labour.
- Government can have a significant influence on the business environment, both positive and negative.
- Poor coordination among local jurisdictions impedes efforts to improve the business environment.

The Oregon Forest Cluster Analysis follows the United States' regional competitiveness study of 2001 (Hovee and Logue 2005: 4–9). It uses Porter's determinants of regional productivity: firms' strategy and rivalry, factor (input) conditions, demand conditions and related and supporting industries (Porter 1990). The conceptual model of the forest cluster in Oregon begins with the traditionally defined forest sector at its core – forest owners, timber harvesters and primary and secondary manufacturers – around which forest industry organisations, such as grading agencies and industry trade associations, are grouped. The outer ring consists of a more diverse set of participants, ranging from allied supplying industries to financial institutions, university researchers and consultants. The report of Francisco X. Aguilar *et al.* 2009 shows the continuing interest in the United States in using positive cluster effects as an instrument for promoting innovation and competitiveness.

For Germany, forestry cluster studies undertaken in recent years show a variety of thematic issues and methodological approaches. Cluster structures and branches in German forestry and wood processing at various spatial scales have been analysed through four case studies, at national, state, regional and local levels (Kies *et al.* 2008, 2009, 2010; Mrosek *et al.* 2005). A spatial analysis of the regional forest industrial cluster and stakeholder groups in the state of North Rhine–Westphalia is available (Mrosek *et al.* 2010; Schulte 2002; Schulte and Mrosek 2006). The regional cluster study for Lower Saxony provides information on macroeconomic forestry data and on wood processing and regional roundwood flows (Rüther *et al.* 2007). It compares the changes in wood stocks and utilisation intensities between two national forest inventories (1987 and 2002) and estimates wood potentials up to 2036 depending on different roundwood utilisation patterns.

The cluster study for Baden-Württemberg examines the competitive position of the forest and wood cluster as a whole. It describes the existing wood-based value networks and their links with related economic branches in the region (Baden-Württemberg 2010). Profiles of strengths, weaknesses, opportunities and threats (SWOT; see Chapter 8, Section 8.1.5) were developed and recommendations made for enhancing wood utilisation. The analysis covers forestry production, sawmill processing, wood-based panel production, pulp and paper manufacturing, wood products trade and bioenergy consumption. It extends to industrial and artisanal companies and enterprises involved in packing and manufacturing wooden articles, the wood furniture industry, construction enterprises that build with wood and research and training institutions. Recommendations to policy makers for enhancing competitiveness and innovation capacity in the wood sector refer to factors such as logistics, maintenance services, consulting and engineering and information technologies. Public support and promotion are gauged through investments in education, maintenance of infrastructure and focused research programmes.

2.1.7 Maintaining the natural resource base

The wood-based sector faces the challenge of developing cost-conscious and integrative forms of management that can maintain forests as a renewable natural resource base for both wood production and environmental and social services.

This involves different combinations and trade-offs between economic efficiency, satisfaction of society's needs and attention to ecological requirements. Demand for environmental services is increasing. Strict attention to private and public demands and a clear understanding of the resources available for financing forestry measures are a prerequisite for success.

Changes in public attitudes are causing politicians to put more emphasis on the meaning of forests as an integral part of the environment and prompting new approaches in forest protection and sustainable forest management. Political processes over recent years have led to regulations that affect forest owners, corporate policies and the goals of the private wood-based sector. Complex human-environment interactions between private forestry activities and forest regulations determine how the forest's multifunctional uses are apportioned.

Public policies and law, which establish the political framework for balancing private and public interests, are changing in response to societal demands (Von Prittwitz *et al.* 1994).

- National constitutions guarantee the rule of law, provide a foundation for private activities and entrepreneurship, define the extent of state authority and affect the conduct of both the private and the public sectors.
- Economic, trade and finance policies and legislation establish a framework for socioeconomic production and cultural integration, based on a country's constitution and involving sector and cross-sector policy programmes.
- Laws and policies promoting development and social security have important consequences for economic productivity, income generation and social integration; they include education, programmes for innovation and funding for research.

In response to the principles of sustainable development, public regulations in forest management and the wood-based sector address the economic, social and environmental value of forests. This implies a combination of resource protection, land-use strategies and land management rules (see Figure 2.10).

- Protection regulations seek to maintain forest cover and protect the environment and its biodiversity; they also ensure preservation of the cultural and spiritual values associated with trees and forests.
- Land-use strategies provide for zoning of forestland, control of forest clearing, protection of a permanent forest estate and establishment of new forest resources through afforestation.
- Utilisation and management rules determine the responsibilities of forest owners with regard to sustainable production of wood and nonwood products, protection of soil and water resources and public access to forests and recreational uses.

Maintaining forests as a renewable natural resource base requires a balance between private and public interests and the consent of citizens, land users and land managers. Interest groups involve complex multisector and multilevel net-

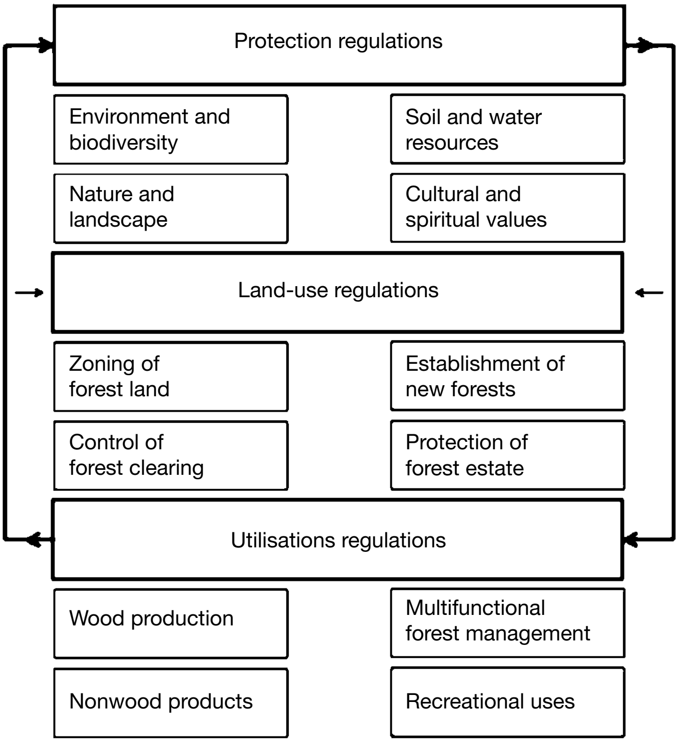

Figure 2.10 Regulations addressing forest protection, land use and utilisation

Source: Schmithüsen 2004b, modified

works of landowners, private companies, nongovernmental organisations (NGOs), politicians and governmental agencies. National and local problems have to be balanced against the continental and worldwide concerns of the private sector, citizens and governments.

Policy decisions about wood production affect the forest industry but must also accommodate societal and cultural values and a growing range of environmental concerns. For instance, limits on wood harvesting not only affect private and public forest owners but also have ramifications for investment strategies and management decisions of industrial wood processors and for the silviculture and harvesting activities of forest enterprises.

Regulations in European countries increasingly reflect the forest's economic potential for industrial wood production and processing, its value as a multifunctional social resource for urban and rural areas and its importance for maintaining biodiversity. The result is multifunctional forest management that accommodates divergent economic and social interests and demands. Similar objectives for policy and forest law were first set forth in the 1970s in the United States and Canada (Schmithüsen and Siegel 1997).

Multifunctional forest management practices, a major component of sustainable development, have the following characteristics:

– decision-making processes involving corporate owners and managers of industrial enterprises, owners and users of forestland and other stakeholders, such as environmental and nature protection groups;
– new balances between private and public interests and the elaboration of workable arrangements to help landowners meet public demands;
– a shift from hierarchical, governmental regulations to negotiation, processes and joint management responsibilities between the public and private sectors; and
– financial arrangements involving market proceeds, public funding and contributions from private users and interest groups to provide multiple forestry outputs.

Figure 2.11 shows three dimensions that determine an integrative approach between the private and public sectors in forestry and natural resources management. Private sector activities relate to economic production and technology; deal with commerce, trade and finance; are undertaken by artisans, farmers and the industry; and contribute to economic growth, value added, employment and income. Public activities are determined by a country's constitution and democratic system, which define citizens' rights and responsibilities and regulate the decisions and interventions to which private and governmental actors are entitled.

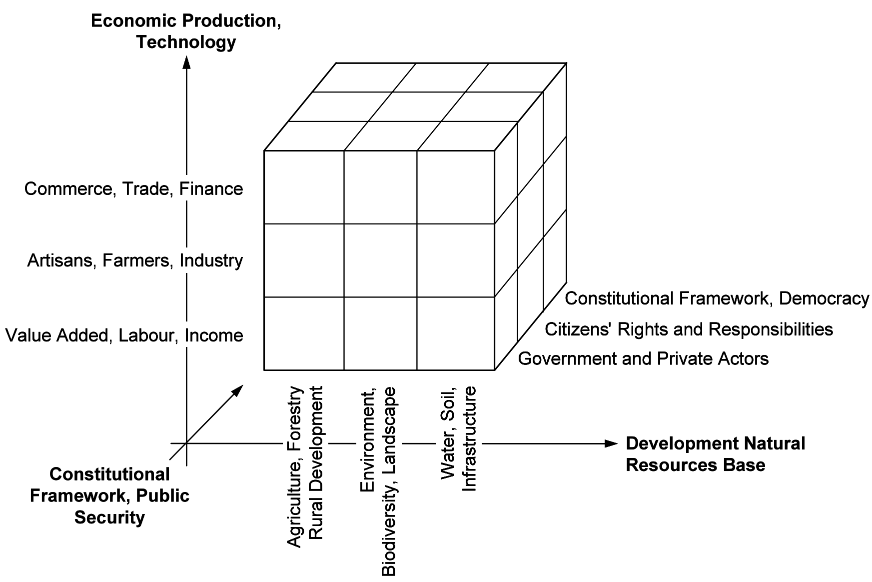

Figure 2.11 Private and public activities in using the forest resource base

Source: Schmithüsen 2004b, modified

Both the private and the public sectors intervene in natural resources management, forestry and rural development, biodiversity and landscape conservation, and water, soil and infrastructure protection.

Global, European and national commitments lead to a complex framework of public policies and legislation. At the global level, free trade, environmental protection and biodiversity are dominant subjects. Forest-related aspects include increased industrial uses through access to new areas, reduction of large-scale deforestation and conservation of natural forests. At the national level, emphasis is laid on forestry and wood processing as productive sectors and on regulation of forest management practices. At the local level, multiple forest uses providing employment, protection and recreation are of immediate concern. The roles of the private and public sector are being redefined as governments take on the new role of fostering collaborative processes instead of making unilateral decisions. One task is finding equitable and effective balances between the benefits for and responsibilities of stakeholders. A systematic consideration of cross-sector effects and policy links is a concern of the international community, identified by the United Nations Conference on Environment and Development in Rio 1992.

An expanding network of agreements adopted by the Ministerial Conference on the Protection of Forests in Europe (Forest Europe), alongside binding legal instruments within the EU, now govern forest uses and management. Business managers in the forest sector must deal with several new perspectives:

- a comprehensive vision of the large variety in forest management conditions in European forests;
- a concrete understanding of common responsibilities and new opportunities in maintaining and expanding the forest natural resource base;
- a multilateral approach in building forest ecosystem networks covering large regions of Europe;
- progressive adaptations of national policies and laws as a result of joint political decisions and collaboration within an increasing number of European countries; and
- common management principles and standards in forest protection and development based on joint projects in wood-processing technology and in forest and environmental research.

2.2 Enterprises and companies

2.2.1 System structure, transformation process and legal form

Enterprises, companies and firms are legally constituted, autonomous economic entities engaged in productive activities that allow an opportunity to make a profit. In market economies they are characterised by self-determination of the business plan (the principle of autonomy), investment of capital, the profit-making purpose and the principle of ownership and property. Enterprises, companies and firms, as profit-oriented economic entities, share several characteristics:

- organisational unity;
- combination of the factors of production – capital, labour, natural resources, technology and information;
- production to meet others' requirements;
- links to markets and to the social environment;
- production of goods and services;
- profit orientation; and
- financial balance to maintain liquidity.

Enterprise has probably the broadest meaning: it signifies a production and commercial activity in a generic sense as well as an individual economic unit engaged in productive activities. It encompasses the whole sociotechnical business system of people, information and technology. The term may refer to a private or a public organisation, an autonomous enterprise, an organisational part of a larger enterprise or a combination of economic aggregates. Enterprise and entrepreneurship reflect the fundamental quality of any economic activity in a competitive market: to engage in business transactions that can satisfy customers' demands for goods and services to be sold in existing markets or in markets created by innovative entrepreneurship.

Company addresses primarily the legally constituted form and entrepreneurial setting in which the activities of economic units are organised. A company may be owned either by an individual entrepreneur or by a group of shareholders making an investment for a common purpose and focusing on making a profit.

Business refers to the economic field or activity in which enterprises and companies are engaged: for instance, to agricultural production, wood-based sector activities, production of industrial goods, engineering and consultancy services or a range of consumer services. Large, diversified companies may be engaged in several businesses. *Business units* are production and service units forming part of an enterprise or company.

System structure refers to the arrangement of elements or components that determine an internal setup and functionality. Important structural elements in productive economic entities include employees, whose knowledge, behaviour and motivation determine a company's performance capacity. Other structural elements include production equipment, technology processes and information and planning systems. The relationships between the elements of a company's structure are basically the result of the circulation of materials, energy flows and information exchange. They include collaboration among staff members, interrelations between employees and the means of production, and a combination of production equipment and processing technology.

Enterprise architecture describes the entire system of an enterprise with the intention of improving effectiveness and efficiency through innovations in the organisational and functional structure of business activities.

The sociotechnical configurations of economic entities can be characterised using various *structural characteristics* (Peters *et al.* 2005: 39–40; Schierenbeck

2000: 27; Thommen and Achleitner 2006: 63–4;). Table 2.3 illustrates constitutive and sector-specific characteristics:

- The constitutive characteristics include the legal form, the operating location and the organisational connections and integration.
- Sector-specific characteristics include the size of the work force, the technical economic structure and the type of equipment and installations.

Table 2.3 Characteristics of enterprises and companies

Legal form	– Civil law form of enterprises – Enterprises run by public bodies – Enterprises run by administrative bodies under civil law – Privately owned
Enterprise location	– Sphere of action and location of enterprise facilities – Geographical: local, regional, national, international, multinational – Central or decentralised enterprise locations – Sales-oriented location or orientation relative to specific production factors
Integration	– Collaboration with other enterprises – Horizontal or vertical integration
Size (employees, balance sheet total, turnover)	– Small enterprises – Medium-sized enterprises – Large enterprises and corporations
Technical enterprise structure	– Predominant technology and production factors – By output type: single-item, multiple-item, serial production – By production process: workshop production, assembly-line production, building site principle
Asset base	– Employees – Equipment – Operating resources

Enterprises and companies may have several subsidiary production units, either organised internally or constituted as subsidiary legal entities. Subordinate units of enterprises and companies are referred to as business units engaged in different production and commercial activities (see Figure 2.12). Distinguishing between autonomous enterprises and companies on the one side and subordinate business units on the other is necessary for organising the management accounting system, identifying relevant business indicators and making performance comparisons. Terms such as operating expenditure, operating costs and performance, or company accounting refer to the central purpose of an enterprise or company (see Chapter 5).

Public bodies – state, city, village and local district authorities – can be owners of or partners in companies and enterprises. Such enterprises do not generally differ from those in private ownership in terms of their structural characteristics

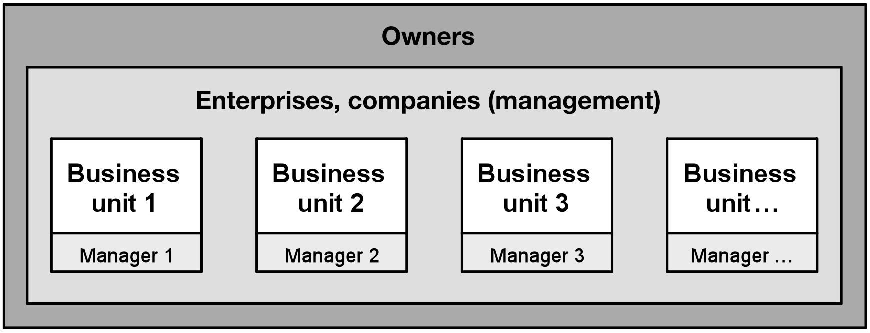

Figure 2.12 Business units

and decision-making processes. To the extent that public bodies act as entrepreneurs, their activities may be profit oriented, may focus on not-for-profit activities or may be a combination of both. Nonprofit activities usually relate to the provision of social services, environmental services and recreational benefits to the public or a specific group of citizens; they may be subject to restrictions on the profit-making principle in favour of cost recovery. For example, the management of municipal forests may be undertaken by public forest services staffed with specialised technical personnel. The owners are the citizens, who are represented by city councils and other municipal bodies.

Transformation processes: Companies and enterprises take resources from their economic environment and then, having processed and transformed them, return them to the economy in the form of new goods and services. One can speak of a transformation of resources within an input–output system (Peters *et al.* 2005: 119–20; Thommen 2007: 57, 425, 1000). Entrepreneurial transformation covers both material and information processes, which are functionally related. Three types of transformation processes may be distinguished (see Figure 2.13):

– management processes – design, implementation and control through business goals and policy, strategic and operational planning and review of the economic results;
– production or commodity turnover processes – the procurement of production factors, the production of consumer and investment goods and the sale of goods and services on markets; and
– financial turnover processes – securing the necessary working and investment capital, monitoring cash flows and proving the profitability of the invested capital.

Business transformation is undertaken, monitored and controlled by *management and information processes* that ensure a goal-oriented capacity to act, constant adjustment to changing economic conditions and task-oriented performance and communication. Management tasks arise in particular in the following areas:

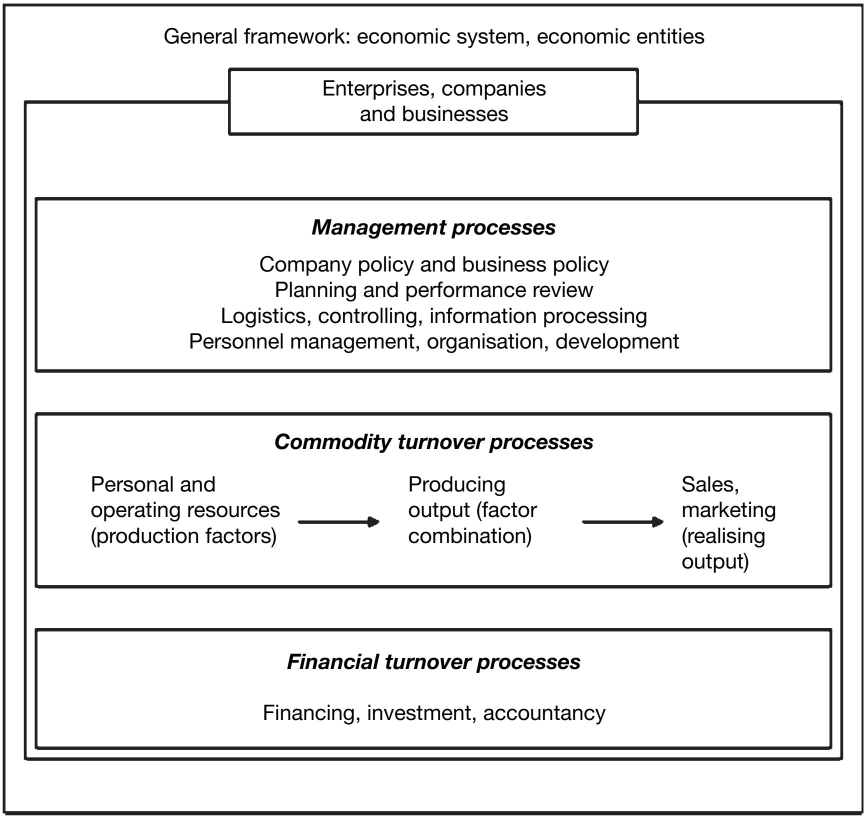

Figure 2.13 Management and turnover processes

- ensuring an enterprise's long-term ability to operate through effective business policy and strategy;
- setting specific and attainable goals and implementing them through appropriate planning, decision making and controlling instruments;
- creating effective working conditions and collaboration through adaptive personnel management standards, efficient process flows and organisational structures;
- ensuring adequate, regular and timely communication flows, both internally and externally, through efficient information communication instruments;
- ensuring financial balance and entrepreneurial success through a comprehensive accounting system, regular strategic and operational analysis and effective assessment and qualification procedures.

Transformation processes for the production of goods and services take place in a complex mosaic of activities conducted simultaneously, parallel with each other or in consecutive order. The transformation process begins with the founding of a company or the establishment of a new product line. The subsequent steps include acquisition of investment capital, recruitment of personnel, procurement of equipment and materials, actual transformation through a combination of production factors, and marketing operations. Financing is obtained through earnings from marketed products or services and through acquisition of financial means from owners, shareholders and banks that ensure the company's liquidity or solvency.

Legal forms of business organisation establish the formal status of an enterprise, determine its rights and obligations to act internally and in relation to external partners and stakeholders, and describe its status as an independent or subsidiary economic unit. The legal form may also affect the internal organisation of an enterprise. The effects of the constituted legal form of an enterprise relate in particular to the following points:

- legal representation of the company in making commercial transactions and concluding contracts and agreements;
- regulation of roles in decision making;
- establishment of internal rules for monitoring, evaluating and verifying business results;
- determination of the rights and obligations of business owners, staff and public authorities;
- decision making for capital acquisition, investment projects and partnership agreements; and
- accountancy regulations and enforcement, regulation of corporate taxation and applicable procedures in case of business liquidation.

With regard to national legal stipulations for partnerships and public limited companies and how they affect a company's organisation and legal and economic scope for action, consult the specialised literature (e.g., for Germany, Peters *et al.* 2005: 39–40; Schierenbeck 2000: 28–9; and Thommen and Achleitner 2006: 63–4; for Austria, Karl Lechner *et al.* 2010: 171–2, 354; for Switzerland, Thommen 2007: 71–2).

In Central Europe, the majority of small and medium-sized private forests belong to individual owners, partnerships or limited companies. Under civil law, private forest owners may form cooperatives, associations and foundations. Large private forests tend to be owned by private limited partnerships and public limited companies. Enterprises of a certain size in forest management and timber processing use the limited company or the joint stock company as a legal form. Public forests are owned mainly by territorial authorities representing state and local municipalities (see Table 2.4). If these entities manage their forest areas using their own forestry personnel, their legal representation and economic scope for action are determined by the status of a corporation under public law. However, public corporations that own large areas of forest may choose to organise their forestry businesses under civil-law company forms. In some cases, foundations and institutions established under public law may be forest owners.

Table 2.4 Legal forms of public forest ownership

Forms without separate legal status	– Publicly owned but independently run enterprises – Owner-operators – Special assets – Affiliated public-law institutions
Forms with separate legal status	– Independent public-law bodies – Territorial authorities – Personal corporations – Real corporations – Independent public-law institutions – Independent public-law foundations

2.2.2 Forest enterprises

Forest enterprises are economic entities owned and managed by forest landowners or by companies that have acquired the use and management rights to forestland. As organisational business units with specific operational goals, they engage in the production of goods and services by using and managing the natural capital of a renewable natural resource in combination with financial investment, labour and technology, and technical installation and infrastructure. Management of small forest areas, particularly private forests owned by farmers, often involves complementary operations in mixed agriculture and forestry business units.

The stages of forestry production processes can be characterised as follows:

- Acquisition encompasses the availability of forestland, the employment of workers and technical staff, the procurement of materials and equipment and the establishment of access road infrastructure.
- Transformation processes comprise biological production (e.g. silviculture), technical production (e.g. wood harvesting) and interventions to ensure protective and recreational forest functions. Increasingly, they also comprise services related to landscape conservation and biodiversity protection in forest areas.
- Financing for forestry activities comes largely from the sale of roundwood assortments. Nontimber forest products may contribute financially at the local or regional level. For services that are delivered mainly in the public interest, markets are limited or nonexistent. This means that, at least under present conditions, funding from national, regional or local public and private institutions is required for such services as erosion control, avalanche protection and natural area protection.

Economic units vary in terms of goals, work force size, local conditions and forest types, and the economic and social environment in which they operate (see Table 2.5). Accurate and valid profiles for economic units in forestry can be used for the following purposes:

– to characterise production conditions and business circumstances;
– to assess the efficiency of the company's production and management;
– as a prerequisite for analysing the company's strengths and weaknesses; and
– as a starting point for improving performance, introducing operational innovations and exploiting new opportunities for development.

Table 2.5 Characteristics of forest management enterprises

Structural characteristic	*Expression*
Forest ownership	Private forest owners, public forest owners, others (churches, cooperatives)
Legal form	Unincorporated Forestry businesses with civil-law company forms Forest businesses run by public bodies Forest businesses with special legal forms under forestry laws
Horizontal and vertical collaboration	Intercompany and industry-wide collaborations, type and intensity
Business size	Forestry operating area, annual wood production volume
Location as forestry production factor	Geographical position, geology and soil conditions, morphology and topography, climate and vegetation, forestry policy and social framework
Operating structure of forest stands	Forest structure and tree species, age structure and spatial arrangement, medium- and long-term production potential, biodiversity and ecological stability
Forestry business goals	General goals, output area of raw wood production, output area of infrastructure, other output areas
Business organisation	Business management, territorial subdivision
Business equipment	Access routes, employees, working capital, business facilities
Development potential	Opportunities for development and threats
Financial aspects	Cost structure of output areas, yield structure of output areas, capital intensity of production, capital requirements and liquidity

As economic business units engaged in the primary sector, and increasingly in the tertiary sector, forest enterprises have specific characteristics and opportunities. Typically, they are determined by the following:

– their legal status;
– the multifunctional forest management possibilities;
– the short-, medium- and long-term goals of forest production cycles;
– the potential use of prevailing forest ecosystems;

- the productivity, structure and resilience of forest stands; and
- alternative combinations of forest production, conservation and preservation goals.

Large forest management companies are important, for instance in Scandinavia, Germany and Austria, all of which have large areas of private forest holdings. In Austria the state forest estate is managed as an independent company, the Austrian Federal Forests (ÖBf AG), in which the Republic of Austria is the sole shareholder. By contrast, large forest management units are rare, for instance, in Switzerland, which has many small forest holdings and a high proportion of communal and corporative forests managed directly by their owners. Commercial nurseries for replanting stock, private contractors engaged in wood harvesting and log skidding, companies operating in roundwood transport and specialised operators that build forest roads and avalanche control works complement forest management activities. In countries where many forestry activities are carried out by public state forest services, the trend is now to privatise the actual logging and wood transport operations, thus increasing the work share of specialised private contractors.

Another trend is setting up semi-autonomous public management organisations for large state forest holdings and at the same time limiting the role of governmental forest services to policy and law implementation. Here again, more recent organisational forms (e.g. Hessen Forst and the Bavarian State Forest Enterprises in Germany) are now competing with the traditional system of public forestry district offices with their comprehensive responsibilities for managing state forests as well as supervising and supporting communal and small-scale forest owners.

A new line of business has developed in the area between forest management and wood processing. Forest contractors and forestry services companies offer their services to forest owners not willing or able to engage in forestry operations. This occurs, for instance, because forest owners lack the technical and management skills and experience, or because they cannot afford the expensive machinery for modern wood harvesting and skidding. Large companies in the wood industry have begun to fill these gaps. They use cooperative ventures and company start-ups providing a range of management support facilities for private forest owners. They invest in machines and provide marketing expertise. Such developments give rise to mixed forms of business cooperation, with forest owners managing their forests independently but forest contractors and service companies of various sizes providing a range of services to small and medium-sized owners and holding structures.

2.2.3 Enterprises of the wood-based sector

Technical economic characteristics and organisational types of production determine industrial production processes in the wood industry. Table 2.6 gives an overview of structural characteristics of wood industry companies.

Table 2.6 Characteristics of wood-processing enterprises

Structural characteristic	*Expression*
Sector and segment assignment	Production trade (secondary sector), wood industry and its groupings
Legal form	Limited partnerships (often emerging from joint partnerships), large companies, public limited companies
Company links	Shares, links, mergers, fusions
Company size	Employee numbers, turnover, balance sheet total, production quantity, amount of raw wood processed
Location	Geographic position, transport connections, economic, political and social framework
Operating structure	Well-developed company or start-up, concentrated in one location or geographically distributed
Business equipment	Employees, working capital, business facilities
Technical business characteristics	Material-intensive, capital-intensive, labour-intensive, energy-intensive, environment-intensive production factors
Priority strategic goals	Market leadership, cost leadership, profit maximisation, niche specialisation
Assortment structure	Value-creation steps in production, concentration on specific finishing steps, standard assortment or special manufacture
Target markets and procurement markets and their structure	Local, regional, national, international consumer goods markets, investment goods markets, service markets, monopoly, oligopoly, atomistic markets
Financial aspects	Cost structure of output areas, yield structure of output areas, capital intensity of production, capital requirements and liquidity

Technical and economic characteristics are used to describe various forms of output provision (Schierenbeck 2000: 38–9). Important aspects here are the place in the performance process, the type of technology used, the production factors applied, the specific production programmes and assortments chosen, the type of market relations present and the extent of specialisation of production processes.

Organisational types of production can be classified in various ways:

- In *building site production*, operational capacities are applied at different times on different sites. This kind of production can be found, for instance, in the building industry and industrial plant construction.
- *Insular* or *group production* divides the whole production sequence into production engineering units and assigns them to individual groups or production islands.

- *Workshop production* is characterised by functional specialisation: machines and workplaces in which similar types of work are carried out are combined into workshops. The products are accordingly transported from workshop to workshop during the production process.
- In *production lines* the machines and workplaces needed for manufacturing correspond to the processing sequence. Unlike workshop production, this arrangement takes the principle of workflow into account.
- In the spatial arrangement of machines and workplaces, *continuous production* corresponds to line production. However, time requirements are set for the length of the individual steps that are temporally coordinated.

Wood industry companies are connected by a tight network of competitive and synergetic relationships. They compete for raw materials – for example, the wood-based materials industry competes for wood with bioenergy producers. Or they may work in the same sales markets – for example, construction timber sawmills and construction companies are both in the wood-based materials industry (Van Acker and Fioravanti 2008). Similarly, synergetic relationships exist for suppliers or customers – for example, between the sawmill industry and the building industry, or between the veneer and furniture industries. A characteristic of wood industry development is the way in which companies in newer branches (such as the wood-based materials industry and the wood energy industry) have emerged from older branches. Vertical business structures are widespread. Companies in the wood industry in Central Europe compete directly with companies in other regions that can purchase raw materials at lower cost. Economic concentration of processing capacities leads to business mergers in the sector, company takeovers and the closure of uneconomic production entities.

Some areas of the wood industry, such as the sawmilling and building joinery industry, still characteristically feature small and medium-sized companies. Although they no longer process the majority of roundwood and wood products, they still numerically represent the majority of companies in the sector. Both the woodworking crafts and the sawmill industry largely consist of medium-sized, family-owned companies and can be described as being more labour intensive and less capital intensive than the large units in the pulp and paper industry, as they work with a limited amount of mechanical equipment or on the basis of craft skills. Both the family company structure and the comparatively small proportion of capital costs enable these firms to respond quickly to market fluctuations, whereas large production units are forced to maintain high levels of capacity because of their high burden of fixed costs.

2.2.4 Size and business location

The *size of an enterprise* is important in several respects. Size has a direct influence on the scope for action available to an economic entity and to its equipment, staff management and organisation (Lechner *et al.* 2010: 43–4, 441; Peters *et al.* 2005: 61–2; Schierenbeck 2000: 34–5; Thommen and Achleitner 2006: 65–6, 401–2).

The sizes of enterprises and companies are multidimensional – that is, they may be characterised by different parameters taking company-specific and branch-specific features into account. For example, the quantitative criteria of balance sheet total, turnover and employee numbers are important for public limited companies in national codes of commercial law (in Austria *Unternehmensgesetzbuch*, UGB; in Germany, *Handelsgesetzbuch*, HGB; in Switzerland, *Obligationenrecht*, OR). They include regulations affecting annual financial statements (balance sheet, profit and loss account, income statement), the financial report, the compulsory audit of annual accounts by an auditor and duty of disclosure (publication of annual accounts) (Lechner *et al.* 2010: 560–1; Schierenbeck 2000: 508–9).

Companies may be classified as *large*, *medium* or *small*. The size characteristics of small public limited companies, for instance, are described in paragraph 267 of the German Commercial Code (HGB) as having a balance sheet total of less than approximately €4,000 million, turnover of less than approximately €8,000 million, and an annual average of fewer than 50 employees. Medium public limited companies have a balance sheet total of €4,000 million to €16,000 million, turnover of €8,000 million to €32,100 million, and an annual average of 50 to 250 employees. Large public limited companies are those that exceed at least two of the three totals or those with shares traded on stock markets.

Small and medium-sized enterprises are usually grouped together under the abbreviation SMEs. Strengthening the strategic and operational abilities of this group of enterprises is a necessity. They provide the greatest share of jobs in the labour force and are often competitive on international markets. Many are a source of innovative products and work processes. Because of the large proportion of small-scale forest owners and enterprises in many European countries, public support to SMEs promises a considerable advancement of the wood-based sector. Prospecting for new clients and business opportunities, improving the competitive position in national and international markets, facilitating credit access for financing investment projects, improving production cost efficiency and providing professional education and management training for entrepreneurs are major issues to be addressed (Aidis 2005; IUFRO 2011; Niskanen *et al.* 2007a; Nonic *et al.* 2012).

Cluster formation and cluster management at local and regional level support cooperation and innovations in forestry and the wood-processing activities of small and medium-sized enterprises. The example of the City of Arnsberg 2006, probably the first local-scale case study undertaken in Germany, shows how a SWOT analysis of strengths, weaknesses, opportunities and threats can be used to promote SMEs in the regional wood-based sector (see Table 2.7; Mrosek *et al.* 2006, 2009).

In 2006, the city had a strong, locally developed wood-processing industrial sector employing about 2,500 workers. Identified strengths were the availability of sufficient forest resources, a network of various branches of the wood-working industry, a considerable number of active small and medium-sized enterprises and a culture of business cooperation. Opportunities to be developed were seen in building on the present structure by strengthening logistics, communication,

Table 2.7 SWOT analysis of the City of Arnsberg forestry cluster

Strengths	*Weaknesses*
→ Availability of forest resources → Presence of all branches of the forest and wood-based industries cluster → Presence of small- and medium-sized enterprises in the wood-based industries → Effective cooperation between forestry and wood-processing industry → Competence cluster in forestry → Suitable infrastructure	→ Inefficient business structure of small privately owned forests and negative legislative and political framework → Limited cooperation between forestry and many branches of wood-based industries → Gaps in the local chain of production and value adding → Weak public relations → Limited integration of forest-based tourism and forest conservation
Opportunities	*Threats*
→ Further optimisation of logistics and multiple forest use → Further access of business opportunities (e.g. commercial wood energy, forest-based tourism and education) → Improved communication and cooperation between stakeholders along the chain of production and value adding → Improved public relations	→ Negative development concerning economic performance of small forestry companies with increasing loss of wood-based companies → Further decreasing of perception and support of the forestry sector through policy, media and the public → Further reduction of public funding

Source: Mrosek *et al.* 2009: 60–2

cooperation and public relations between stakeholders along the value-adding chain. Development of forest-based tourism and expanding education and technology networks were another line for future action. Weaknesses and threats lay in inefficient business structures of small, privately owned forests, gaps in the local production and value-adding chain, decreasing awareness and support for the forest and wood-based sector in policy, media and the public, and reduced public funding for social and environmental forest services.

The *surface of a forest holding* – specified as total operating area, wooded surface area and fully stocked area – is an important criterion for size comparisons in forest production. It has substantial effects on the forest management regime in terms of the available stocking volume per hectare, the intensity of forest management planning, the opportunities for rationalisation in wood harvesting, the type of marketing strategies and the extent of forest access installations. In Central European forestry business activities, the area of managed land is usually fixed and can be increased only to a limited extent. Improvements of the wood production base are, however, possible through cooperative agreements among forest owners, formation of joint management units covering several forest holdings, or mergers of forest properties under a common management regime.

The structural changes taking place in different branches of the wood industry, as a result of increases in production, takeovers and buyouts, show a more dynamic development in business structures.

Business location describes the economic factors that are important for the geographic site or area of activity of enterprises and companies (Peters *et al.* 2005: 55–6; Thommen and Achleitner 2006: 96–7, 813): it means the site of companies and businesses at which the production factors are used. Companies may have several locations at which they conduct business activities. Links to the location and choices between various locations are important constitutive characteristics. Enterprises and companies whose locations are largely predetermined are mainly found in the field of primary production – in mining, agricultural production and forestry.

The *choice of location* is decided when a company is founded or is being expanded. Depending on specific requirements of the prevailing business activity, the location may be selected for proximity to markets, raw materials, energy supply or often a combination of such factors. The decision is based on a comprehensive analysis of alternative locations, in which current and future requirements and potentials are assessed and weighed. The comparison of conditions in various locations and different requirements needs to be supported by investment and utility analyses.

Factors to be taken into account when choosing a location include the following:

– labour – supply of workers, cost, skill level, productivity;
– materials – transport costs, reliability of supply, product-specific requirements;
– sales – proximity to customers, competition from other suppliers, potential expansion of demand, product-specific requirements;
– infrastructure – transport infrastructure, teaching and research institutions, social and cultural institutions, ecological environment; and
– fiscal concerns – fees, social contributions and tax regimes; development programmes and grants available for start-ups; exchange-rate effects on cross-currency commercial and business transactions.

In location considerations, the geographic extent of the field of business activities and of procurement and distribution networks needs to be considered:

– *Local*: Operations are limited mainly to the area of one or more municipalities.
– *Regional*: The enterprises are active in a specific region of the country.
– *National*: Business activities extend throughout the country.
– *International*: Production is carried out domestically but a substantial proportion of the product is exported.
– *Multinational*: The company is active in several countries or throughout the world and has subsidiary companies or business units abroad.

Locations for forestry activities: As in other areas of land-based production, the location of forestry enterprises is determined by the productivity of forest sites and management goals. Long-term developments in land-use practices and the prevailing system of property and use rights play an important role. New options for the choice of location apply if forestland holdings can be purchased, or if additional areas become available from afforestation schemes.

Locations for wood-processing enterprises: The choice of locations by different branches of the wood-processing industry in Germany has changed over time (Mantau 2003; Mantau and Weimar 2003; Mantau *et al.* 2003a*,* 2003b). In the past, wood-processing enterprises selected locations mainly in accordance with the availability of wood as raw material and as a source of energy. Creeks and rivers were other favourite locations because flowing water provided mechanical energy, delivery of floating roundwood and transport for finished products, such as sawnwood, to markets. The Black Forest region in Baden-Württemberg, which has large volumes of high-quality wood and excellent transport on the Rhine and Neckar rivers, was a typical example for a resource location choice. Following the expansion of national railway and road systems, the wood-processing industry moved closer to final consumer markets and located in regions with high population densities and strong purchasing power. This was the case, for instance, in North Rhine–Westphalia, which is the most industrialised region of Germany and has the highest concentration of the furniture industry.

Today, companies locate in the vicinity of strategic partners and processing facilities and seek competitive advantages in local tax concessions, special investment regimes and long-distance transport via rail or sea. Perhaps most important has been the development of intercontinental container shipping, which has moved the geographic centres of gravity and determined the formation of new wood industry clusters.

2.2.5 Horizontal and vertical cooperation

Cooperation and collaboration develop in different segments of the wood value chain through information networks and formal agreements (Peters *et al.* 2005: 51–2; Schierenbeck 2000: 49–50; Thommen and Achleitner 2006: 83–4, 311, 960). The term *horizontal cooperation* describes links at the same level of production between economic entities in related business branches. *Vertical cooperation* between companies exists when economic entities are linked to the preceding or following steps within the value-added production chain. *Diagonal links* between enterprises and companies refer to business activities in different economic branches. Companies maintain their legal and entrepreneurial independence when they participate in horizontal, vertical and diagonal links, but not when they are the subject of mergers and acquisitions. The result of such transactions is either a takeover of one company by another, or the establishment of a new company arising out of the merger or acquisition process.

Links of cooperation and collaboration are established for a variety of reasons and relate to all sorts of business processes and organisational domains within an enterprise.

- *Procurement*: Through joint purchasing, companies can negotiate more favourable supply conditions, ensure regular deliveries and dovetail the supply of raw materials and intermediate products. More efficient use of raw material is achieved by sorting it for optimum end use – based, for instance, on technical or demand criteria.
- *Production*: Existing capacity can be better used. The division of labour is improved through specialisation; production processes can be rationalised; manufactured products can be standardised; economies of scale are achieved by increasing the number of similar or modified items; new production processes can be developed jointly.
- *Sales*: Diversifying and coordinating the range of products supplied create larger markets and reduce risks. Joint sales organisations, with coordinated advertising and marketing strategies, can reduce costs and enhance efficiency.
- *Research and development*: Synergies arise and duplication can be avoided; research and development costs can be shared.
- *Investments and finance*: Joint participation makes possible large projects and improves access to capital funds.
- *Management and organisation*: Coordination improves rationalisation, streamlining and efficiency.

Forms of cooperation in which the participating enterprises maintain their legal and entrepreneurial independence include consortiums, joint ventures and industrial associations. Consortiums are suitable for many cooperation tasks. In purchasing and sales associations, companies present themselves to market partners jointly. Industrial associations are established for the purpose of representing common industry-wide interests to the public, in politics and for policy formulation and implementation.

A *joint venture* is a new entrepreneurial unit in which the collaborating enterprises participate. It may facilitate expansion into new markets by combining different competitive entrepreneurial strengths: one company may provide new products and technology while other partners contribute appropriate business locations, experienced managers and international marketing knowledge. Another form of collaboration involves a *strategic alliance*, in which companies attempt to eliminate their weaknesses by pooling technologies or marketing strengths; such alliances are also used to develop unified product standards. As the word strategic suggests, these alliances are intended to increase the competitiveness of the participating enterprises.

In Europe, intercompany and to some extent industry-wide collaborations in which forest owners take an active part – called *cross-property collaboration* – are important. In the EU, for instance, more than 50 per cent of the forest area belongs to private owners (Schmithüsen and Hirsch 2010: 5–10, 56–7). Cross-property collaboration is particularly necessary among small and medium-sized private and municipal holdings. The focus is on horizontal collaboration between forest management units through procurement associations, marketing associations or joint forest management associations. Vertical collaboration between forestry and the wood industry extends roundwood supply agreements and integrated logistics circuits in roundwood delivery to the wood-processing units. Cost reductions here are achieved because larger volumes are sold and purchased jointly, regular supply arrangements specify dates of delivery and roundwood assortments can be graded according to the specific requirements of industrial buyers. Better use of machine capacities in forest management associations reduces fixed operating costs and thus raises efficiency.

Against the background of structural change in the wood industry, the trend is towards larger units of forest ownership, replacing the often complicated ownership patterns (e.g. because of inheritance issues) of small forest holdings. In Germany and Switzerland, for example, forest ownership is increasingly being organised in the form of collaborations with defined legal forms. Owners of forest properties with more than approximately 500 ha mainly choose general partnerships and public limited partnerships, but occasionally public limited companies. Owners of small private forests are organised into cooperative or association structures. These may be regulated by civil or public forest law covering all forest management practices or only some aspects, such as joint timber sales. At the national level, the German Forestry Council, representing private, communal and state forest owners, ensures vertical integration between the federal and state levels and promotes regional and local operational integration.

2.3 Entrepreneurship

2.3.1 Innovation – an entrepreneurial challenge

Entrepreneurship denotes the role and capacity of entrepreneurs acting as organisers of an economic venture, promoting and managing an enterprise, and assuming the economic risks of a business activity (Webster's Third New International Dictionary). Entrepreneurs may be owners or executive managers of an enterprise, or they may act as intermediaries. They may work in a large international company, or they may be independent persons providing goods and services to clients. Facing competition in their professional activities, they need to be dynamic actors in developing new markets and promoting efficient and effective production processes. Innovation, adaptability to changing economic, social and political trends, and the capacity for identifying new opportunities are essential qualities of an entrepreneur. Entrepreneurial capabilities, based on a general attitude towards life, are needed at all management levels in private business, as well as in other organisations and public institutions. Innovation depends foremost on attentive, devoted and gifted people with sensitivity to social and economic change, an ability to work together in confidence and a willingness to learn and try new approaches.

Successful business management poses high demands for cognitive competences that combine rational reflection and quantitative assessment with a future-oriented perspective, interest in human and cultural advancement, abilities to deal with uncertainties of the future and a capacity to reason in a holistic approach

(Bendixen 2011: 227). Entrepreneurial qualities develop in a cultural setting, depend on personal dispositions, are supported by teaching and training and grow with professional activities and experiences.

Understanding of multiple and complex relationships, analysis of decisive factors and knowledge of the requirements for obtaining results, as well as an intuition for new settings and strategies, are necessary requirements (Bendixen 2011: 220–2). Important entrepreneurial qualities are comprehension of the consequences of action, an ability to evaluate the chances of success based on factual information and the creation of excellent communication networks. Entrepreneurship requires structured thinking, openness to new concepts and ideas, and creativity in looking for new ways to act. Entrepreneurs are willing to improve a given situation and able to perceive new opportunities and risks as a result of changes in society. A competent entrepreneur analyses the situation and acknowledges the decisive role of individual performance and human resources development.

Entrepreneurial strength is determined by the ability to respond speedily, flexibly and efficiently to economic, political and social change (Porter 2004a). Access to local, regional and global markets and the ability to supply goods and services at competitive prices are major factors for business success. Setting entrepreneurial goals, developing strategies and operational procedures and organising the value-creation process effectively are critical tasks.

Innovation is the basis for facing processes of change and taking corrective action in a competitive environment. Without innovative thinking and action, the establishment of new business and further growth and advancement of an existing business are not possible (Albach 1990; Berndt 2000; Leder 1990). Innovations can remedy shortages and bottlenecks in production and stimulate new demand. Technological innovations are a source of new opportunities and entrepreneurial challenges. Information and communications technology have given rise to new managerial approaches and business solutions. Branch-specific innovations that result from industrial research and development increase the productivity of value-creation processes. Innovative companies enter new territory and depart from established production and trading processes, as well as from familiar organisational and human relations patterns.

A culture of innovation is characterised by the use of existing and potential strengths, the correction of apparent weaknesses, the avoidance of foreseeable risks and the grasp of opportunities in managing enterprises and companies. It can be achieved with management staff and employees who are committed to innovation as a continual challenge. Owners and managers need to create a climate that favours innovative strategies and implementation processes. The reactions of those involved in designing and implementing innovations, as well as those facing them in the surrounding environment, are often difficult to predict. Communication and persuasion are necessary for effecting change, and both require entrepreneurial and management skills.

Management processes and governance systems promoting innovation have changed considerably in practical terms. Based on empirical country studies, an overview of research addressing innovation and entrepreneurship in the forestry and wood-processing sector (Pickenpack 2003; Rametsteiner *et al.* 2006a: 669–70; Rametsteiner *et al.* 2006b) reveals a focus on innovation in multiple products and services, considering different types of business units, closely related organisations and policy issues. One conclusion is that innovation and technology transfer are no longer seen as a top-down, government-induced process. That linear concept has been replaced by a more complex understanding of innovation and entrepreneurship as a mosaic of nonlinear and iterative processes involving a range of actors and users. Successful innovation design and implementation are now largely considered bottom-up processes initiated by those who benefit from them; this process is known as *innovation pull.*

Figure 2.14 presents a systems approach in identifying major innovation components in enterprise and organisation networks. Internal and external factors relate to general product and process innovations as well as to specific regional, sectoral and branch-specific innovations. Innovations are driven by motivated creative persons, institutions and networks, promoted by systematic management and embedded in a broad, future-oriented culture. System functionalities and specificities, resources for launching and maintaining innovation momentum, and appropriate methods and instruments for managing increasingly complex dependencies and interactions are necessary requirements. In modern innovation clusters, both private and public sectors cooperate more systematically than in the past. Sectoral and regional innovation clusters are an important instrument in combining private and public efforts.

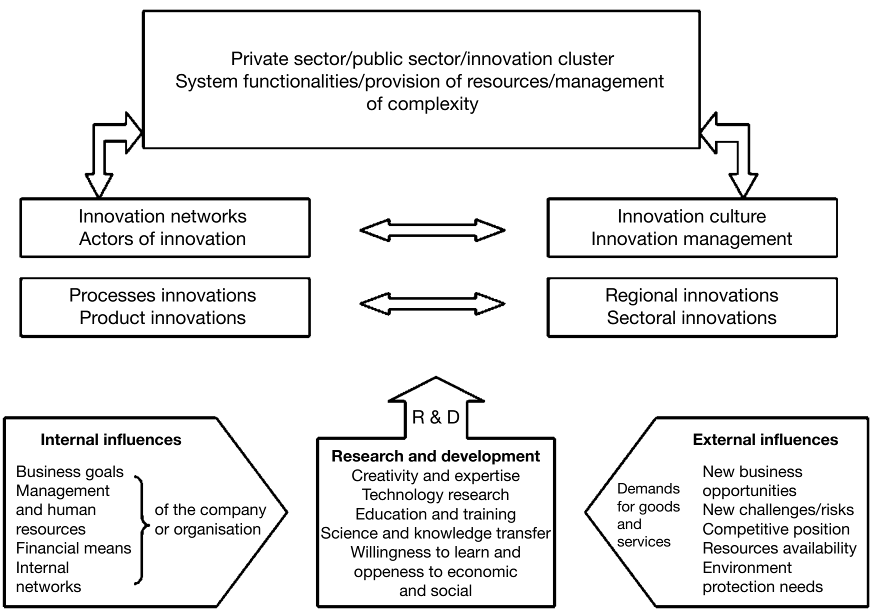

Figure 2.14 Innovation in enterprises and organisations

Sectoral and regional innovation systems have gained considerable momentum. Several analytical elements are used to describe the nature and functionality of such systems (Kubeszko *et al.* 2006: 706–8):

- *Product and process innovations* may be distinguished. Product innovations are changes in the output of goods and services of enterprises or organisations. Process innovations are technological or organisational innovations.
- *Innovation systems* comprise the players and institutions that contribute to the development and diffusion of innovations. The performance of the system depends on the contributions of individual participants and their interactions. Innovation management is an institutional process in which entrepreneurs are engaged and supported by external institutions.
- *Sectoral innovation systems* consist of enterprises and other actors engaged in a particular economic branch or sector. Significant aspects are the specificity of the knowledge base and learning processes, the specificity of consumer demands, and the specific relations between enterprises and other private and public organisations.
- *Regional innovation systems* are territorially based. They are concerned with innovations at local or regional levels and focus on the innovative dynamics of technological change, organisational learning and familiarity with possible sources of information and support.
- *System functionalities* may be grouped according to activities related to input factors and innovation processes within an enterprise or cooperative. They are concerned with the use of innovations, such as formulating management strategies, improving cooperation, resolving conflict and addressing risks and uncertainties.
- *Provision of resources* refers to financial, human and knowledge resources as inputs, either within an enterprise or from outside. For instance, specific resources may take the form of skilled personnel and experienced advisers, patents or licences, and subsidies or tax incentives.
- *Management of complexity* is a significant aspect of innovation processes. Information resources, professional competence and work experience help in reducing uncertainty and risks, managing cooperation, resolving conflicts and facilitating institutional change to handle and reduce complexity.

Making value-creation processes efficient means that the dynamics of demand and the resulting business-specific differentiation must apply to the whole range of outputs. Production innovations have focused on expanding the supply base for a variety of roundwood assortments and finding new markets for a diversified range of products, and the result is more vertical and horizontal integration in procurement, production and distribution of goods. With modern information technology, the continuous flow of information among all business activities has become a central element in value-creation processes within the wood-processing chain.

A systematic use of environmentally friendly silvicultural interventions using geographic information system-based inventories and production programmes is a major achievement. In private and public forests, increasing attention is given to innovations that relate to recreation, welfare, conservation and preservation. In densely populated regions, forest uses and management are becoming more service oriented. Studies of public and private forest in Switzerland show that innovation activities and potentials in multifunctional management are by no means limited to improvements in wood production but cover a range of social and environmental services, process innovations in improving cooperation among forest owners and joint undertakings with private landowners and public institutions (Hansmann *et al.* 2009).

Overall, the changing conditions of forestry and wood processing require not just responses to present trends but positive entrepreneurial action to transcend boundaries and quickly grasp new areas of business. The common challenge facing forest owners and companies in the wood industry is collaboration along the entire value chain, taking customers' needs as well as the interests and demands of other stakeholders into consideration. Periodic monitoring inside and outside the company is necessary to develop innovative options for action at an early stage. It is only then that one can speak of entrepreneurship in the true sense of the word.

New materials and system solutions promoted by industrial groups, the intensive production of large-scale forest management units and continuing growth in integration within wood processing are competitive factors in Europe and North America. At the same time, some countries in the tropics and subtropics have new forest resources because of recent reforestation programmes and intensive plantation management. On the demand side, calls for sustainable energy use, protection of the environment and better soil and water resource practices reflect consumers' changing attitudes. On the supply side, foresters need to use resources more carefully, improve sustainable management and use energy and materials more efficiently. Closed processes of production and more integration among consumption, reuse and disposal of materials are necessary to make progress towards the worldwide goal of sustainable development.

Another trend arises from the demand for increased participation and co-determination by the population and directly affected groups. Stakeholders want more influence over the way livelihoods are shaped, the choice of environmental protection measures and the use of energy and materials. Such trends have strong implications for values, motivational structures and target groups among forest owners, entrepreneurs in the wood industry and potential customers and consumers (Kammerhofer 2006). The need for measures to preserve biodiversity and rare biotopes leads to land-use restrictions through zoning. Although the scale and intensity of these developments vary from region to region and country to country, the political and legislative influence on forest management practices has substantial effects (Wagner 1996).

Shifts in land use are another factor affecting forestry and wood supply prospects. As agricultural areas in climatically and structurally disadvantaged regions are abandoned, opportunities arise for afforestation and special biomass production. Particularly in Southern Europe and in the new market economies of Central and Eastern Europe, considerable changes can be expected. A countervailing trend – to expand food and energy production – may diminish the forest estate, however. Driving economic factors for determining the future land base for wood production will be energy and food prices versus the prices for roundwood and wood-based products.

2.3.2 Factors of change in the wood-processing industry

Several conditions determine the context in which enterprises and companies operate (Porter 1992):

- general state regulations and legal standards (public institutions and policy domains);
- quantitative and qualitative changes in market demands and relative price levels between wood-based products and competing materials (demand side);
- availability of resources for production and cost ratio on procurement markets (production basis);
- opportunities for or obstacles to new companies that enter the market (market access and competitiveness); and
- development of new technologies and structural adaptation in production and marketing processes (substitution processes).

Examples in the wood industry illustrate the importance of innovation (Hovegaard *et al.* 2005). Automatic data processing and mobile communication offer better ways of organising comprehensive value chains. The use of modern technology with chipper canter machines has boosted productivity in the sawmill industry. New production processes allow former waste products to be used as higher-value raw materials. Programmable manufacturing machines in the furniture industry, with short re-equipment periods, produce large numbers of product variants and optimise material use. Important innovations are being achieved by adapting company structures, establishing strategic collaborations and changing company culture – all while taking social sustainability into account.

Development of forestry and wood processing depends on several factors (see Figure 2.15):

- the activities of large regional and international companies that increase competitive pressure;
- the globalisation of markets, standardisation of products and services, more integrated trading and marketing systems and strong position of customers – final consumers in particular;
- competition from other structural materials that can substitute for wood, as well as technologies that create new types of wood products and composite wood materials;
- increasing demand for specialised and technologically high-quality products in established markets and the emergence of new markets for standardised

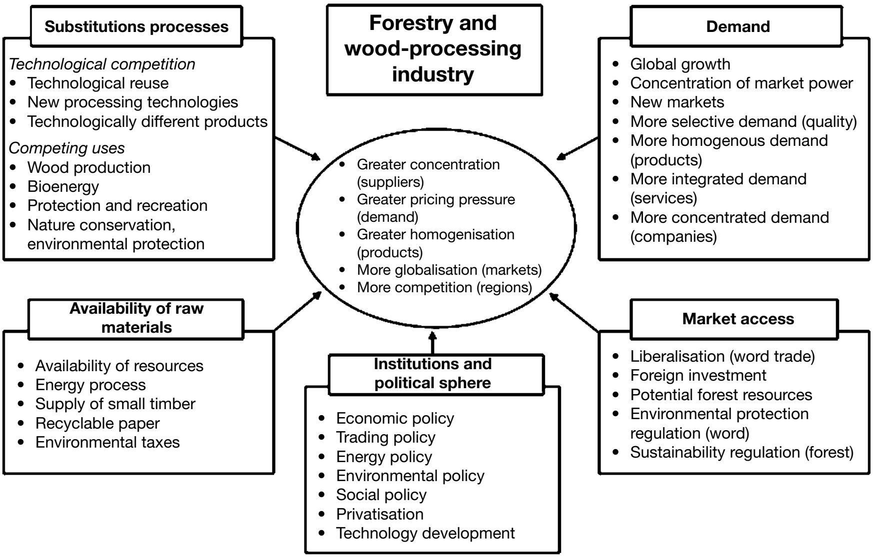

Figure 2.15 Factors determining forestry and wood processing

Source: adapted from Schmithüsen 1997: 21

products (e.g., in construction, biotechnology and pulp and paper production); and

– global and regional trade agreements that improve or restrict market entry opportunities for wood-based enterprises.

Among the factors that influence trends in sustainable roundwood production, the following merit mention (see Figure 2.16):

– Increasing pressure on forestry to reduce costs and organisational bottlenecks along the wood value chain will necessitate structural changes.
– Cost reductions will require rationalisation, collaboration and specialisation of logistics systems.
– Unfavourable developments in the value of wood relative to income trends could slow or end certain forest management operations.
– Wood biomass for energy will compete with roundwood as a raw material in procurement strategies.
– Demand for high-quality roundwood assortments and specific tree species offers new opportunities for wood supply from intensively managed forests.
– For mass-market roundwood assortments, pooling of procurement practices, rigorous standardisation and flexibility in deliveries to the industry will be essential.

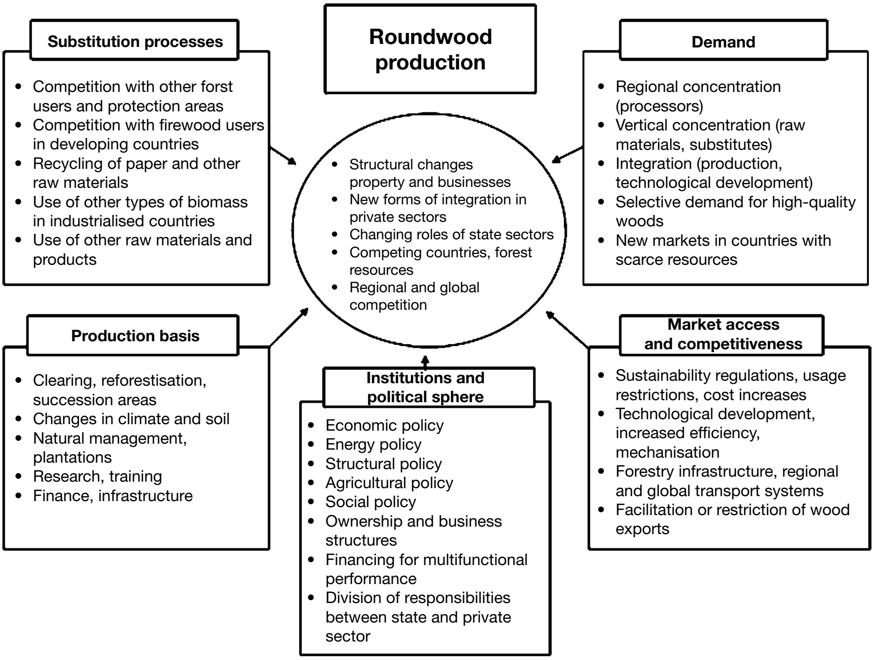

Figure 2.16 Factors determining sustainable roundwood production

Source: adapted from Schmithüsen 1997: 22

– Competition for wood supply may increase as a result of recycling and re-use technologies, particularly through recycled paper and post-consumer wood utilisation.
– The demand for forest recreation, protection forests and nature reserves, as well as restrictions in the management of natural forest areas and old-growth stands, could reduce roundwood supply for the industry.
– Shifts on the supply side can be expected as a result of growing export shares among the forest regions in the northern hemisphere as well as from deliveries from tropical and subtropical regions with extensive afforestation programmes.

A study of the competitiveness of the wood-processing industry in the EU for the year 2000 showed that most product areas were globally competitive from a *qualitative* point of view (see Figure 2.17; European Commission 2000: 40–1). The quality of products supplied met customer requirements and was at least as good as that from international competitors. For *quantitative* parameters, however, *production costs* were high, disadvantaging European firms on international markets. Updated material can be found at European Community under Enterprises and Industry/Forest based industries.

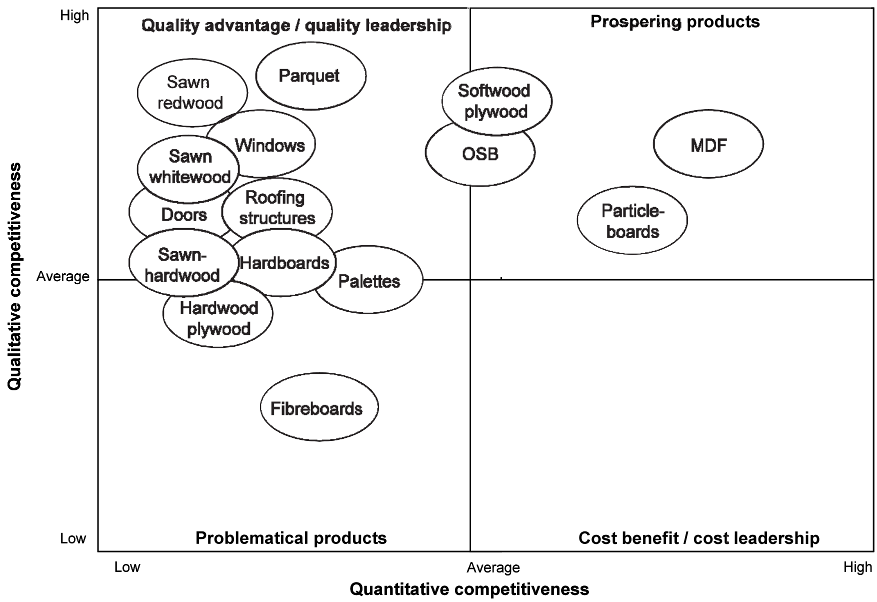

Figure 2.17 Competitiveness of the wood-based industry in the EU

Source: European Commission 2000: 44

Pointers for entrepreneurial action in improving competitiveness were revealed in an analysis of strengths, weaknesses, opportunities and threats. The *strengths* of the industry lie in an expanding, secure and sustainable raw material base. High technological and educational standards, proximity to large and versatile markets and a differentiated production structure are other advantages. As *weaknesses* to be eliminated through innovative entrepreneurial measures, the SWOT analysis found that some European countries have high costs for raw materials and labour, rather low capital profitability, insufficient investment in research, lack of rationalisation, particularly in roundwood production, and an insufficient tradition and culture, at least in certain regions, for using wood in construction and building (see Table 2.8).

Opportunities identified in the SWOT analysis lie in devising high-quality and coordinated product–service offers for end consumers, integrating production sectors and market segments, and using raw materials more efficiently all along the forest and wood-processing value chain. *Threats* included intense competition on procurement markets – between wood and other structural materials and between nonwood products and semi-finished and finished wood products. Failure to keep up with innovative technologies, offer competitive full-service consumer solutions and capitalise on environmentally friendly wood uses were seen as other potential threats, along with competition both within Europe and from other regions with more favourable production costs.

Table 2.8 SWOT analysis of the wood-based industry in the EU

Strengths	*Weaknesses*
→ Sustainable and expanding raw material base → Strong technology, know-how and skill base → Proximity and access to large and sophisticated market → Industry clustering and development of home-base advantages	→ Relative lack of wood culture, stifling opportunities to rejuvenate markets → High raw material costs (especially wood) → High labour costs → Low profitability, reducing opportunities to re-invest, R&D consolidation and rationalisation
Opportunities	*Threats*
→ Expanding use of wood: – promote wood as lifestyle product – broaden product propositions, create solution packages for end-users → Further development of home-base advantages around clustering, synergies between sub-sectors (e.g., geographic, know-how, technological, supplier, infrastructural) → Capitalise on expanding EU forest resources → Participate in supply chains from "cost-competitive" regions	→ Competition from Eastern Europe, Russia, Southeast Asia and Latin America based on established and low-cost resources → Failure to develop products and solutions, leading to increasing substitution by other materials and products → Failure to capitalise on environmental initiatives

Source: European Commission 2000: 44

The conclusions from such findings are manifold. Economic and technological competition is based on the price-cost relationship, the quality of products and services offered at various production stages and, most importantly, the quality of products and services offered to end consumers. Quality needs continuous improvement and costs need to be monitored and wherever possible reduced at all levels of the wood value chain. The prerequisites are efficient organisation of all steps from roundwood production, processing and marketing based on innovative technology, effective information systems and specialised advisory services. Efficient logistics and distribution patterns tailored to supplying local, regional and worldwide markets are needed. This requires dovetailing of primary production with industrial processing, with efficient system solutions backed up by considerable investment. Industrial research and development and adaptability to changing demand are decisive competitive factors.

2.3.3 Human-environment systems interaction research

Forest and landscape dynamics are the result of complex human-environment systems interactions between physical and ecological conditions, changing societal needs and values, economic opportunities and evolving political institutions.

Understanding these interactions requires an integrative view of the multiple and spatially differentiated uses of forests as an important renewable natural resource base.

Figure 2.18 presents a systems approach to analysing the conditions for sustainable management, protection and preservation of forests as a combination of linked human and environmental factors. The *x* dimension indicates the spatial effects of resource use and management on the physical and human environment as a whole, at landscape levels, for different land-use categories and land management units. The *y* dimension shows the dynamics of social change and the driving factors that determine the prevailing use of renewable natural resources. Significant aspects are cultural values, societal demands, economic needs and opportunities; political and legal networks setting the conditions for resource use; and decision-making processes involving landowners, land users and other stakeholders. The *z* dimension presents the interplay between private and public goals, available technologies, policy instruments and the consequent feedbacks and results.

Once human-environment interactions have been identified and a path chosen, consistent, empirical and politically relevant socioeconomic frameworks are constructed to indicate factors and links of importance in a given context. Such frameworks show the socioeconomic context of sustainable resources utilisation and land management – an important step for modelling and systems analysis of physical processes and interactions of environmental change. Frameworks help in

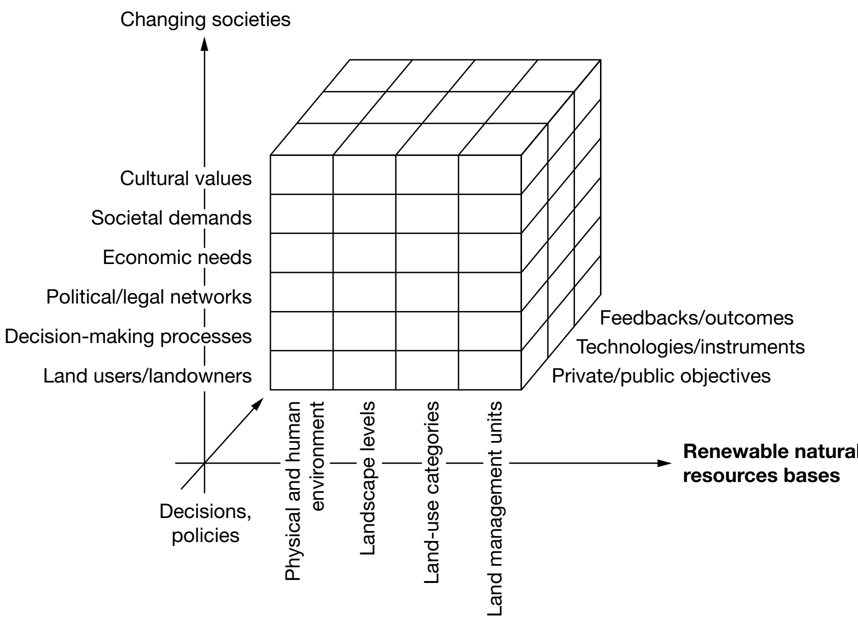

Figure 2.18 Human environment systems interactions in forest management

Source: Schmithüsen 2005

the conception and design of innovative research that systematically integrates the natural sciences, environmental sciences and social sciences. Modelling the physical effects with the social, economic and political drivers that determine private and public forestry use and management practices creates added scientific value.

The more fundamental issue is how to establish working relationships and institutional structures that foster creative interactions between the different sciences. This requires dialogue and cooperation among researchers as well as an exchange of views with private and public stakeholders. To build an active research base, researchers need to focus on concrete problems and conduct studies that have political relevance. And they need to understand the language and methods of different disciplines. All this takes time and is difficult to accomplish but is essential if the results are to address the complexity of changing environmental conditions and sustainable use of forests.

For a better understanding of the continuously changing interactions of human-environment systems, the natural and social sciences need to be on an equal footing. Research methods must integrate quantitative and qualitative knowledge, and case studies should provide empirical insight into concrete problems and solutions (Scholz and Tietje 2002). Research combines material flow analysis of natural resource use with the analysis of prevailing economic, social and political systems and identifies agents and the links among them that determine the effects of private and public decision making on the environment and natural resources (Binder 2007a, 2007b). This complexity requires increasingly interdisciplinary and transdisciplinary approaches to research and education that produce different kinds of knowledge, leading to a new social contract between science and society (Gibbons *et al.* 1994; Novotny *et al.* 2001).

Forest research, part of environmental, land management and ecosystem sciences, can make a substantial contribution to the wood-based sector if it considers human-environment systems interactions as they affect forest and landscape management in a rapidly changing society. An interdisciplinary research approach, combining socioeconomic analysis and modelling of processes and interactions of the physical resource base, can improve land-use planning and land management practices and promote more effective public policy measures and instruments.

The design of innovative socioeconomic forest research programmes is based on the specifics of using renewable natural resources:

- sustainability as the guiding principle for maintaining and developing the natural resource base;
- multifunctional and locally adapted land management practices that address economic, societal and environmental demands;
- interplay between natural processes, technological solutions, societal behaviour and political decision making;
- improvements in land management through effective public institutions and involvement of stakeholders;

- use of appropriate market-based instruments and coordinated public policy instruments; and
- multidisciplinary approaches between natural, technological and social sciences that lead to a common scientific basis in dealing with economic production, societal needs and cultural values.

Forest business economics, founded in the concepts, models and methodologies of management science and economics, seeks to explain the economic production and marketing conditions within forestry and the wood-processing sector. Students in this field should be well grounded in the current literature and the results of applied economic research. Forest business economics encourages an entrepreneurial spirit, strategic thinking and human relations abilities. Primary subjects are the end markets that drive business, process management and strategic innovation techniques, measures to foster competitive wood production and new approaches in marketing environmental and recreational services.

Students, teaching staff, professionals and practitioners need to understand the complex management processes of enterprises in a free-market economy. They have to know how to optimise production within the entire value-added chain and to understand the primary role of markets and marketing. At the same time, they should be able to evaluate the options and constraints of industrial production of the wood industry versus multifunctional forestry production systems providing a wide range of goods and services. Important management and economics topics to be included in this programme are business politics, human resources and organisational development, accounting systems and methods, financing and investment, logistics and production processes and strategic planning and controlling.

Resource economics deals with optimisation of production and consumption processes in a dynamic and intertemporal allocation perspective. Resource economists develop models of the conditions for the optimal consumption of resources and for correcting suboptimal consumption practices. In particular, environmental economics analyses the positive and negative external effects of production and consumption and how these externalities can be internalised to improve utilisation. It is based primarily on a static resources allocation analysis dealing with actual competitive use of environmental resources. Ecological economics deals with dynamic systems in evolution and with human preferences reflecting broad ecological opportunities and aversion to environmental constraints. The timeframe of the processes studied extends from short to very long, its scale extends from local to global and the focus is on sustainability as a combination of economic, environmental and social factors. Combining theoretical concepts and methodologies in a problem-oriented research and teaching approach helps in grasping such complex issues as forest utilisation, ecosystem management and the role of forests in maintaining a liveable environment.

The focus of resource economics is the understanding in a reasoned and scientific manner of the economic values related to sustainable use and management; analysing human behaviour towards forests, nature and landscape in economic terms; and developing economically efficient solutions for a wide range of ecological problems. Primary teaching subjects encompass the following:

- multiple cross-sector links, positive and negative conditionality between economic decisions and effects on natural environmental processes – climate, soil, water, vegetation and fauna;
- intertemporal effects of alternative use and management strategies on stocks of renewable natural resources;
- economic implications of positive and negative externalities in production and consumption for the behaviour of firms and individuals;
- social aspects of providing public goods and managing common property resources to meet collective economic, societal and political demands and respect culturally derived attitudes and beliefs;
- the dynamics of changing private and public consumer demands based on an optimisation of economic strategies combining production, protection and preservation outputs; and
- identification, quantification, valuation and monetisation of the environmental, social and cultural services and benefits that result from multifunctional forest management, environmental protection and nature and landscape preservation.

There are many possible interactions between the production of private goods and services from forests on the one hand, and the potential and limitations of the flow of public goods and services from forests on the other hand. By exploring the dynamic relationships between land and society through empirical analysis, forest and resource economists seek a better understanding of the requirements and opportunities of the private and public sectors.

The subject of business economics research is individuals and the institutions in which they work. In the German speaking business literature, several fundamental research approaches have been developed over time for analysing business management problems (Lechner *et al.* 2010: 53–8).

The *factor-based approach*, developed by Erich Guttenberg, examines an enterprise primarily as an entrepreneurial system combining productive factors for providing goods and services to generate revenue and make a profit. Analyses of the functional production processes illuminate the relationship between factor input and factor revenue. Production and cost theory, selling procedures and financing considerations are important elements of this research approach. The *decision-oriented approach*, developed by Edmund Heinen, puts emphasis on enterprises and companies as groups of workers whose collaboration needs to be based on normative and ethical relationships, such as personal agreements and formal regulations. It develops a descriptive and empirical research approach to investigate principles of individual and business decision-making processes. Of particular interest is how responsible managers behave in a given situation, how they arrive at their decisions and which procedures they choose for implementation. Interdisciplinary research methods combining, for example, economics, sociology and psychology are used.

The *system-oriented management approach*, developed prominently by Hans Ulrich, focuses on the development of creative models in addressing enterprises and companies as productive social systems and developing strategies for their further development (see Chapter 4, Section 4.1.1). Building on systems theory and cybernetics in explaining management and work processes, it explores effective business organisations and underlines the importance of collaboration and coalitions of functional groups of workers. The *behavioural science approach*, promoted by Werner Kirsch, analyses the premises and the logic of individual and small-group decision making in organisations and builds a bridge to organisation theory. Information processing and communication networks are important factors for explaining how steering and regulative processes function in managerial decision making. The *situative or contingent approach*, presented by Alfred Kieser and Herbert Kubicek, deals with how an organisation is described and the factors – technology, size, importance and environmental dynamics – that influence the behaviour of its members and the organisational structures. The underlying research assumption is that investigating these factors provides insight into the functioning of private and public institutions.

The *marketing approach* puts the conditions and dynamics of markets at the centre of analysis and develops a market-oriented management strategy for the enterprise or company, targeting customers in intermediate and final sales markets. With complementary research interests in the role of nonprofit organisations, macroeconomic issues (e.g. maintaining renewable natural resources, ethical considerations and social responsibilities), the approach extends to society-oriented management issues. A *cultural and evolutionary approach* presented by Peter Bendixen in understanding economic development and entrepreneurial success is another extension. It draws from such factors as globalisation in procurement, production, trade and consumption, international financing and, foremost, the different cultural backgrounds of people working together (see Chapter 4, Section 4.1.1). *New institution economics* has gained importance in business economics research. The focus is on an analysis of the role of property rights, transaction costs and principal agents in human-environment systems interactions (see Chapter 4, Section 4.3.4).

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3 Markets and marketing

3.1 Markets

3.1.1 Supply and demand

The term *market* refers to an exchange of commodities between a supplier offering goods or services and a customer with a demand for those goods or services. Before the introduction of money as a means of payment, barter was the common format of trading: people gathered in a marketplace – a physical location – to exchange goods and services directly. Even though local commercial transactions remain important in many countries, nowadays markets and marketing have a much broader meaning. Individual steps involved in the exchange of commodities are complex and may occur at separate times and in different forms of communication between buyer and seller. As the universal means of payment, money plays a decisive role in the functioning of this exchange and is the predominant measure of the value of goods and services.

Marketing now means the whole system of exchanges between buyers and sellers. Market transactions are based on the fundamental mechanism of supply, demand and price (Hardes and Uhly 2007: 34–5; Varian 2007: 7–8). A supply of a defined amount and quality of goods at a specific price meets a demand and a willingness to pay associated with it. A transaction takes place if the customer's willingness and ability to pay match the minimum price demanded by the supplier (Altmann 2003: 262–3).

The marginal utility of a good is the extra benefit from the consumption of the last extra unit of a product, all other things being equal (Hardes and Uhly 2007: 125–47). This is easily illustrated for everyday commodities. The benefit of the first drink for someone who is thirsty is undoubtedly high. Consuming additional drinks reduces the level of thirst, up to the point at which the benefit of additional drinks reaches zero. At that point, the individual is no longer willing to pay for any more drinks. The principle underlying this process is known as the law of diminishing marginal utility.

The connection between the amount consumed and the consumer's willingness to pay can be illustrated graphically in the form of the demand curve D, shown in Figure 3.1. The shape of the curve depends on the type of good involved and the

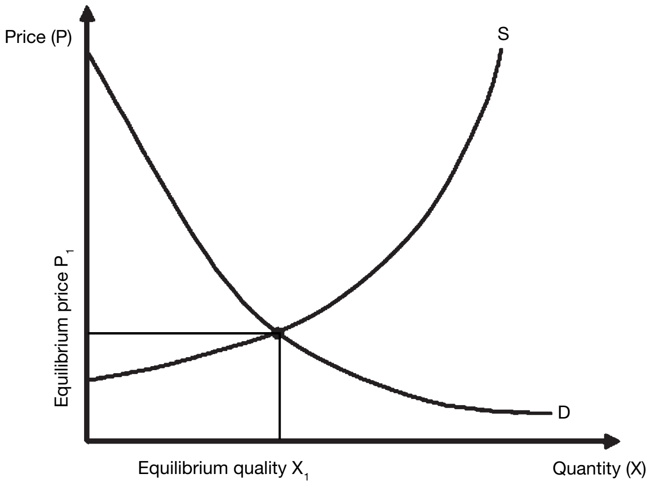

Figure 3.1 Demand and supply curve

consumer's preferences. If the consumer responds sensitively to price changes, the demand is described as having a high degree of price elasticity. The demand curve then tends to be shallow (Altmann 2003: 264–5, 295–6).

The amount of supply depends on achievable prices. If the costs of producing goods are lower than the prices that can be obtained for them, then it is attractive for entrepreneurs to produce additional units of the goods concerned, since they can make a profit in the process. Companies will continue to produce goods of a specific type as long as the marginal costs are lower than the current prices. Marginal costs are the additional costs arising when production is increased by one unit (Altmann 2003: 319–20, 325).

As with the demand curve, the connection between the amount produced and the marginal costs of production can be illustrated in the form of the supply curve S, shown in Figure 3.1. The willingness and ability of suppliers to respond to price variations is known as the elasticity of supply. It is determined by variable and fixed costs of producing goods and services. The shape of the supply curve thus depends on the producing company's cost function.

In a free market with perfect competition, the intersection point of the demand and supply curves is known as the *equilibrium price* or *market clearing price*, P_1, and the associated quantity is known as the *equilibrium quantity*, X_1. At the equilibrium price and volume, there is said to be *market equilibrium*, P_1/X_1. At this point, the supplier will not produce any further units of a good because the price obtainable will no longer cover the marginal costs and the result would be a loss. Consumers will not accept a higher price because the marginal benefit to them is less than the price demanded.

A state of market equilibrium is not stable over time but changes in accordance with the varying preferences of consumers and current production costs of the suppliers. Changes in these values lead to temporary market disequilibrium. For example, an increase in activity in the building industry may increase the demand for sawnwood and therefore purchasers' willingness to pay for it. This shifts the demand curve D_0 towards D_1 (see Figure 3.2a). If the production quantity X_0 remains constant, the price for sawnwood will increase to P_x. Because the market price is now above the marginal costs of production, suppliers will increase the production of sawnwood. In accordance with the altered supply quantities, the market price will then continue to change along the demand curve until new market equilibrium is reached, at P_1/X_1. An increase in demand leads to a change in the market price and an adjustment of production quantities.

A change in the supply curve has similar effects on prices and quantities (see Figure 3.2b). For example, a decrease in log costs leads to a reduction in sawnwood production costs and thus to a shift in the supply curve S_0 towards S_1. Because the current market price is above the marginal costs of production, sawnwood producers increase the quantity supplied. If there were no change in the price P_0, they would continue to do this until the quantity X_P was reached. However, the increase in supply leads to a reduction in the price along the demand curve until a new market equilibrium point is reached, at P_1/X_1.

The speed at which the new market equilibrium is reached depends on the general availability of information. On the side of the supplier, it depends on how quickly companies and their production capacities can respond to a change in demand. On the buyers' side, it depends on how quickly they react to changed production quantities. In reality, both the demand curve and the supply curve shift constantly.

The system of using money for exchange and determining prices and quantities for goods based on supply and demand is referred to as the *market mechanism*. It leads to constant changes in current prices and quantities produced. For example,

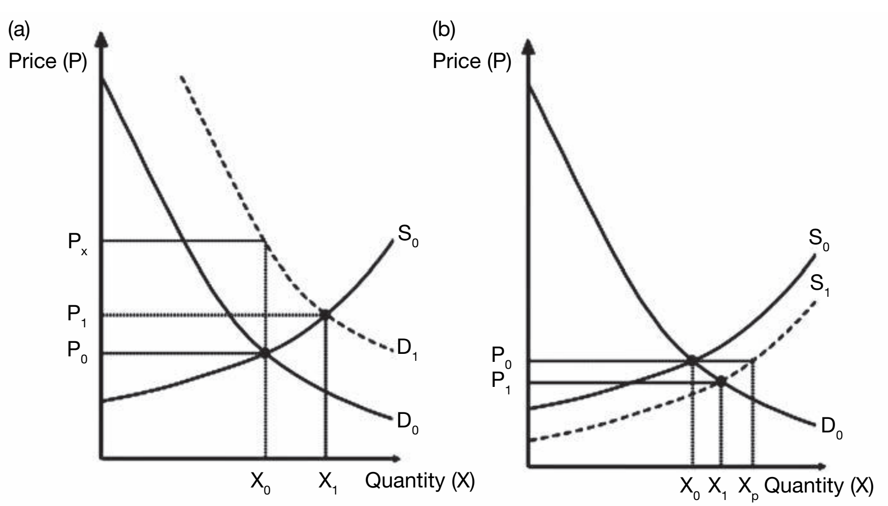

Figure 3.2 Changes in demand (D) and supply (S)

the demand for raw materials is extremely cyclical. In phases of strong economic growth, demand increases. However, supply and demand usually cannot adjust to each other immediately. With regard to the quantities supplied, suppliers are guided by the market prices they expect. The demand side then determines the price at which the supply is accepted. If stockpiling of goods is an option, the demand side will take expectations on available volumes and future prices into account.

If the supply remains constant, an increase in demand initially leads to an increase in the price. Suppliers then respond to this by increasing the quantities produced, in accordance with their current marginal costs. This leads to over-supply, which in turn is associated with falling prices (see Figure 3.3). The new market equilibrium, P_n/X_n, which corresponds to the altered demand and supply curves, is reached via an iterative process of price and quantity adjustments. The pattern resembles a spider's web, described as the cobweb theorem (Altmann 2003: 361–2; Bergen *et al.* 2002: 64–5). It results in the more or less severely oscillating quantities and prices that can be observed, for instance, in international markets for raw materials.

The market mechanism does not work effectively if there is an asymmetric distribution of market information. This is the case, for example, if buyers are not aware of the current market prices and pay higher prices on the basis of their own preferences. On the other hand, suppliers who are in a strong market position can attempt to reduce the supply to increase the prices paid. This is seen particularly in supply monopolies.

The speed with which buyers and suppliers respond to changes in quantities and prices affects the efficiency of the market mechanism. The development of market

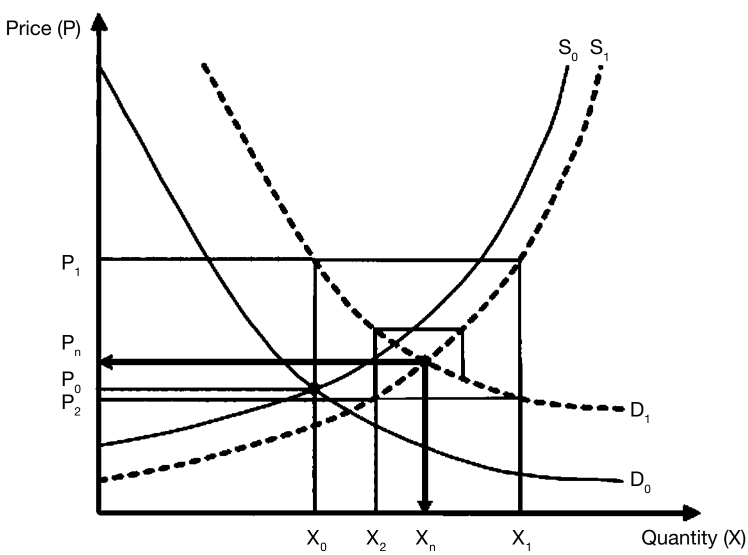

Figure 3.3 Cobweb model

prices depends on the frequency with which a specific good is traded. In transactions involving unique objects of exchange, the prices often have to be determined in prolonged negotiations between the supplier and the purchaser. This can be seen, for instance, when companies are to be sold. In such a case, the views of the seller and the purchaser regarding the value of the assets or of particular objects of exchange are often widely divergent. Views about prices are determined both by assessments of business data and by strategic development options of the company interested in the takeover.

3.1.2 Private and public goods

The functioning of market mechanisms presupposes that commercial goods traded on markets have specific characteristics that are determined by the exclusion principle and by consumption rivalry (Blankart 2008: 52–3).

The *exclusion principle* states that to charge for a good or service, the owner (a person, an enterprise or a public institution) must be able to exclude anyone from its use. For example, on the basis of his property rights, a forest owner can exclude others from using the trees in his forest or the timber assortment that he produces. A sawmill can use the roundwood it requires only if it is prepared to pay the price on which the seller and buyer have agreed. An example of the absence of an exclusion principle is the legally guaranteed right in some countries for the public to enter woodlands for recreational purposes: walkers are generally not obligated to pay a price for using the woods, and as a consequence, access to forests for recreational purposes has no market price unless something else is provided, such as special attractions or parking spaces.

Consumption rivalry means that the use of a specific good by one person curtails the use of the same good by another person: there is competition between various parties for the use or purchase of the good. Consumption rivalry arises when there is a shortage of a good in which several users or purchasers are interested. This applies to all goods that are traded on markets.

By contrast, with *public goods* – those that are available to the public generally, or at least to a specific group of authorised individuals – there is no consumption rivalry, or only in certain conditions. A classic example is viewing a beautiful landscape along a particular hiking trail. Another example might be avalanche and rockfall prevention measures that protect the inhabitants of a village, to the benefit of all of them. Lack of rivalry is relative, and whether consumption rivalry exists depends on the intensity of use. The pressure from public use of a natural site can increase to such an extent that some form of rationing – for example, by regulating access – might become necessary.

When the two criteria – exclusion and rivalry – are compared, a matrix of four categories of goods emerges (see Figure 3.4).

With *private goods* that are privately or publicly owned, both the exclusion principle and consumption rivalry are present. The result is that these commodities can be exchanged on organised markets without restriction, provided sellers and purchasers agree on a price for trading the good. Market equilibrium between

	Rivalrous	Non-rivalrous
Excludable	Private goods	Club goods
Non-excludable	Common goods	Pure public goods

Figure 3.4 Categories of private and public goods

supply and demand and the price function lead to a balance in the production of private goods.

With *club goods*, the exclusion principle is applicable, but there is little or no consumption rivalry. Examples of this would be the Internet or cable television, the use of which by one person does not restrict its use by another person within the range of existing capacity limits. This type of good is often marketed by issuing individual access rights with fixed fees and entrance charges. If the demand rises for a club good, consumption rivalry increases and overuses may follow.

Common goods or *common-pool resources* are not subject to the exclusion principle, but there is often strong consumption rivalry and usually no way of extracting payment from the users. Individuals and companies have a strong motivation to maximise profits by consuming as much as possible of a good of this type. When property rights are not adequately regulated and if it is not possible to exclude excessive consumption, there is no incentive to manage the commodities sustainably. In fact, consumers have an incentive to act as 'free riders' and overexploit the good. This problem often appears in connection with management of renewable natural resources. The problems linked to their preservation, management and sustainable use have been intensively discussed and analysed in the context of using and maintaining common property resources (Ostrom 1990).

For *pure public goods*, neither the exclusion principle nor consumption rivalry is present. This type of good cannot be traded in market-economy systems, since no rational consumer would be willing to pay a price for its use. People and organisations use public goods, if they are available, without restriction, and profit-oriented businesses have no incentive to produce them. Since market demand is not a primary driving factor, there is nonresponsive supply, and either shortages or surpluses may result. The question of who covers unavoidable costs also arises.

Looking at forestry outputs and forest uses more specifically, several aspects of private and public goods can be observed. The most obvious private good in forestry is the production of wood. In addition, there may be a large range of nonwood products that are either privately owned or considered some form of public good, depending on the prevailing land tenure, forest and hunting legislation. Depending on the ownership status and regime of forests, one finds that nontimber forest products are either privately or publicly owned and may be sold, bought or leased within the framework of the applicable (and usually rather restrictive) legislation. In many other aspects, however, the same forests have a public good character because of the multifunctional social and environmental benefits that they provide to the community as a whole. The *club good* character is represented, for instance, in communal, cooperative or other forms of collective forest tenure arrangements: members use and manage the forest as stipulated either by customs and traditions or, as is the case today, by applicable laws and regulations. Other examples would be the purchase of a hunting licence or the payment by visitors for an educational tour of a forest area.

A number of use options for goods and benefits connected with forests represent common goods or pure public goods, depending on the properties of the good and the applicable legal framework. For example, sustainable forest management may have positive effects on the environment and mass balance, such as CO_2 sequestration, regulation of water resources, protection against soil erosion and local influences on the microclimate. Some of these benefits may arise simply from the fact that the forest area is being preserved. The strict forest maintenance policies that have been implemented in the public interest in many countries make forest areas at least partly a public good or common good. Accordingly, the landowners are not entitled to change the land use, or can do so only in a limited way. The same applies to recreation areas. If free access to forests for recreational use is legally established, then the forest owners cannot charge entrance fees or levies to cover any resultant costs.

The classification of goods is a useful basis for understanding their economic nature and the consequences resulting from it. But one should realise that a good may have several aspects and functions that can confound classification, and that the character of a good may change over time as its value changes – for instance, by public regulations. An example is a road that was constructed by the government for general and free public use as a *public good* but later requires maintenance, and because of a lack of public funds, the government decides to recover its costs in the form of a toll. This means that the road has become a *club good*. Sometime later congestion has increased, traffic is slow and consumption rivalry has become a reality. We would now call the road a *common property good*. To get rid of the headaches, the government may sell the road to a private company, to be operated according to the firm's own business goal. The original public good is now a *private good* – an asset on the books of the company. Or, more likely, the government makes an agreement with the company to operate the road for 30 or 50 years against a toll payment from the users. Now the road has aspects of both a *temporary private good* and a *public good*. The government could even return to the original situation once the contract with the company expires: a road with free public access and no user fees.

The road example is actually quite comparable to forests and forestry: the character of the good is a result of actual use values, the legal setting and the dynamically changing social, environmental and cultural significance of trees and forests.

3.1.3 Market forms and market trends

Various forms of markets can be distinguished, depending on the numbers of suppliers and purchasers who participate (see Table 3.1). A market in which exchanges between many suppliers and many purchasers lead to an equilibrium price is known as a *polypoly*. The characteristic aspect is that none of the agents on either the demand or the supply side can have a decisive influence on market conditions. The quantities supplied and demanded are controlled by the market price. The roundwood market for the sawmilling industry in Central European countries, for instance, is a typical example of a polypoly. A large number of forest owners, as suppliers, face a large number of purchasers, which in turn supply large numbers of customers.

When a large number of consumers face only a few suppliers or when many suppliers act in concert (e.g. as members of a trade association), the situation represents a *supply oligopoly*. In this case, the suppliers may be in a position to influence the market price through targeted market strategies, such as changing the quantities produced. One example is the civil aviation industry, in which the market for large passenger aircraft is supplied by only two companies (Airbus and Boeing). Other examples can be seen in telecommunications and in the oil business. Concentration processes in an industrial sector favour the development of supplier oligopolies. This market form involves a risk of implicit or deliberate price-fixing, which undermines the market mechanism. Implicit price-fixing may be encouraged by the fact that no single company has any clear cost advantages over its competitors, and it is advantageous for all the competitors to maintain a high price level. This can restrict competition, lower efficiency and reduce technological development.

Table 3.1 Market forms

	One large purchaser	*Few medium-sized purchasers*	*Large numbers of small purchasers*
One large supplier	Bilateral monopoly	Limited supply monopoly	Supply monopoly
Few medium-sized suppliers	Limited demand monopoly	Bilateral oligopoly	Supply oligopoly
Large numbers of small suppliers	Demand monopoly	Demand oligopoly	Full competition (polypoly)

Source: Peters *et al*. 2005: 144

A *supply monopoly* is present when a single supplier faces a large number of purchasers and can dominate the market and influence price formation (e.g. by influencing production quantities that are offered to the market). Supply monopolies can arise at least temporarily because of patents, which prevent potential competitors from producing the protected products. State regulations can also lead to monopolies, through administered price regulation, in the production and marketing of goods that are regarded as essential to meet basic needs, or goods with high development costs that might otherwise not be supplied in adequate quantities. Examples include energy supplies, maintenance of public transport systems and communications services. Supply monopolies are problematic because they tend to restrict innovation and service provision. However, there is often the alternative of imports. *Demand monopolies* based on market dominance by purchasers lead to dependency among the suppliers, since their business position is largely determined by the purchaser's concentrated buying power. Demand monopolies may arise when large producers outsource parts of their specialised production. In many countries, and in the EU, regulations prevent and control the development of business monopolies. Public deregulation measures are taken to reduce or abolish monopoly structures.

Markets have general trends that determine the distribution of bargaining power between suppliers and purchasers and the resulting effects on the exchange of commodities (see Table 3.2). In a buyers' market, the purchasers are in a strong position and can exploit their advantage, relative to producers and suppliers. When the supply of goods and services is plentiful and there is tough competition among the suppliers, buyers demand low prices, product innovations, high-quality products, flexibility in supply and increasingly extensive service provisions. In sellers' markets, the focus is on the type and quantity of the supply and the products being traded. Typical characteristics in this case are the existence of only

Table 3.2 Sellers' and buyers' markets

Characteristic	*Sellers' market*	*Buyers' market*
Economic development stage	*Economic shortages*	*Affluent society*
Relationship of supply to demand	Demand > supply (excess demand) Purchasers more active than suppliers	Demand < supply (excess supply) Suppliers more active than purchasers
Bottleneck in company	Procurement and/or production (output provision)	Sales (output exploitation)
Company's primary efforts	Rational expansion of procurement and production capacity	Stimulating demand and creation of preferences for company's own products
Long-term establishment of company's basic functions	Primacy of procurement or production	Primacy of sales

Source: Peters *et al.* 2005: 138

a few product variants, a low level of price sensitivity among the purchasers and fairly limited requirements by customers for product quality and service provisions.

A widespread shortage of goods followed the Second World War, putting producers in a strong position relative to customers. Since then, the shift has been from sellers' markets towards distinct buyers' markets. With the growing variety in the quantity and quality of the commodities available, intense competition in the market economy and unobstructed world trade in goods, many major markets nowadays are clearly buyers' markets. Suppliers seek to sell their products through intensive marketing and consumer advertising. However, sellers' markets in raw materials often arise during economic booms, if the expansion of production capacity takes considerable time or materials are rare in general or markets are growing.

The existence of buyers' and sellers' markets has varying effects on business companies as suppliers and purchasers. In sellers' markets, the shortage of goods and services benefits suppliers. By contrast, buyers' markets require companies to make extensive and constant efforts in marketing, new product development and market research to compete with the constantly expanding supply of goods and services. It is no longer possible to exploit company and business performance successfully without making active and systematic efforts to achieve sales and even acquire individual customers. The phrase 'the customer is king' is not just a figure of speech but represents the reality of entrepreneurial activity. It is a matter of creating additional demand in varied and sometimes highly specialised markets and guiding customers' preferences in the direction of one's own products.

Internal changes in the wood-based sector show that a shift from sellers' markets to buyers' markets has taken place in every area (Schwarzbauer 2005). Today, changes in demand development and varying requirements from the final customers are the driving forces in the marketing of raw wood and in the wood industry – and this will be increasingly true in the future as well. The decisive potential for differentiation and development in sales markets for the forestry and wood industry therefore lies in rigorous adjustment to customers' needs. The usual criteria for raw wood assortments provide a standard here that is accepted in the industry and makes commercial exchanges easier. Partly because of technological innovations, forest industry companies have opportunities to keep their product range rigorously in line with the requirements of wood industry customers and thereby surpass the existing standards for wood assortments.

Raw wood used to be a sought-after and sometimes scarce raw material that suppliers were able to sell without any great difficulty in receptive markets. Since the early 1960s at the latest, however, competition for sales opportunities in the forestry industry has stiffened. Selling raw wood is no longer conceivable without targeted marketing efforts and familiarity with customers' precise needs. The same applies to wood industry sectors, where there is intense competition for existing customers and above all for new customers. Wood – as both raw material and final product – now competes with consumer goods made of other materials. In addition, the rapid European and worldwide integration of markets for raw wood and processed wood products requires suppliers to consistently meet the needs of the intermediate markets and above all the changing demand on the final sales markets.

3.1.4 Market life cycles

Life cycles provide a general understanding of growth, maturity, decline and revival processes that occur in nature, ecosystems and human life as well as in dynamic functional systems, such as management, organisation, learning and research, and science and knowledge development. Life-cycle models can be used in systems analysis for biological, sociological, economic and political problems. Life-cycle assessment may refer, for instance, to new products and investment projects, software releases, the development of entire enterprises and companies, and systems development in general.

The *market life-cycle model* illustrates characteristic stages that markets go through and the resulting economic changes (Meffert *et al.* 2008: 67–8; see Figure 3.5). It shows market developments as the result of rising or declining demand and supply over time. The dynamism can be seen in changes in product types, market volumes and customer and supplier groups.

Characteristic elements of a market life-cycle model are the introductory, growth, maturity, saturation, decline and end-of-life phases. In practice, the concept of the market life cycle shows many variations. Market entry may be slow or rapid and steep. Growth rates may vary seasonally or follow an economic business cycle. Saturation effects may occur from time to time or follow a steady trend. Product revival may succeed or fail.

As a general model, the concept provides a typology for strategic analysis, focusing attention on opportunities and risks for developing specific markets (Meffert *et al.* 2008: 272–3). It allows for analysing the actual sales and

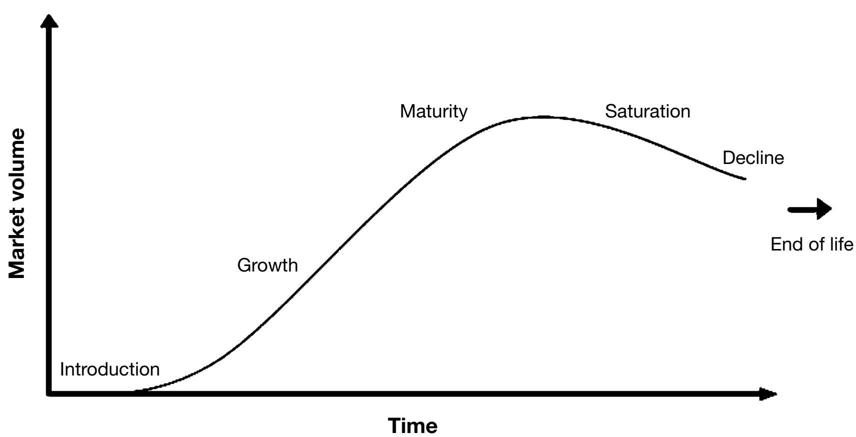

Figure 3.5 Model of a market life cycle

profitability of specific products and product lines in accordance with the principle that market success depends on offering good products at the right moment in an attractive context to the right customer groups. Strategies can be developed for each phase of the cycle that require targeted marketing measures – for instance, in the upswing of a product or when there are signs of incipient saturation. However, clear boundaries between the individual phases are often difficult to determine. Neither the precise sequence of phases nor their duration and degree of success can be predicted for particular market segments and products. Some markets are cyclical, with alternating phases of growth, decline and revival. Or a phase of maturity may be followed by a further episode of growth.

During the introduction phase, the market volume is small but is poised to expand. New products are available in only a small number of variants and may be technically new but not yet fully developed. Because of the products' novelty and unfamiliarity, purchasers may take an expectant attitude and hesitate to buy them. With more information and experience, positive feedback from other customers and systematic advertising measures, demand rises constantly. Or, for instance, in case of new electronic devises, people may buy a new product to gain experience or show that they are technologically savvy. This leads to a first peak when new products come on the market.

On the supplier's side, introductory product costs are high, initial market volumes may be low, profit is small or nil but competitors are still rare. The entrepreneurial qualities needed in such a situation are those of a pioneer: vision and courage, the ability to innovate and the willingness to take risks. Alternatively, in the case of a first buying boom of new products, profits may be high, and the marketing challenge is then to sustain sales and penetrate additional segments of the market.

During the *growth and differentiation phase*, costs are reduced through economies of scale. Supply difficulties may occur because of insufficient capacity in production and logistics. New products find growing numbers of buyers, and sellers' markets develop, in which profits are generated. On the customer side, demand becomes more differentiated, more market segments may develop and the number of product variants increases. Higher profitability of goods and services during the growth phase motivates other suppliers to invest in the expanding market, increasing competition and pushing down prices. Entrepreneurial qualities now in demand include the ability to set and achieve realistic development goals, anticipate opportunities as well as business risks, work with collaborators and build networks with customers, suppliers and external stakeholders.

In the *maturity phase*, growth rates in market volume and product variability remain stable. The growing number of suppliers leads to larger production capacities and eventually overcapacities. Prices stagnate or decrease, and the sellers' market becomes a buyers' market. Efforts to reduce production costs and find cheaper sources for materials and services are now important. The number of product variants may continue to rise, but differences between variants diminish. Enterprises seek to differentiate and add value to their products by making them more attractive through new designs, multiple product presentations, elaborated product descriptions and refined company and branch logos (branding). Entrepreneurial qualities such as team player, communicator and motivator are now in demand. Human relations become important.

In the *saturation and decline phase*, the market volume either ceases to expand or declines. Profit per product unit and business profit as a whole decline. Structural adjustment in processing and marketing to reduce production costs leads to strategic changes in business. Companies expend great effort to provide additional value for customers through technological novelties and process innovations, in the hope of achieving another upswing in the market cycle. If they do not succeed, market volumes continue to decline and profitability diminishes further until certain product lines ultimately disappear. Products may reach the end of a life cycle because they are no longer needed, having been replaced by a new technology, or because consumer habits have changed profoundly. Or they disappear until revived decades later.

The life cycles of different coniferous roundwood assortments can be tracked. For instance, demand for quality coniferous saw logs of large dimensions (*Blochware*), was traditionally high in the sawmill industries of Austria, Germany and Switzerland. Demand has fallen considerably, however, because the new chipper-canter technology requires different wood dimensions in sawnwood production. Thus a long and stable mature phase in demand for a certain product may sometimes be followed by a rapid decline. In contrast, demand for oriented-strand board (OSB) is currently in a phase of growth. That said, it may be difficult to assess in a particular case whether the maturity phase has been reached or the growth phase has finished. And of course, a future change in technology might increase demand for a product now in decline.

Life-cycle assessment (LCA) is a comprehensive environmental accounting tool that has well-established procedures and methods governed by rules and standards, mostly developed by the International Organization for Standardization (ISO). In the context of a green economy, LCA has gained considerable importance for analysing and demonstrating the advantages of wood production and industrial wood processing (FPAC and PWC 2010). It examines environmental effects across the whole life cycle of products and services in the wood-based sector, from raw material extraction to manufacturing, packaging, distribution, end uses and recycling.

For each stage of production and consumption, all process steps are evaluated for inputs – such as materials, labour and energy – and outputs – such as emissions and pollutants. Inputs and outputs may be grouped into environmental impact categories with quantitative and qualitative indicators – for instance, for effects on abiotic depletion, soil and water acidification, climate change and stratospheric ozone depletion. Human toxicity, biodiversity and ecosystem resilience, and fossil fuel depletion are other indicators to be compared. The results of LCA indicate whether and to what extent products and services are transferring pollution from one life-cycle stage to the next or from one medium (air, water, soil) to another.

Because of consumers' interest in environmentally sound consumption and procurement practices, LCAs are relevant to the choice of primary and intermediate processors. Comparisons between wood as a structural material or energy source and alternative materials are also important for developing marketing strategies. In such comparisons, however, the scope of the LCAs must be truly comparable: it must encompass all production and consumption steps and all effects from measured inputs and outputs. Many of the environmental assessments used in marketing are based on only a segment of the entire production and consumption life cycle. Sustainable forestry and the industrial wood-processing sector therefore have an interest in fostering research that conducts credible, rigorous LCAs and ecosystem balances for wood and competing materials.

3.1.5 Markets for wood-based products

The wood-based industry obtains the great majority of its turnover and yield from sales of raw wood that has been processed into various timber assortments, depending on the species of tree and the size and quality of the timber. The economic basis of companies and businesses in the forestry industry depends to a great extent on their entrepreneurial success in the wood markets. Wood is a natural product that is characterised by a wide variety of features, technological properties and possible uses (Jöbstl 1994). The large number of tree species and types of wood makes it possible to create an abundance of different products whose special characteristics need to be taken into account and evaluated in a targeted way during production and marketing.

The wood-based sector integrates various value chains ranging from the marketing of roundwood to the stages of industrial processing and the manufacture of a large number of final products. End consumers' needs and requirements are subject to faster and more wide-ranging changes than those of the intermediate links in the value chain. Wood markets are heterogeneous and can be classified according to products, regions and customer profiles (Meffert *et al*. 2008: 3.4, 46–7).

Wood and wood products that are traded on specialised wood markets have the following features:

- Different types of wood products are sometimes processed and used as alternatives for each other, in a complementary fashion, or in competition with each other.
- Wood and wood products are in direct or indirect competition with numerous other materials. In many cases, customers can choose between wood products and equally suitable nonwood items.
- Wood varies substantially in its quality and technical characteristics. The variability of solid wood and processed wood products in many cases adds value for customers.
- The variability of wood as a raw material also creates problems for manufacturing and use. These problems can be solved technologically but require special attention and the provision of targeted and accurate information and advice to customers.

- Wood is a flexible raw material with a wide variety of uses. Particularly in the construction industry, modern wood technology has opened up new possibilities. Minimum requirements need to be met for size, quality and other characteristics, with proof provided for the customer.
- Solid wood and some processed wood products are sensitive to air conditions and weather and can be used outdoors only in specific conditions. Treatment to allow long-term utility is indispensable for outdoor purposes.

The use of wood, with its carbon-neutral biological growth cycle – when sustainably managed – makes important contributions to sustainable development and to the environment. Because wood is a renewable resource, wood products have considerable added value for producers and customers. The carbon balance of wood and wood products is thus considerably more favourable than that of materials and energy derived from nonrenewable materials and fossil fuels. This point is still often not adequately acknowledged in assessments of greenhouse gas effects from human activities and in discussions of environmental, energy and economic policies.

The carbon footprint has become a scientific and at the same time popular way of expressing the amount of greenhouse gases (GHGs) – e.g. carbon dioxide, CO_2, and methane, CH_4 – emitted by a human activity, such as the consumption of products and services, or by a particular country or mode of living. The concept of a carbon footprint can be extended to assess not just the manufacture of products but the broader, combined and indirect effects of human activities; such as land clearing for agriculture and grazing, transport of goods, business and personal travel, subdivision developments, roads, airports and ports, railway systems and communication lines. The dimensions of carbon footprints can be demonstrated by measuring GHGs emissions or making calculations ('carbon accounting'). As in the context of LCAs, the major problem is determining the system limits of analysis. This is especially important for comparing the use of wood with other materials. One issue is how to treat the CO_2 that is taken up by growing trees and forests but eventually released when the wood decays or is converted into products or energy.

Wood is traded in specialised markets that compete with each other and with nonwood raw material procurement markets, intermediate industrial markets, energy markets and markets for alternative end products.

- End markets for wood and wooden articles include wooden buildings and furniture made from wood; articles manufactured from wood and wood composites; heat and electricity from wood biomass; and products and composites from cellulose and wood chemicals.
- Intermediate wood-processing markets include sawnwood, veneer and plywood markets; wood-based panel markets; and pulp, cardboard and paper markets.
- Wood procurement markets include fresh wood and wood fibre from sustainable forest production; wood particles and wood fibre residues from

intermediate processing; and wood and wood fibre from post-consumer residues.

For reasons of technical suitability, market preferences and customer attitudes, the requirements for successful marketing and sales strategies differ between investment goods and consumer goods. The main factor is the type of demand, rather than specific product characteristics (Seiler 2008b: 51–2). Operating simultaneously on markets for investment goods and consumer goods is a demanding entrepreneurial task.

Investment goods are procured by production companies in commerce and industry so that they can create their own output using these means of production and thereby obtain a profit. Buyers of investment goods make their purchasing decisions in accordance with rational criteria for production, economic efficiency and operational flexibility. What matters for them is purchasing goods that will enable them to create their own high-quality products at low costs. In addition to price, important factors in the marketing of investment goods include quality and useful life, flexible use options, technical innovation and performance, supply conditions and service facilities.

A considerable proportion of wood is purchased to produce investment goods, in particular in the private and public building sector. Sawmills, veneer producers and makers of panels and wood-based products purchase raw wood to make products that other companies can use as materials for subsequent value-creation processes. Alternatively, as in the case of joinery and furniture, companies may produce consumer goods for the end user. The same applies to value-creation chains in the paper industry, which uses recycled paper, raw wood and waste wood from other wood industry sectors in its production processes to make a wide variety of products for further processing and for final consumers.

Consumer goods are purchased for customers' own needs. Purchasing decisions in consumer goods markets are based on price and quality, the suitability of the product for the individual's needs, the price-performance ratio and service and repair options. Additional criteria that may influence purchasing decisions include the image or brand associated with a specific product, a new design or a fashionable colour. Consumer goods may be purchased sporadically and in small quantities or regularly to meet basic needs, out of habit and tradition or on impulse because of their novelty.

Economic and technological developments are changing the customer structure and demand behaviour in the sawmilling industry, with considerable repercussions for forest management, wood harvesting and sales strategies. Forest managers are facing larger and more powerful buyers, particularly in the case of standard goods. Customers have new and more complex requirements in relation to procurement logistics and warehousing – for example, 'just-in-time' deliveries. It is more difficult for small and medium-sized forestry units to be sufficiently flexible in delivering large quantities of raw material in the requested species, quality grades, dimensions and schedules. New forms of cooperation and supply behaviour are needed. At the same time, vertical integration is taking place in several European regions, with the wood industry extending its activities into the field of wood harvesting and transport from the forest to the processing units.

Factors that determine the demand and supply of wood are primarily forecasts of wood demand for material and energy uses on one side, and the estimated wood biomass supply from forests and other sources (e.g. landscaping residue) on the other. Potential biomass supply from forests has been projected for 2010–2030 (Mantau *et al.* 2010a, 2010b). From the forestry industry's point of view, the supply of wood for different customer groups is primarily determined by current opportunities for using the available forest stands, particularly long-term volume, wood assortments and quality levels for each species of tree. An unpredictable factor is the amount of salvage wood from storms and other natural events. Business production goals, such as rotation time and target trunk diameter, which depend on commercial decisions, also affect the structure and quantity of the market supply.

In Central Europe, the market supply is determined largely by forest cultivation decisions to ensure efficient, site-appropriate and semi-natural forest stands. For example, when stand development is controlled by targeted forest-tending measures, a yield of small-diameter timber is supplied to the market. Marketing decisions therefore cannot be made exclusively on the basis of current market demand but must take into account the risks of cultivation and future production opportunities. On the other hand, it should be noted that apart from salvage harvesting following natural disasters, most forestry businesses have considerable opportunities to respond flexibly to customers' wishes and to cyclical fluctuations in demand in specific market segments.

Carbon markets are a new development whose implications for the wood-based sector are still difficult to assess. The Kyoto Protocol established an environmental regime with legally binding objectives for trading GHGs via market mechanisms. The objective of emissions trading is to make the international regime cost-effective, as no party would spend more to reduce GHGs than any other party. It assumed that a carbon price would emerge that revealed information on the costs of lowering GHG emissions to address climate change (Yamin 2005: 153–99). Cap-and-trade schemes established by some countries define a maximum level of total emissions of a determined pollutant. This total emissions amount may be traded among the emitters, which can either take emissions reduction measures or buy additional emissions permits from other participants. The scheme seeks cost efficiency by enabling those companies that can reduce their emissions at low costs to trade their permits with parties that face higher reduction costs.

Regulating GHGs is a major ecosystem service of forests. Conserving forest biomass prevents the release of CO_2 and other GHGs, whereas the destruction of forest cover releases GHGs into the atmosphere, aggravating climate change. Regulatory markets have been developed to meet emissions targets set by international and national regulatory authorities. Voluntary carbon markets have developed as well, allowing companies, governments and nongovernmental organisations (NGOs) to make compensatory agreements for reducing carbon emissions (Streck *et al*. 2008: 11–29). In 2010, the global volume of carbon traded in markets amounted to 6.9 billion tonnes; the value of transactions was US$142 billion. The EU Emissions Trading System (EU-ETS) is the leading carbon market, representing more than 80 per cent of global trade. The voluntary carbon market, which is the main growth segment for forest carbon projects, reached a transaction volume of 132 million tonnes, valued at US$424 million. Under the Kyoto Protocol's Clean Development Mechanism, in which developed countries invest in emissions reduction measures in the developing countries, 13 new afforestation and reforestation projects covering an area of 73,000 ha were approved within a period of 12 months (UNECE/FAO 2011b: 109).

3.1.6 Customers for wood-based products

Important groups of customers in the wood-based sector are briefly described below. Most of them process and convert the raw material into new products, which they sell to customers for further processing or to end consumers. Figure 3.6 provides an example illustrating material flows and business links among major customers and product groups in the wood-based industrial sector.

Sawmill industry: The sawmill industry is one of the most important and immediate customers in the wood-based sector (see Chapter 1, Section 1.3.3). Roundwood assortments are bought from forest owners and logging enterprises. Sawnwood assortments are sold to the building and furniture industry and to manufacturers like joinery and carpentry shops. Processing capacity and

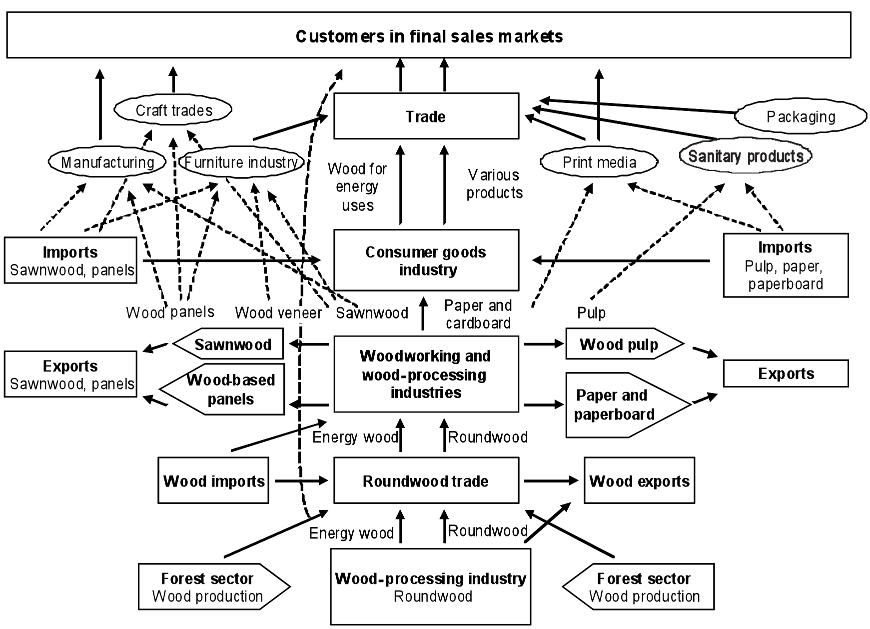

Figure 3.6 Material flows and business links

technology vary substantially. Large sawmilling companies, which are few in numbers, have an annual processing capacity between 200,000 and 1 million m^3 of roundwood. Medium-sized companies lie in the range of 30,000 to 200,000 m^3 annual roundwood cutting. Small business units cut between 20,000 and 30,000 m^3yearly, and very small units turn around 5,000 m^3. Hardwood and softwood sawmills differ with regard to wood assortments, production techniques and sales arrangements. Size, target markets, available technology and different types of networks with customers lead to a variety of business relations in both roundwood procurement and sawnwood marketing. This affects the stocks of product assortments, the type of sales procedures, the level of flexibility needed in operational planning and the continuity, timing and regularity of deliveries. Customer-oriented marketing is essential for achieving business success.

Veneer sheets and plywood industry: The veneer sheets and plywood industries have close links with each other and with the furniture industry, interior panel and door making manufacturers and the manufacturers of wooden cases. Production is concentrated in large manufacturing units and companies that purchase large logs of high quality to make veneers for plywood and surfacing veneers for panels and furniture. Tropical hardwood species are used as well as domestic hardwood varieties, such as beech, birch, oak, ash and maple, subject to the changing demand of furniture buyers.

Wood-based panel industry: The wood-based panel industry consists of the producers of particle board and fibreboard in large industrial units (see Chapter 1, Section 1.3.5). They buy fresh roundwood of small dimensions from the forest and procure large quantities of wood chips from the sawmilling industry. The forward customer links reach mainly to the building and furniture industries. The *chipboard* or *particle board industry* uses roundwood, wood chips and other industrial wood residues. OSB contains longer chips for greater stability and can be used in the construction industry, prefabricated housing and packaging. *Fibreboard* is made from defibrated wood chips that have been treated under heat and steam. It is more homogeneous and has a higher density, making it more easily moulded and painted. Its customers are also mainly the furniture and construction industries.

Wood-processing manufacturers: Whereas the sawmilling and wood-based panel industries have client relations to the sellers of wood as a raw material, this group of industries and artisans provides products and services addressing the customers of the final consumer market (see Chapter 1, Section 1.3.6).

Building industry: Wood products are used in many ways in the building industry, particularly for structural elements, interior finishing, accessory building materials for lining and panelling, and fencing and scaffolding. Cyclical variations in the demand for wood products in the construction industry sometimes cause massive price fluctuations. The structural lamination technique has substantially increased the possibilities for using wood in construction. The fitting of large-scale construction components with statically and technically standardised properties allows wood to be used as a load-bearing component in modern industrial construction and public buildings, such as school and university buildings, sports complexes and community buildings.

Furniture production: The customers of the furniture industry fall into two types. On the one hand is a high demand for mass-produced, affordable furniture that appeals to a large segment of buyers, in particular the younger generation. Most of this furniture is produced in large quantities from either particle board or MDF, using low-cost inputs from coniferous wood. On the other hand are the customers who demand high-quality furniture made from solid wood and are prepared to pay a higher price. Certain tree species and combinations of panels and solid components are used in production of this furniture. Particularly high standards are required for wood used to make furniture veneers, and a high level of value creation is possible here, with correspondingly high prices. Even though this market segment is limited, the effect on the roundwood market is important, and the demand for high-quality hardwood depends heavily on trends in home furnishings.

Pulp and paper industry: The pulp and paper-making industry is an important purchaser of industrial hardwood and softwood. It has undergone a process of concentration during the past few decades. The demand for raw materials is concentrated in few companies. The paper industry usually purchases fresh coniferous roundwood in small sizes and is therefore in direct procurement competition with companies in the wood-based panel industry. In paper manufacturing, chipboard wood competes with waste wood from the sawmill industry and, increasingly, with recycled paper.

Industrial power: The generation of energy from wood has remarkable growth potential. This industry employs efficient and environmentally benign technologies to produce power from renewable resources. Several countries have instituted special programmes to promote the use of renewable energy resources, including support for the use of wood to generate power (Pelkonen *et al*. 2001). These programmes have led to rapid expansion in fuel systems using wood chips as an energy source for local heating-supply networks, such as combined heat-and-power systems for schools, municipal buildings and sports complexes. The wood-processing industry partly meets its own energy needs with wood. For example, if cost factors show that it is beneficial, sawmills power their wood-drying kilns using their own sawmill waste, thereby becoming more independent of other energy suppliers while incorporating a co-product into their own production process.

Domestic heating: Private households in rural areas continue to use wood. The usual varieties are firewood and wood chips, and the retail trade serves as a sales intermediary. The installation of wood pellet stoves to generate heat is meeting with increasing acceptance for new and replacement heating systems in detached houses and apartments and even public buildings.

3.2 Marketing

3.2.1 Customer needs and marketable products

Marketing is generally described as the process ‘by which individuals and groups obtain what they need and want through creating and exchanging products and value with others' (Kotler *et al*. 2007: 14). Specific needs and desires are expressed in customers' demand for goods and services and their willingness to pay a corresponding price for them. Anything that a company offers to satisfy needs or desires is referred to as a product. Products may be material goods, such as roundwood, sawnwood and pulp and paper, or services, such as transport and consultancy. The exchange of marketable products takes place in markets with purchasers who can satisfy their needs through processes of exchange. In speaking of markets and marketing more broadly, one refers to current and potential exchanges between suppliers who offer marketable products and customers who acquire desired products for an agreed price. It is thus not so much the location or the act of exchanging goods that is meant.

Opening and expanding markets in a targeted way and orienting a company's goals and objectives towards competitive supply of goods and services to customers is a major entrepreneurial activity in business management. Marketing covers the design, implementation and control of multiple exchange relationships between companies and clients with the aim of satisfying market demand in an effective and efficient manner. Distribution and sales are operating units of a company's organisation responsible for output provision and sales turnover.

Different attitudes towards customers and markets can be categorised into four basic marketing concepts (Kotler *et al*. 2007: 5). In the *production approach*, the assumption is that customers prefer products that are generally available at low cost. Marketing focuses on achieving low prices through efficient production and widespread distribution. This approach is appropriate if the demand for a product is high, production can quickly open up market opportunities, and price is the predominant purchasing criterion for customers – as it is for many standard products. Companies that offer their products at lower prices and achieve higher profit margins through production cost control gain an important competitive advantage over other producers.

The *product approach* is based on the notion that customers prefer products that meet their needs to the highest possible extent. They are willing to pay higher prices for high-quality products with a large number of attractive characteristics. In this case, marketing is oriented towards producing good and attractive products and constantly improving them. Product orientation is an appropriate marketing concept if the products are designed for specific customer needs and if the demand for them is sufficiently large. However, focusing on one's own products and their characteristics can lead a company to lose sight of customers' actual needs and preferences. A classic example is the Hollywood film industry bosses' decision not to enter the TV business because they thought their own product superior (Seiler 2008b: 25–6). Focusing too much on one's own specialised products thus risks blindness to what customers truly want.

A central aspect of the *selling approach* is the assumption that customers will not spontaneously purchase products offered in the planned quantities without special marketing measures taken by the producer. Sales need to be promoted through sophisticated and sometimes aggressive techniques to inform customers about the product being supplied and persuade them to buy it. This type of sales approach is used, for instance, by companies when they have excess capacity and want to sell the manufactured products as quickly as possible. The degree of customer satisfaction following the purchase plays a fairly minor role – and this is the real problem with the selling approach. Dissatisfied customers will tend to avoid the product in the future and tell potential buyers about its quality standards. Marketing that is based purely on the selling approach is risky and in the longer term rather unsuccessful.

A *comprehensive marketing approach* places customers' needs at the centre of business activities and is based on four main pillars:

– *Market focus*: No business is capable of operating simultaneously in all markets. It is more useful to concentrate on specific, promising and clearly defined market segments. The definition of market requirements and market segments is to be carefully considered and supported by empirical evidence.
– *Customer orientation*: Customers purchase products because they want to satisfy specific needs, and the way to produce good products is to become familiar with those needs. Companies and businesses can familiarise themselves with market opportunities through market research and intensive communication with customers.
– *Integrated marketing*: Successful marketing coordinates sales, advertising and market research. Activities in other areas of the company, such as production, logistics and staff management, have to be oriented towards satisfying customers' needs.
– *Success through satisfied customers*: Companies need satisfied customers in the long term, and customer satisfaction is essential for entrepreneurial success. One of the central tasks for marketing management is to identify promising target markets and monitor on a continuing basis whether customers are being satisfied.

Orientation towards specific customer needs has become important in the public sector (Raffée *et al.* 1994: 43–5; Schedler 1996: 13). In a democratic system, political decisions and public services and their implications for citizens are determined by constitutionally appointed representatives. They decide on the type and extent of services to be provided to the public and on associated staffing and financial resources. Modern approaches to public administration are putting more emphasis on clearly expressed or presumed citizens' demands in organising regulatory and performance processes. Because exchange processes differ in many respects from those in the private sector, a specialised subdiscipline has developed, known as public sector and nonprofit organisation marketing (Kotler and Andreasen 2008; Purtschert 2001).

Customers' benefits from products can be differentiated by level (Kotler *et al.* 2007: 493–4), with each higher level conferring an increase in value (see Figure 3.7). The *core benefit* of a product is what marketing considerations usually focus on; it stands for the purchaser's primary needs. The core benefit demanded by customers is converted into a *basic product*, which meets their elementary

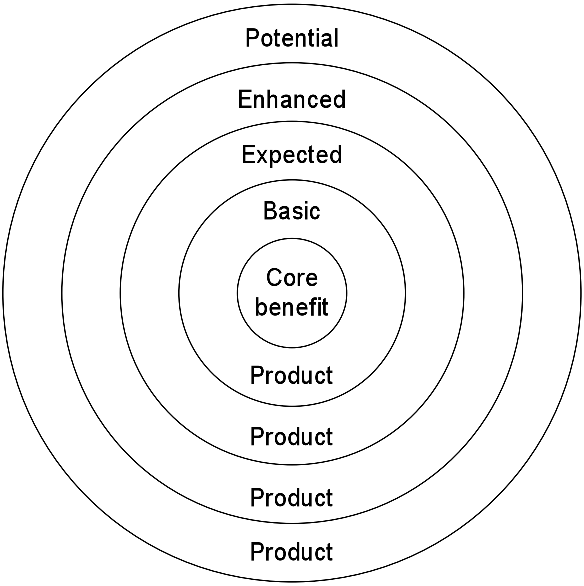

Figure 3.7 Levels of conception of a product

Source: Kotler and Keller 2007: 326, 573. © 2012 Reprinted by permission of Pearson Education, Inc., New York: Upper Saddle River.

requirements and expectations. In the case of investment goods, for example, these consist of technological qualities and output performance. In the case of consumer goods, they are the practicality and suitability of a product to meet the immediate demands.

The level of the *expected product* is what customers assume they can take for granted – the requirements that a product must meet for it to be of interest to the customer at all. At the level of an *augmented or enhanced product* – a product with enriched customer benefit – additional functional and aesthetic attributes make the market offer particularly attractive. These are characteristics that customers normally do not expect but attract their attention and represent additional value. At the highest level, there is the *potential product.* This is characterised by attributes and properties that the customer believes will become useful and important in the future. This level is above all concerned with product developments that are technologically possible and desired by the clients.

In many sectors, strong competition takes place at the level of augmented or enhanced products, for both investment and consumer goods. How the product is augmented can be decided in analysing problem-solving behaviour of potential customers and investigating aesthetic, cultural and personal preferences of particular client groups. For example, agreements can be made with a purchaser regarding regular delivery of specific quantities at specific times. Demand for consumer goods can be stipulated through attractive design, multiple uses or easily understandable user guides. With augmented products, services play an important role in increasing the benefit to customers. However, an increase in value associated with additional services may lead to higher costs for suppliers. Over time, additional benefits associated with a product will come to be taken for granted by the purchasers. The 'surprise element' for the customer diminishes or is lost and will then need to be regained through new product characteristics. How much customers are willing to pay for additional benefits and the extent to which additional costs can be absorbed need to be carefully examined.

The views of actual and potential customers on the levels of the benefits they may derive from products and services are complex and varied. A sawmill, for example, may require a certain kind of roundwood because there is a market for sawnwood for particular products – say, furniture. This is the real benefit for the sawmiller in processing the procured roundwood. In turn, the benefit for the customer may lie in the suitability of sawnwood for the production of furniture for clients who value a traditional natural product. Firewood is another example. Demand originates in its potential to generate energy. Compared with fossil fuels, however, it offers an additional benefit for the customer – the satisfaction associated with making a personal contribution to reducing environmental pollution by using a largely carbon-neutral heating resource. The high energy yield from modern combined heat-and-power plants is not only more efficient but also contributes to reducing climate change risks and achieving independence from fossil energy sources.

As in other industrial and commercial fields, providing additional customer benefit creates a competitive advantage in the wood-based industry. One successful marketing strategy is offering comprehensive solutions for complex wood utilisation problems. This applies to the sawmill industry, for example, which is producing increasingly specialised product ranges for both industrial customers and private users in the do-it-yourself market. It also applies to the wood-based panel industry, which is providing new and cheaper technical solutions based on high-quality panels and composite materials for the construction and interior decoration industries. It is a strong trend in the pulp and paper industry, which is developing new grades of paperboard and new industrial packaging solutions and finding ways to use recycled newsprint and printing paper. In enterprises such as joinery businesses and parquet-layers, the combination of high-quality materials with specialised technological expertise and competent consultancy services provides a basis for competitive sales.

In forestry, marketing can provide additional benefits for customers of both wood products and multifunctional forest management services. One example is organising recreational uses for forests (Mantau 1994: 314–5). The core benefit for hikers is basically satisfied by forest trails. For today's outdoors enthusiasts, however, forest recreation at the level of the expected product often includes not just a trail but also a near-natural forest, with older and more varied trees, open spaces and protected natural areas. They expect well-designed lookout points, parking spaces at the trailhead, well-maintained walking paths or special guided tours of the forest. In general, forest recreation as a product provides the basis for attractive greenbelt recreation areas and tourist services. In cities and peri-urban areas, it allows woods and green areas to be used by the population. In other areas, it makes a substantial contribution to promoting tourism and supports the economic development of a region.

3.2.2 Marketing policies

Marketing policies comprise groups of measures and tools that are combined in a reasoned way to implement specific business marketing strategies. Marketing policies and strategies will be ineffective or bound to fail if the multiple factors determining the opportunities and risks of a company are not carefully analysed and taken into consideration. The literature usually classifies market policies into four groups according to the 'four Ps model' popularised in the United States by McCarthy in the 1960s. This classification is based on the understanding that suitable products need to be promoted and then delivered at a competitive price at the right place and time. Product policy, price policy, distribution policy and promotion policy are consequently the foundation of effective and efficient marketing strategies. Figure 3.8 shows the components of the four Ps concepts.

Product policy: Based on direct experience from customer contacts and observations of purchasing behaviour, product policy deals with designing and producing useful, attractive and competitive goods and services. It is an important part of production and marketing processes. Product design is concerned with elaborating product characteristics capable of meeting demand from current and

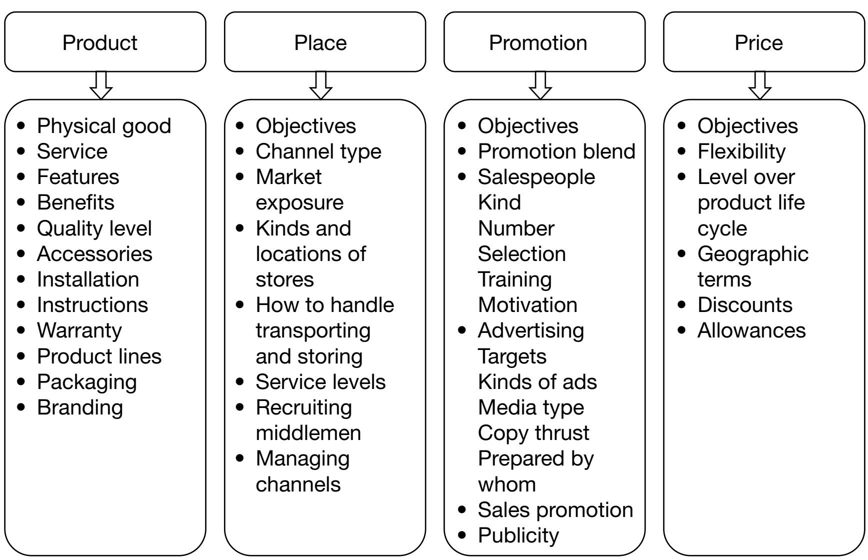

Figure 3.8 Strategy decision areas organised by the four Ps

Source: Perreault *et al*. 2011. © 2011, exhibit 2–5, page xvii; with permission from McGraw-Hill Education.

potential customers. Depending on what other products are available and what the company is currently supplying, the product range can be changed (Peters *et al.* 2005: 147–8). The requirements of target customers can be summarised in a structured way and used as a model for designing new products that are more suitable and attractive to customers. Important characteristics are then documented in a standard format to be used for product development in accordance with the newly defined market requirements.

Product differentiation is a response to mature markets in which purchasers tend to have ever more specialised requirements. Suppliers accordingly produce and market variants of existing products that address clients in different market segments. Product variants may involve physical characteristics, such as colour, shape, attractiveness and environmentally friendly content or manufacture, and functional aspects, such as quality and durability. Companies may use psychological factors to differentiate their products by establishing brand names or registering models and thereby anchoring product-specific real and perceived characteristics in customers' minds. An example of a well-differentiated selling programme is the automobile market, with its multiplicity of models and vehicle types. Product differentiation here relates not only to technical characteristics, such as car size and performance, but also to variations in appearance, colours, equipment and quality standards. Car companies often produce several brands to achieve the greatest possible market penetration.

Value-increasing subordinate services or products achieve differentiation through specific additional benefits (Borowski 1996: 106). This typically involves sub-processes that contribute to an improvement of the entire production and logistics chain. For example, the producer may take over work processes or provide additional services that are awkward and costly for the purchaser. Alternatively, greater efficiency in the value chain can be achieved by having the customer or user take over processes that are traditionally carried out by the supplier. This type of mutual outsourcing activity is advantageous if it leads to greater flexibility in production and marketing, a better yield from raw materials, cost savings to the producer and price reductions to the customer.

In roundwood production, for instance, the classification of logs according to dimensions, quality and end uses is an important tool for differentiation in wood procurement. Log grading is generally done by species, utilisation category, diameter, length and wood quality. There may be additional grading criteria for specialised assortments – for instance, for veneer logs, acoustic resonance wood (used in musical instruments), sawnwood and pulpwood, or railway sleepers (ties). The sales mass by volume or weight is another aspect of product differentiation. To allow free trade in national markets and within the EU, roundwood assortments and log grades are determined and standardised either by official regulations or by industry association guidelines.

Because suppliers today must respond flexibly to individual customer requirements, the present trend is for trading roundwood according to specifications agreed upon directly between buyer and seller. For hardwoods, for example, grading to customer requirements is common. For softwoods, standardised market supplies allow rationalisation in procurement and processing of roundwood, as well as cost savings, but the increasing need for customer-specific log conversion and individual delivery conditions offers an opportunity for better sales and higher profits. Another reason for product differentiation is the organisation of work processes in the value chain between wood production and wood processing. Thanks to combined operations in logging, grading and wood transport (full-tree logging), based on integrated information technology, the industry can now assume operational and managerial activities that previously had been the domain of forest owners and forest managers. This leads to roundwood marketing of standing trees with agreed harvesting contracts. Tree felling, wood sorting and transport to the factory are undertaken by the buyer and their contractors. Measuring wood deliveries is carried out more efficiently by the customer, using automatic measuring equipment at the factory.

Product innovation can be generally defined as new ideas that are converted into market success. These are important for the development of companies: they provide an opportunity to open up new markets and make a decisive contribution to company growth. Product innovations can be classified according to several criteria (Kotler *et al.* 2007: 1128):

- less expensive products, which provide comparable or even better utilisation performance at lower cost;
- repositioned products – that is, existing products that are used for new purposes or supplied to new market segments;
- improved or further developed products, which are more useful for the customer or have been modified for new purposes;
- supplements to product lines, which extend an existing product range;
- new product lines, which give a company access to an existing or new market; and
- world firsts – new products for markets that do not yet exist.

Innovation must be an integrative and lasting part of production and marketing; its aims are developing improved and new products that satisfy consumers' needs and wants, maintaining the range of existing customers and attracting new clients. It entails continual analysis of real, perceived and potential customer needs. Innovations are necessary particularly for marketing specialised environmental and infrastructural services. For example, forest owners outside cities can establish commercial relationships with users of recreational products and habitat protection services, thereby acquiring new customers. This involves a precise definition of the environmental benefits, translated into distinct, marketable products, and it requires research on how much citizens and their political representatives are willing to pay or allocate for multifunctional forest management.

A company may eliminate products if they are obsolete or no longer profitable and need to be replaced with newer versions. Sometimes a shortage of production capacity may compel a switch to manufacturing more profitable products. Whether to keep or eliminate products from the market depends on strategic aspects of the production programme as a whole, the rate of utilisation of existing operational resources, the possible effects on customer relations and the likely consequences for the company's image. Operational considerations based on a break-even analysis or contribution margin calculation provide an important but not exclusive basis for decision making. Calculating the contribution margin for individual products and sub-processes of the value-creation chain helps determine whether they are economical for the company or should be dropped.

Pricing policy involves agreements between suppliers and customers on prices, discounts and surcharges, and delivery, payment and credit conditions. These agreements have effects on saleable quantities, the market value of products and above all, the company's profits. Pricing is a decisive factor in meeting marketing targets and achieving a company's goals. The purpose of pricing policy is to compare alternative price demands in relation to potential customers and exploit the scope of the price options available (Meffert *et al*. 2008: 478–9). External and internal factors determine the available choices (Figure 3.9). In many cases, the pricing policy is largely predetermined by the market situation and the strategic marketing goals. In the case of widely available standard products, companies have little opportunity to influence selling prices through negotiations. The situation is different for high-quality and innovative products, specialised services and additional service provisions. Some companies are in fact able to implement an active pricing policy because of the strength of their market position. Four approaches may be chosen in determining a pricing policy: cost-oriented pricing, use-oriented pricing, demand-oriented pricing and competition-oriented pricing (Meffert *et al*. 2008: 524–5).

Companies that pursue a *cost-oriented pricing policy* seek to meet manufacturing costs plus a profit margin. This type of pricing is based on confirmed cost data; market research is not necessary. A cost-oriented price is not flexible, since it is based on the company's own costs rather than on market potential (Seiler 2008b: 279–80). It is used for complex one-off outputs based on the purchaser's individual requirements. Because no comparable prices are available for guidance, the supplier tries to reach a price that is attractive to the company, based on production costs and expected profit. This is the usual method of calculating offer prices for infrastructure facilities, power stations or defence systems ordered by public entities.

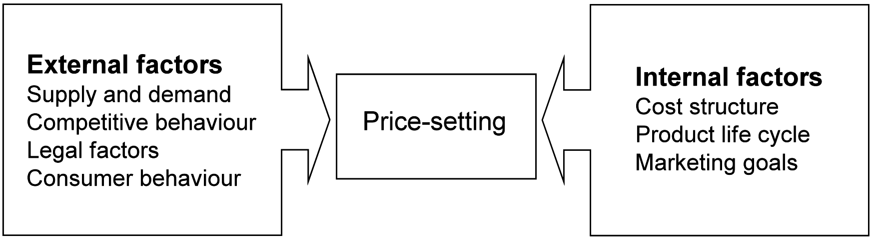

Figure 3.9 Factors influencing pricing policy decisions

Source: Seiler 2008b. © 2008 Orell Füssli Verlag AG, Zurich.

A *use-oriented pricing policy* tries to model customers' real purchasing decisions to establish the basis for the price demanded. If there are no reference prices, a use-oriented price makes it possible to approximate the customers' potential price expectations. On the basis of these considerations, the supplier tries to exploit the scope available for the pricing policy, but this is often difficult to do. Purchasing decisions are often associated with complex considerations on the part of the customer that need to be identified using elaborate empirical analyses. This policy has its limits, particularly with specialised products and purchasers who are unwilling to reveal their preferences.

A *demand-oriented pricing policy* (Meffert *et al*. 2008: 531–2) is used by companies that are already in an important or dominant position facing a large number of purchasers (an oligopoly or monopoly). They can influence the amount of demand in the entire market through their price decisions. Provided they establish the demand curve for a product, they can set prices that maximise their profits. Several medium-sized suppliers facing a large number of purchasers (a supply oligopoly) are likely to use a *competition-oriented pricing policy* (Meffert *et al*. 2008: 528–9). Quantity responses by the market to price changes affect competitors' sales quantities. Suppliers try to force competitors out of the market using aggressive pricing. However, cartel-like behaviour may occur, in which competitors are jointly guided by a largely standardised pricing policy.

Another pricing option is *price differentiation*. This is intended to open up additional market segments through negotiation of individual prices with purchasers (Meffert *et al*. 2008: 511–12). Prices are differentiated in accordance with temporal or geographic criteria or quantities purchased. This approach can be combined with other marketing tools – for instance, the development of product variants. Many suppliers follow a differentiated pricing policy. Prices may be varied by time (e.g. pre-season, peak season or post-season), customer class (e.g. students, pensioners) or location (e.g. city centre or outskirts).

Discount offers reduce prices for specific sales considerations. A distinction is made between functional, quantity, time and loyalty discounts (Meffert *et al*. 2008: 544–5). How supply and payment conditions are structured and agreed upon is important. The *terms of delivery* set out the supplier's obligations with regard to time and location in a purchasing contract. They relate to delivery deadlines, acceptance of transportation risks and contractual regulation of default penalties in case the supplier fails to meet the contractually agreed terms. *Terms of payment* set out both the form (cash, bank transfer, etc.) and the timing of payment. With extensive supplies covering longer periods, partial payments may be agreed at times set in advance. The delay between supply and payment implies that the contractual partner is offering limited-period credit.

Distribution policy ensures that customers receive the desired products with the associated services at the right time, in the right quantity and quality, and in the correct place (Seiler 2008b: 303). Central aspects of distribution are the sales channels and the structural logistics (Meffert *et al*. 2008: 560–1). Companies can sell their products to customers either directly or through sales intermediaries – that is, traders and trade organisations. In a competitive market, access to the target markets is always a critical factor, and the choice of sales channels often distinguishes companies. For example, some manufacturers of construction equipment or commercial vehicles for professional purposes distribute their products through their own network of sales points, while other competitors use the wholesale trade. Likewise, some products are sold through specialist wholesale channels, while others go through do-it-yourself chains. Some suppliers prefer to establish their own selling points with their own branding and packaging, whereas others work with large commercial partners. Higher price expectations usually combined with higher distribution and marketing costs have to be weighed against lower prices and lower sales costs.

A direct sales channel is useful if the number of customers is small or if regular contacts with customers are necessary. Direct contacts provide valuable information about clients' requirements and about ways of developing and selling new products. In forestry, at least in Central Europe, it is customary for standard assortments of roundwood to be marketed directly to various branches of the wood-processing industry. Sales associations on the forestry side and buyers' associations on the wood industry side exist in particular for large quantities of pulp wood and energy wood. Growing trends are short- and medium-term wood supply contracts concluded between large processing industries and individual forest owners. Another trend can be seen in the pulp and paper industry, where large companies cooperate with forest owners in an integrated logistical infrastructure that combines wood harvesting and delivery to the processing unit with the wood-selling operation.

In indirect distribution, one or more trading levels intervene between manufacture and final consumer. Examples of sales intermediaries include specialist shops, retail and wholesale traders, brokers and agents. The task of a sales intermediary is often to establish a balance between supplies that are produced in large quantities and products that are purchased by final consumers in small quantities. This enables manufacturers to limit their sales logistics to business relationships with a limited number of intermediaries.

The task of *communication policy* is to promote product sales, gain customers, establish a positive image of the wood-based sector in its social environment and provide technical assistance and training in systems application. It is not sufficient to offer good products, set an attractive price for them and choose appropriate sales channels; all of that has to be communicated to the customer persuasively.

Tools for organising and maintaining effective and efficient communication policies are classified in different ways in the literature on marketing. Kotler *et al.* (2007: 653) distinguish five types of communication used in marketing, each with its own tools.

– *Advertising* is a targeted form of communication that promotes the spread of ideas and sales of goods and services. Opportunities offered by mass communications technology play an important role.
– *Sales promotion* provides short-term incentives to purchase products; it requires a combination of product, pricing and distribution policy measures.

– *Direct marketing*, based on communication via mass media, addresses clients or consumer groups.
– *Personal marketing* involves targeted and personal communication with selected customers and aims at achieving an immediate purchasing decision.
– *Public relations work* seeks to influence the public image of a company or sector, or in a more specific way, the image of products, production processes or raw materials. The aim here is to use information and demonstrations to create or maintain public awareness, knowledge and readiness to buy.

3.2.3 Certification

Certification confirms characteristics that are expected by customers, such as defined environmental product standards, absence of damaging additives, biodegradability of residues and evidence that a product originates in a specific country or region. It satisfies the needs of an industry for reliable standards in procurement, production, marketing and management procedures. Certification standards enable producers to meet the needs of companies and suppliers, clients and customers, stakeholders and public agencies for verifiable quantitative and qualitative information. Effective and efficient certification processes help companies gain access to investment and consumer markets and then maintain a competitive position.

The International Organization for Standardization, known as the ISO, defines international certification standards and brings about agreement on their use. It organises certification and auditing processes confirming that the activities of companies and other entities conform to the standards. Regular updating of standards is undertaken and new standards are defined as needed. A private organisation with headquarters in Geneva, the ISO cooperates closely with the private and public sectors, national organisations, the European Community and other international entities whose rules and regulations often become the subject of international certification processes. A fundamental principle of ISO certification is its voluntary character: a company is not obligated to use ISO standards and criteria, but if it does, it must respect the ISO's procedures and regulations. ISO certification is a dynamic, evolving process that addresses multiple issues in business management.

The ISO does not itself certify organisations. Many countries have formed accreditation committees to authorise certification bodies, which audit private companies and public organisations and issue certificates to those that meet the requirements. Both accreditors and certifiers charge fees for their services. Accreditation services have mutual agreements to ensure that the certificates issued by an accredited certification agency are accepted worldwide. Certification entities operate under quality standard ISO/IEC 17021, and accreditation entities operate under ISO/IEC 17011.

Certification procedures can be defined and practised at three levels: for individual products, individual production processes or entire management systems:

- *Product quality certification*: For commercial and industrial companies, the importance of product certification is that it ensures access to markets and distribution channels.
- *Certification of production processes*: This level of certification confirms that ISO standards have been observed throughout the production process. The standards of ISO 28000 and 28001, for instance, specify security management systems for the supply chain.
- *Certification of management systems*: During the 1990s, certification standards became widely established for entire production chains. Car manufacturers, for example, required certification from their suppliers; as a result; manufacturers of automobile components had to be certified to reach or maintain a competitive market position. Management systems certification usually combines several standards into a family of standards.

For each family of standards, the '0' standard (ISO numbers ending in zero) defines the purpose and norms and the '1' standard describes the criteria and application. For the forestry and wood-based sector, quality management standards, environmental management system regulations and principles and guidelines for risk management are of particular interest.

Quality certification standards, defined in accordance with ISO 9000 and 9001, give detailed information about a company's quality management systems, which are reviewed by accredited, independent auditing organisations. An organisation applying for certification is audited based on an extensive sample of its sites, functions, products, services and processes. The auditor presents to management a list of problems, called nonconformities, together with observations and suggestions for improvements. For major nonconformities, the organisation responds with corrective action reports showing how the problems will be resolved. Once the certifier is satisfied with the improvement plan, the certificate is issued. An ISO 9001 certificate must be renewed at regular intervals as recommended by the certification entity, usually once every three years.

Environmental management systems may be certified in accordance with ISO 14000 and 14001, which guide organisations in developing their own approaches. ISO standard 26000, published in 2010, provides guidance on *corporate social responsibility*. For technological and environmental dangers, ISO standard 31000, revised in 2009, presents principles and guidelines for risk management.

Determining specific and verifiable standards in wood-based production starts with defining the quality standards of the raw materials: specific qualities of different tree species are defined and testing procedures are developed. As in other industries, certified quality and environmental management systems in wood-processing companies contribute to increasing productivity, fostering innovation and gaining a competitive position in established or new markets. And in sales promotion to intermediate clients and end consumers, certified qualities of products and services can contribute to marketing success.

In forestry, international and national certification systems include the Programme for the Endorsement of Forest Certification (PEFC, formerly known as

Pan-European Forest Certification) and the Forest Stewardship Council (FSC) certification standards. Whereas PEFC certification focuses mainly on European and since 2010 on American forests, FSC certification is used in Europe and in other world regions. Both systems focus on whether wood is produced according to sustainable management practices corresponding to defined environmental and social criteria. In North America, the American Tree Farm System was an important certification system until 2009. The Malaysian Timber Certification Council is an example of a national certification scheme used in a tropical country.

The PEFC standard's requirements for sustainable forest management (PEFC ST 1003:2010) address the following criteria:

(1) maintenance and appropriate enhancement of forest resources and their contribution to the global carbon cycle;
(2) maintenance of forest ecosystem health and vitality;
(3) maintenance and encouragement of productive functions of forests (wood and nonwood);
(4) maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems;
(5) maintenance and appropriate enhancement of protective functions in forest management (notably soil and water);
(6) maintenance of other socioeconomic functions and conditions.

The FSC principles for responsible forest management have a somewhat different profile (FSC-STD-01-001 V4-0):

- Principle 1. Compliance with laws and FSC principles: to comply with all laws, regulations, treaties, conventions and agreements, together with all FSC principles and criteria.
- Principle 2. Tenure and use rights and responsibilities: to define, document and legally establish long-term tenure and use rights.
- Principle 3. Indigenous peoples' rights: to identify and uphold indigenous peoples' rights of ownership and use of land and resources.
- Principle 4. Community relations and workers' rights: to maintain or enhance forest workers' and local communities' social and economic well-being.
- Principle 5. Benefits from the forest: to maintain or enhance long-term economic, social and environmental benefits from the forest.
- Principle 6. Environmental impact: to maintain or restore the ecosystem, its biodiversity, resources and landscapes.
- Principle 7. Management plan: to have a management plan that is implemented, monitored and documented.
- Principle 8. Monitoring and assessment: to demonstrate progress towards management objectives.
- Principle 9. Maintenance of high conservation value forest: to maintain or enhance the attributes defining such forests.

– Principle 10. Plantations: to plan and manage plantations in accordance with FSC principles and criteria.

From 2002 to 2011, certified forest area tripled, from 125 million ha to 375 million ha (UNECE/FAO 2007: 105–6; UNECE/FAO 2011b: 99–108). Almost 90 per cent of certified forests are in the northern hemisphere. In Western Europe, the proportion of certified forest represents more than 50 per cent of the total forest area. The figure is 35 per cent in North America. Less than 5 per cent has so far been certified in other regions. The PEFC portfolio, comprising various regional certification systems, amounted to 236 million ha in 2011. This is slightly less than two-thirds of the globally certified forest area. Dual certification – that is, recognition of the same forest area by two systems – and chain-of-custody certification are of growing importance.

Certification of roundwood and wood products from sustainably managed forests is changing opportunities for market access (Rametsteiner 2000). With an eye to the final consumer, some customer groups, sales intermediaries and wood industry companies require or state a preference for certified wood. In a growing number of European countries, use of certified wood is now widespread in major sectors of the industry, including consumer products offered by large retail chains. Public procurement rules increasingly stipulate certified wood products (Simula 2006), but it is difficult to anticipate to what extent the momentum of recent years will continue.

Since one of the goals of forest certification is to confirm that roundwood is harvested from sustainably managed forests, landowners and land managers often face communication challenges in translating sustainability criteria into concrete terms. Evidence of good forestry practices, as defined in the past, is insufficient for today's requirements. Originally intended to signify a high-value product, certification is now becoming an expectation in wood marketing: it represents less a competitive advantage than a means of avoiding the disadvantages associated with a lack of certification.

A new challenge results, for instance, from the EU timber regulations that took effect in 2013. They require that only legally produced wood is accepted on EU markets. Forest owners and the wood-processing industry have to maintain the chain of custody and provide evidence that certified wood is kept separate from uncertified wood throughout the value-added chain – from the forest to the final consumer. Establishing the chain of custody along the entire processing chain is not an easy task. Each actor, from the roundwood producer to the manufacturer of products for final consumption, must take responsibility for proving that the chain of custody is secure.

3.2.4 Marketing strategies and target markets

Material goods and personal services are complex sales objects, and promoting their properties and uses is the challenge for modern marketing strategies. Marketing consumer goods required for everyday needs is substantially different from marketing consultancy services provided by specialised engineering offices. The diversity of products and customer benefits leads to differentiated sales plans and specialisation in marketing processes and promotion campaigns (Meffert and Bruhn 2006: 50–1). The range of individual marketing concepts reflects the characteristics of the products and the target groups of customers (Hilke 1989: 8). Final consumer goods may need only limited service for explanations and instructions, whereas high-technology production units and equipment must be accompanied by services for installation, operation and maintenance.

A marketing strategy starts with an analysis of market opportunities and leads to the determination of goals, measures for implementation and indicators for performance review (Juslin *et al*. 2003; Perreault *et al*. 2008). Two assessments need to be made for selling individual products and reaching target markets. First, the position of a product relative to the company's goals and strategies and to potential competitors has to be clarified. Second, useful combinations of marketing tools have to be developed for the products and the target customers.

Marketing strategies are developed in the context of a structured and systematic problem-solving process that outlines the alternatives (Meffert *et al*. 2008: 229–30; Thommen and Achleitner 2006: 123–4). If largely similar products are being marketed to a homogeneous group of customers, a single marketing strategy is usually sufficient. However, many companies produce multiple goods – from wood products to multifunctional forest management with recreational and environmental services – and thus must address heterogeneous groups of customers. Because the various combinations of marketable products can hardly be met with a single strategy, marketing mix concepts, adapted to specific target markets, need to be developed and coordinated as part of the company's overall business strategy.

The process of developing a marketing strategy that results in a specific marketing mix of measures has two phases (Kühn and Pfäffli 2007: 25–53; see Table 3.3):

– Phase I involves an analysis of the marketing situation, which determines the possible options for entrepreneurial decisions. It identifies the current state of relevant markets, characterises the economic and social environment in which the company operates and assesses opportunities and risks for developing new products and identifying new markets.
– In Phase II, the available information is summed up and a suitable market strategy is established. The marketing mix corresponds to the selected customer profiles and target market segments. Guidelines for market development lead to the selection of appropriate marketing tools. The existing sales organisation is adjusted as necessary, and a plan for monitoring sales results is designed.

The sequence and weighting of individual steps in elaborating the marketing strategy depend on the company and thus vary with the business environment, the

Table 3.3 Development of marketing strategies

Phase I: Analysis of market situation	*Phase II: Market mixture approach*
1. Market definition of market structure 2. Product user analysis of market segments, partial markets 3. Analysis of environmental factors, external stakeholders 4. Analysis of distribution and sales 5. Analysis of actual and potential competitors 6. Analysis of company's internal conditions and guidelines 7. Expected development of market and assessment of opportunities and threats	1. Determination of strategy for each product group and market segment 2. Competitive strategy: how marketing mixture will be used 3. Positioning of products 4. Market development strategy 5. Measures to be used in marketing mixture 6. Changes and adaptations for effective marketing infrastructure, determination of marketing budget

Source: adapted from Kühn and Pfäffli 2007: 25

entrepreneurial context and economic, social and technological developments. Ecological conditions of resources use, cultural perceptions and values of the potential clients, the political framework and legal regulations on the use and trade of the marketed products need to be considered. Foreseeable trends in production and market demand and their implications for the selected market areas and target groups have to be taken into account. Factors that cannot be directly changed by a company need to be distinguished from the effects that can be influenced by an effective marketing strategy.

An analysis of competitors, projections of consumer demand and profiles of typical buyers provide empirical data for assessing the company's relative strengths and weaknesses. *Competitors* here mean both other companies and substitutable products made from other raw materials and manufactured with other technologies. Detailed information should be collected; assessing competitors on the basis of cursory information is insufficient. The analysis begins with analysing one's own company's current marketing mix, marketing strategy and the available resources – both financial and human – for implementing the envisaged marketing strategy: there is no point in developing marketing campaigns that prove impracticable because of a lack of funds and qualified personnel.

The information collected for a marketing strategy give insight into the situation and future trends. Probable developments in the coming years – foreseeable market volume, possible changes in the demand structure, the dynamics of competitors and their products and changes among customer groups and their attitudes – should be expressed in qualitative and quantitative parameters. Relevant threats and opportunities can then be identified and used by the marketing team.

Predicting market trends in forestry and the wood-based industry is never simple, however. Collecting reliable information and interpreting it accurately are complex and difficult tasks. Demand for roundwood depends on a range of investment and final product consumer markets. Boundary lines between different assortments vary over time and location, following price developments and changes in supply and demand. The market situation can be affected by unpredictable natural disasters and consequent salvage harvesting. Moreover, sustainable forest management allows only limited scope for action in timber harvesting.

It is therefore important to focus the analyses on factors that entrepreneurial planning can control and predictions that can be made with some degree of certainty. In forestry, that means clearly defining the market supply in relation to the anticipated demand that determines business planning. The focus is on product-related criteria, such as the market for softwood timber in Europe, or geographic criteria, such as the market for greenbelt recreation in the vicinity of a city.

The assessment of important elements of the market structure and its potential for development leads to the identification of target markets (see Figure 3.10) – enterprises, organisations and individuals. Flows of outputs and financing needs are examined, as well as competitors' marketing mixes. Depending on the type of market, individual elements should be identified in a more differentiated way. If the purchasers are not the users of the products, it is necessary to determine who influences market decisions and distinguish internal and external factors.

Internal influences on purchase decisions, for instance, are important for marketing raw materials for further processing and investment goods. The roundwood requirements of the sawmilling industry are thus determined by the product standards of the purchasers of sawnwood, which in turn depend on the demand of their clients in the construction or furniture industry. *External influences* on purchasing decisions come from individuals and organisations that do not belong to the actual target market but from those who affect customers' purchasing decisions – perhaps other users, the media or advisers. For example, nature conservation and environmental protection organisations are increasingly persuading buyers to favour wood products as a renewable natural material from sustainably managed forests.

A next step is to subdivide the defined target markets into customer-specific market segments of consumers who have different needs, requirements, perceptions, attitudes and values when considering an investment or a final consumer good. Market segments develop as the variety of goods and services expands in a rising market and during the growth phase of products in market life cycles. Typical criteria for market segments are geographic and demographic characteristics, customers' experiences and level of information and different approaches and behaviour when purchasing a product.

Personal and group-specific purchasing behaviour of customers is especially important in consumer goods markets, whereas sales of investment goods tend to follow other criteria. For investment goods, factors such as the durability and technical specifications of a product, reputation of the company, warranty and service standards or customers' skills in using the product may be decisive. Perceptions, attitudes and purchasing behaviour of buyers can be ascertained from targeted questionnaires, interviews or pilot studies, usually carried out according to criteria such as company size, business branch, geographic location or purchasers' age and income level.

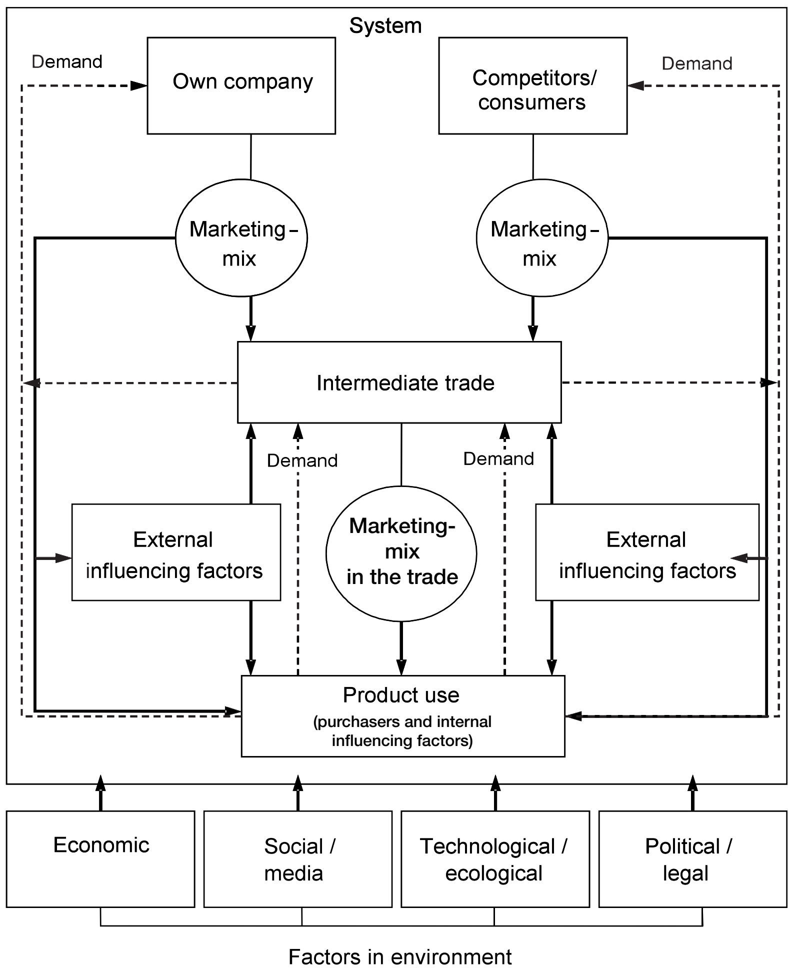

Figure 3.10 Important elements of a marketing system

Source: Kühn and Pfäffli 2007: 28

Technical product characteristics are used to establish market subdivisions in accordance with the product classifications used for competitive specialisation. The analysis may show various combinations, which can be presented as a matrix (see Table 3.4). Partial markets are classified, for instance, according to major roundwood assortment groups like timber for sawmilling and construction, industrial wood for pulp and paper production, and wood and wood residues for energy use. Partial markets may be distinguished by region and country or by the size class of customers using various roundwood assortments in integrated wood-processing chains.

Table 3.4 Market segments in roundwood sales (examples)

Market segments / *Partial markets*	*Industrial sawmill* Standard assortment, large quantities	*Small sawmill* Client-specific assortments, small quantities and local clients	*Wood-based panel industry* Large quantities, qualitatively varied demands	*Veneer makers* Small quantities, high-quality assortments	*Final consumers* Local, regular demand, various species
Roundwood assortments					
Regional, national and international markets					
Individual clients with integrated wood-processing chains					

3.2.5 Marketing instruments

The choice of marketing tools depends on the type of product being marketed and the target customer group. The effectiveness of the tools has to be analysed in relation to the state of competition within a given business branch or economic sector. The tools must be adapted to the entrepreneurial situation and coordinated with each other to promote a chosen marketing mix of goods and services effectively. For example, price-setting tools will be the focus under an aggressive pricing policy, and product policy tools will be used for market development mainly with new products and services.

Product-marketing tools deal primarily with product development and design, such as quality, utility, packaging and prestige; the choice of coherent and attractive assortments of marketable goods and services, such as the breadth, variation and diversification of the product line; presales and postsales service activities, both technical and commercial; and warranty measures that guarantee the promised quality, quantity, functionality and delivery time as agreed between buyer and seller.

Marketing tools focusing on contractual sales conditions are concerned with price setting and calculation; price differentiation and price changes; rebates, discounts and deductions offered for larger quantities or to regular and long-time customers. Other relevant tools are, for instance, delivery and payment conditions as determined by general terms or contractual arrangements and financial terms related to leasing, commissions and credit conditions.

Distribution-oriented marketing tools deal with direct distribution channels between producers and their clients through commercial representatives and agents; indirect distribution channels between producers, wholesalers, retail business and buyers; exclusive, selective and general distribution practices; franchising systems and electronic commerce; and marketing logistics and supply chain management.

Communication marketing tools are publicity and sales promotion; personal selling and event management; public relations and sponsoring; and product placement and Internet presence. Publicity through advertising tools serves to sell mass products by stimulating demand, providing information, positioning and creating a positive image of the products and the company producing them. Designing and implementing successful ad campaigns demands clarity about the goals to be reached, data on customer groups and their level of knowledge, information on competitors and anticipated market volumes and an understanding of a product's quality, uses and intended market position. Direct marketing tools, such as mass mailings, telephone campaigns and electronic distribution of information, are alternative or complementary ways of reaching customers. Product placement and sponsorship of sporting events, cultural and scientific programmes, social organisations and environmental activities are more general tools for carrying marketing messages, as are public relations measures.

Marketing instruments need to be adjusted to markets and market segments that are of greater or lesser importance for entrepreneurial success – that is, which markets and customer requirements are expected to increase, can be actively developed by the company and will generate the highest returns. Decision-making factors here include anticipated costs of market entry, market potential, actual and potential competitors, price or cost level and the company's ability to maintain market share. Whether to pursue a broad market segment or only selected specialised markets (Kotler *et al.* 2007: 196, 387) depends on the predicted market opportunities and the company's capacity to employ different strategies and marketing mixes in selling goods and services.

Various strategies for dealing with competition are suggested in the literature.

- *Market development strategies* establish a new market and grow the market volume. These strategies are particularly important in the early phases of the market life cycle and they are usually temporary and transitional.
- *Market section development* is suggested when substitute products have become established in an existing market. Modified or new products have to be positioned relative to existing products. This approach usually leads to a change in use and consumption habits and sometimes to changes in customers' behaviour.
- *Competitive strategies* aim at distinguishing one's own product from those of competitors. The product is promoted to gain additional market share at the competitors' expense. This approach is usually chosen in a mature or saturation market phase.

Profiling in relation to other competitors can be achieved by offering better product quality, providing more flexible or more valuable after-sales services and waging public or targeted information campaigns that improve the image of the product or company. A clear supply advantage or persuasive argument is needed. Examples of profiling strategies include labels showing the regional origin of agricultural products and energy savings labels for household appliances. Another option is deliberate imitation of competitors (the 'me too' strategy), particularly if strong market leaders are already established. Aggressive pricing strategies can be resorted to, at least as a seasonal or temporary measure, provided the company can afford price cuts for a limited time.

Supply positioning involves placing one's own products in an advantageous light in comparison with competitors' products. Positioning can be achieved through specific product performance – for example, high quality or low price – and through communications, such as advertising that enhances the image of the product or company. Positioning through a difference in performance – the unique selling proposition (USP) – means demonstrating objectively testable characteristics that better meet customers' needs and distinguish the product from its competitors (Kotler *et al*. 2007: 555, 634). Communication differences play on the psychological aspects associated with a product or company and give the product a perceived advantage in the eyes of purchasers.

For both market development and competitive strategies to succeed, market products and the company's specific advantages need to be clearly defined and communicated to the public. Performance and communication profiles complement a successful marketing mix. Efforts to identify and influence customers' attitudes and behaviours are known as psychological precision positioning. It is important to know which customer requirements the product specifically addresses, whether any inhibiting factors among customers need to be overcome, what the image of a successful product should be and what information about the product customers should receive (Kühn and Pfäffli 2007: 65–6). Variants in performance profiling (PP) and communication profiling (CP) are presented in Figure 3.11. A positive performance profile makes it easier to establish a favourable image, which in some cases may persist even after the competition catches up and competing products become similar.

When planning marketing measures in commerce and distribution, the possible instruments first have to be classified in terms of their importance. Some measures are essential and effective; others are complementary or marginal. The dominant-standard model is one way of structuring marketing instruments according to their effectiveness, general importance for sales and the degree of freedom that exists in applying them within a particular marketing strategy (Kühn and Pfäffli 2007: 45–6, 76–7; see Figure 3.12).

Standard instruments are determined by the prevailing market situation and by economic and technological restrictions. They set conditions, which if not met are likely to lead to failure. There is only a limited degree of freedom for varying the design and application of such tools. In forestry, for example, grading of round-wood according to species, dimensions and wood quality, as determined by

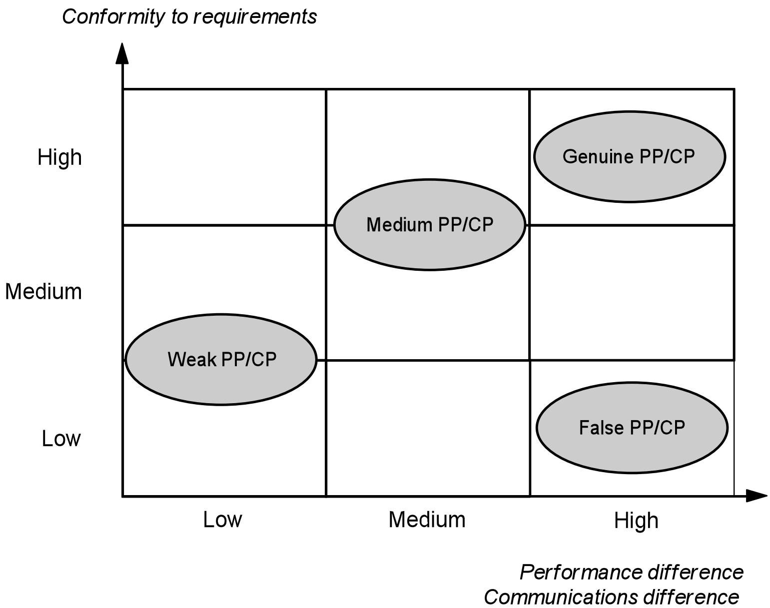

Figure 3.11 Variants in performance (PP) and communication profiling (CP)

Source: adapted from Kühn and Pfäffli 2007: 68

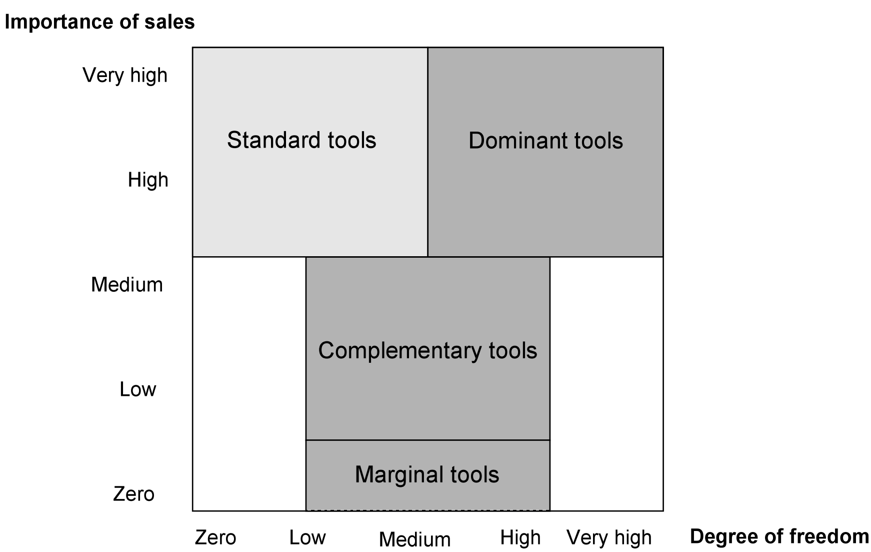

Figure 3.12 Analysis field in the dominant-standard model

Source: adapted from Kühn and Pfäffli 2007: 47

established regulations or customary practices, is a standard tool that informs customers about the type of product. Agreed assortment grades for roundwood have a substantial influence on products and sales policies. *Dominant instruments* are of value in achieving specific market goals. They allow scope for designing individual sales arrangements or for undertaking marketing campaigns for targeted consumer groups. Using such instruments requires creativity, expertise and often considerable negotiation and financial funds. They can be used, for instance, when drawing up contracts, organising product distribution and logistics and providing individual service packages. They offer valid opportunities for distinguishing oneself from other competitors.

3.2.6 Implementing marketing strategies

Innovations are the driving force behind successful entrepreneurial action in national and international markets. The emergence of new life styles, types of behaviour and social needs, as well as modern information and communication technologies, are forcing companies to respond with new products, services, processes and organisational forms to maintain their competitiveness. Research and development result from scientific discoveries, technological innovations and learning processes. Finding efficient ways to meet actual and potential customers' needs while generating profit means directing the firm's innovation strategy towards creating added value for customers. Monitoring the market and recognising customer needs is important, as is anticipating – even creating – changes in customers' preferences. Process organisation, customer focus, information management, dynamic learning processes and a living company culture are decisive elements in maintaining and expanding market shares.

The market boundaries – achievable market size, special customers' preferences and prices that can be obtained for the target products – must be clearly defined. Research into specific needs for innovation and expectations, using market observation and market analysis, is the basis for a clear statement on how the product will benefit the customers and what will compel them to purchase and use it. The implied goals may change during the course of an innovation process because of new discoveries and insights, and the resulting feedback loop allows continual adjustments. Relevant questions concern customers, markets, employees and competitors, as well as the company's competitive know-how and resources (Hinterhuber and Krauthammer 2000: 40).

Questions of this type might include the following examples.

Customers, products and markets:

- What would make customers so satisfied that they become emissaries for the company?
- What needs to be done to win back customers who have been lost?
- What new products and/or services can be offered?
- Which products and services will revolutionise the sector in the coming years?
- What regulations are applicable in the markets that are to be developed?

- Which potential partners and stakeholder groups have a positive attitude towards the company's products and services, and can they help to reach the target market?
- Do the company and its products have a positive image in the public sphere and among actual and potential customers? If not, how can the negative image be changed?

Competition and marketing strategy:

- Who are the actual and potential competitors in the company's target markets?
- What are competitors' main advantages and limitations, and what are the implications for the marketing strategy?
- What are the company's strengths for exploiting new markets and finding new customers?
- What factors, such as technology, public regulations, exchange rates and age structure, will determine the company's competitive position?
- How can the company develop the abilities, skills and motivation to identify new customers and sell them its goods and services?
- How can the company secure and extend its position in the market?
- How can the company learn faster and better than its competitors?

Market success depends on offering useful and attractive products, setting realistic strategies and choosing appropriate marketing tools, as well as on managing turnover and profit margins. Flexibility in implementation takes into account uncertainties in the factors that influence market development and customers' behaviour. Anticipating trends from previous sales and customer data only may lead to incorrect or inaccurate conclusions and failure of the chosen market strategy. It is important to have reliable, current information and data on changing demand and changing customer groups.

Implementing a market strategy begins with clear ideas about what infrastructure is needed, how implementation processes can be organised and how they can be communicated to the public and within the company. Implementation plans set forth the goals and timelines, the measures to be taken and their sequence, the priority in which marketing tools should be used and the staff responsible for coordinating decisions and activities. The necessary financial resources need to be determined and annual marketing budgets set up that specify the use of resources for each target market, customer segment and product group.

Operational marketing action plans determine the goals to be achieved, select the target groups to be addressed and indicate the communication tools to be used. Communications specialists can then develop and guide efficient marketing campaigns that benefit from scientific findings of motivational studies (Meffert *et al*. 2008: 632–3). Companies in the wood-based sector that market a variety of products need to achieve a balance between different purchasing motives and customer requirements. Intensive analysis of the prevailing business situation and a critical assessment of factual information on various customer segments have to be undertaken. Usually a mix of communications tools and marketing messages is appropriate.

Marketing campaigns may be categorised as using predominantly a pull strategy or a push strategy; actually, both are usually needed as complementary approaches. *Pull strategies* start directly with the end users of products and services and create demand based on identified, proven customer requirements. Suppliers conduct extensive market research for their products and use advertising campaigns, information events and customer visits to attract customers. Launching a trademark with an established, easily recognisable identity is a typical example of a pull strategy. Marketing tools aimed directly at customers, and at final consumers in particular, are important.

In *push strategies*, market strategy implementation focuses on intermediate market stages – the wholesale and retail trade, the producer's own sales organisation or external activities and organisations capable of influencing customers' decisions and purchasing behaviour. Marketing success depends on making agreements with intermediate traders to ensure favourable positioning of the products on their shelves. The marketing of specialised textbooks, for instance, depends to a large extent on a push strategy because authors can reach only a limited number of purchasers directly; for efficient distribution and sales, they depend largely on the communication channels of their publishers.

Lack of communication, short time horizons and weak process control may explain failures in implementing a selected marketing strategy. Perhaps the strategy was designed by specialists with not enough communication to line managers and staff, and the approach consequently did not correspond to business realities and lacked plausibility. Market strategies may also fail if they are abandoned too soon, stranding a good product with long-term prospects. Or both the company and its customers were resistant to accept the new product because it was not adequately announced and explained. Or the marketing strategy process was not sufficiently monitored and controlled by management.

Among the factors that contribute to successful sales and marketing campaigns, three may be singled out as especially important: coordination between overall business strategies and marketing strategies, creation of the base conditions for developing innovation capabilities and awareness of the time factor in product development. Coordination of strategies is necessary because market development proceeds from the company's business mission and goals and in turn determines whether its goals are attained. Success also demands flexibility both inside and outside an enterprise and conditions conducive to making innovation a priority – in particular, in the organisational structure. Of equal importance are the relationships between managers and collaborators and the weight given to open and effective communication between the company and its external environment. Entrepreneurial culture and the ability to communicate, combined with strong innovation capabilities, are particularly valuable because they favour creativity, problem solving and teamwork.

Values and attitudes play an important part in communications between suppliers and consumers. Some companies attempt to position their products by promoting cultural events, sports and, increasingly, the natural environment at a level of value that they would not be able to reach with their products alone. The positive values associated with maintaining forests, conserving nature and protecting landscapes can be used in communications work. Although the market for sports and cultural sponsoring is already heavily developed, the market volume for environmental sponsoring is so far comparatively small. There are opportunities at the local and regional level for decision makers to develop relevant and attractive arguments and use them in promoting sustainable forestry management, nature conservation and environmental protection.

A communications strategy to promote uses of wood focuses on the sustainability of wood production and the green characteristics of a versatile natural product. The renewability of the resource, carbon storage in forests and wood products, the permanence and reusability of wood and its cultural significance are all positive values. Forestry and the wood industry thus have an opportunity to establish a positive image for the use of wood in, for instance, the construction industry and among end consumers, both through the industry's own marketing measures and in collaboration with other stakeholders and economic sectors. A persuasive campaign to communicate a positive image of wood products and forest benefits involves linking forest management, sustainable wood production and the positive environmental and recreation benefits for society as a whole.

Communications strategies to address companies in the wood industry differ from those needed to reach retailers that sell many goods besides wood products. Similarly, the strategies needed to market forest environmental and recreational services differ from those that target the wood-processing industry. And pitches that attract customers in the sawmilling industry, the pulp and paper industry and prefabricated timber construction are likewise specific. Small and medium-sized companies generally do not have the financial or staff resources to influence end consumer markets through advertising campaigns. These tasks are usually carried out by industrial sector associations, interest groups of external stakeholders and forest owners associations.

Market research and development become more important as the time between product development, production of new products and market introduction grows shorter. The task is systematically to collect, analyse and interpret information about current and future market situations (Peters *et al.* 2005: 137–8; Thommen and Achleitner 2006: 137–8). Using sociological research methods, specialised research institutes conduct market research on behalf of individual companies or for determined business branches (Meffert *et al.* 2008: 94–5).

In *primary market research*, information is obtained from customer surveys or potentially interested individuals. This empirical field research uses quantitative and qualitative inquiries. Representative samples of respondents are selected using socio-demographic data and typical behavioural characteristics. In a survey with closed questions, the responses can be evaluated in a standardised way. With open questions, the respondents formulate their own answers, which often give valuable additional insights. Another type of survey involves qualitative inquiries and is conducted by trained interviewers; it provides detailed information about attitudes, opinions and behavioural characteristics of customers and social groups representing purchasers on the market. Multiple-topic questionnaires combine quantitative and qualitative survey elements. They generally cover a wide range of topics and are less expensive than specialised surveys. Primary market research can also be undertaken by direct observation of customers' or potential clients' behaviour and by test questionnaires in combination with experimental sales situations in which different purchasing alternatives are simulated.

In *secondary market research*, available information and evidence from selling situations are analysed in a targeted manner. Internal information, such as company sales statistics, reports on customer reactions and evaluations of visits to trade fairs, are used for this purpose. Other important sources include external databases and empirical research results. Statistical information on general economic and planning data, provided by public agencies and the publications of professional associations and market research institutes, is also useful. Material from journals and research reports, press material and information about competing companies can be used for complementary information.

Market research activities in forestry and wood processing have so far focused largely on investment goods. Trends relating to concentration and diversification in the sawmill industry have been analysed in a field research study (Weber 2001). A survey of opinion polls on the perception and attitudes of European customers concerning wood and its uses has been undertaken (Rametsteiner *et al*. 2007). Structural changes in the economy, changes in demand for investment and consumer goods and new production technologies create more competition as well as more opportunities. Well-researched market information and familiarity with regional and worldwide market trends are indispensable for achieving profitability at the various stages of the wood-based value-added chain. Cluster analysis may be used in market research to identify segments of the consumer population, understand relationships among consumer groups and position products.

Research on wood's advantages and disadvantages in comparison with other materials is of particular interest in defining and implementing marketing strategies (FAO 2011a, 33–5). For solid wood products, such as sawnwood and wood-based panels, construction is a major end use with traditional advantages in cost, durability and ease of use. Drivers of this market are population and economic growth, with expansion trends slowing down at higher income levels. The competitiveness of wood as construction material varies between countries and regions. Metal, plastic and concrete are major competing materials. And energy and raw material costs are important factors determining their choice in construction. Countries with significant forest resources and well-established processing industries have more experience and familiarity with wood use and its potential as a building material. Wood-frame construction, for example, accounted for around 90 per cent of homebuilding in the Nordic countries and in North America, compared with 45 per cent in Japan and less than 10 per cent in West European countries (Palmer 2000).

Another significant end use of wood products is furniture manufacturing. Rising income presents opportunities to increase turnover and profitability through quality improvement, innovations and marketing of higher-value products. Demand for wood furniture is largely determined by cost competition from furniture manufactured from other materials, like plastic, metal, glass, aluminium and nonwood fibrous plants, such as bamboo and rattan. Satisfying changing tastes and providing quality products are other decisive factors, particularly at higher income levels.

Changes in public opinions, attitudes and lifestyles become manifest with social trends that occur when living conditions improve and income increases. Once people can move beyond meeting their basic needs, they look for new products and services that can improve their quality of life according to their tastes and preferences. Trends towards larger homes and greater leisure time are among the significant changes. The perceptions of consumers include such intangibles as quality, status and fashion. They become more aware of environmental and social issues and increasingly demand sustainable products. As higher education levels, social networking and easier Internet access contribute to more knowledge and information about markets, products and companies, the sustainability of materials and the environmental effects of different products and use patterns gain importance.

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4 Management, human resources and organisation

4.1 Management as an entrepreneurial challenge

4.1.1 Management systems

Management is generally understood to refer to the shaping, guidance and development of sociotechnical systems using professional methods. Targeted business processes need to be organised, developed and guided by management. Organising a process means creating realistic management systems. Development refers to continuing adaptation of these systems to a changing business environment. Guidance means setting goals as well as planning, executing and controlling entrepreneurial activities. Modern business management thus requires forward-looking decisions, based on today's information and entrepreneurial tools, and continuous review of the effectiveness of prior decisions. The term *management* is used in an institutional sense to refer to the individuals who carry out management tasks. In large companies, management is divided into higher, middle and lower management (Drucker 1954, 1974; Drucker and Haas-Edersheim 2007).

Business management deals with multilayered problems within a complex, often unpredictable, environment. It requires a willingness to engage in a continual learning process and take entrepreneurial risks. It presupposes an ability to quickly recognise and evaluate changes both in the company and in its business environment. In this sense, management is an important prerequisite for deliberate entrepreneurial action. A qualifying and motivating factor in the work of active, self-confident managers is the search for innovation. Management above all means having a talent for leadership and for persuading employees to develop cooperation and implement shared goals making the company successful.

Management derives from the Latin expression *manum agere*, 'to lead by the hand'; it evolved to *maneggiare* in Italian and *manier* in French, with the meaning of guiding or, in a more general sense, handling a particular situation and leading an activity (Kluge 1975; Schneck 2006). Initially used in American English to refer to the work of organisers, agents and coaches working for artists or competitive athletes, it was introduced into other languages mainly in the second-half of the last century. When a new word is adopted from a foreign language, the activities it describes often take on new meaning. Today, *management* is more comprehensive and versatile than just leadership and guidance: it gives greater emphasis to active design, prospective activity relative to expected changes and personal responsibility for the consequences.

Management is a process of decision making based on systematic information retrieval and analysis of the internal and external factors that determine the situation of an organisation or company (Bea and Haas 2005; Steinmann and Schreyögg 2005). Management activities structure business opportunities, identifying goals and possible solutions. They divide decision-making processes into phases for analysing complex situations and examining alternatives.

General management practices address problems at the level of the company as a whole. However, business management also addresses the constituent entrepreneurial activities of the company, such as production, marketing, logistics, controlling and human resources. Although modern management practices have been developed mainly for commercial companies, they are not limited to the private sector. In public institutions and administrative bodies as well, a sound and comprehensive knowledge of management is an indispensable prerequisite for targeted and efficient action. The use of management tools has become increasingly common for publicly owned forests. A special case is the management of large forest estates owned by the state, which present in many ways pure business challenges rather than administrative or policy challenges. To implement this type of management approach, the public administration system must establish suitable conditions.

When management approaches are applied to actual entrepreneurial situations, different priorities result, since not all management tools are equally applicable in all companies. Large companies in particular develop specific patterns to deal with their unique issues. Forest enterprises, for example, have developed their own planning system based on forest inventories and forest management plans. They adapt a general planning approach to the specific requirements of managing forest stands and ecosystems for sustainability.

Contextual or situation management is influenced mainly by three types of factors (Ulrich and Fluri 1995: 30–46.):

– *Task-specific influences* result from the entrepreneurial goals that have been set, the economic sector in which the company operates, the products and services that are delivered to the market, the available technology, any technological and organisational innovations, the available resource base and new opportunities and risks.
– *Person-specific influences* are directly related to the company's human resources and culture. They include, for example, motivation and attitudes, knowledge and skills, group dynamics and cooperative structures in the management system.
– *Influences from the sociocultural environment* emanate from important developments in society and affect economic structural changes, the level of consciousness and changing societal values. Influences of this kind can be seen, for instance, in changes in public awareness that affect entrepreneurial activities and customers' behaviour.

Demands made on management arise in particular in relation to the following:

- grasping the complexity of the contextual situation – that is, the variety of factors at work and their interrelationships;
- evaluating the dynamics – that is, the rate of change or speed of development of external and internal conditions; and
- dealing with uncertainties in assessing the nature and quantity of information required for anticipating and responding to change.

Targeted shaping of sociotechnical systems, taking their interconnections with the environment into account, is the central and challenging task for managers. Whether in a private company or a public agency, the manager is responsible for seeking viable strategies, initiating solutions and ensuring their successful implementation. A senior manager has to create stimuli and momentum for developing the current approach or for setting a fresh direction. Managers are particularly needed to advance fundamental changes and strategically important innovations. Success deserves to be acknowledged, and mistakes and shortcomings need to be analysed so that actors learn from both positive and negative results. Qualified managers reduce the extent to which their decision-making behaviour involves only reactions to events, and increase the proportion of positive, initiatory actions.

The weighting of these two extremes – reaction and action – depends on constantly changing factors in the business environment and internal company parameters. These include, for example, the company's state of development, the tools available for entrepreneurial decision making, employees' level of training and motivation, the opportunities and problems in the relevant sector, specific product characteristics and technical strengths or weaknesses in the actual performance of a company or agency.

St. Galler management model: Business management is described as a complex structured system by the St. Galler management model (Rüegg-Stürm 2003: 17–23). The system operates with six central terminological categories: (1) the external environment and its changing trends; (2) stakeholders, comprising organised groups of people, nongovernmental organisations, public administrations and other governmental institutions; (3) interactions and communication between a company and its stakeholders; (4) structuring elements that provide a framework for entrepreneurial activities in creating value added; (5) processes for conducting specific activities; and (6) fundamental patterns of continuity and adaptability in business development and innovation.

The St. Gallen management model of a systems approach to entrepreneurial activities began in 1972, when Hans Ulrich and Walter Krieg introduced systems theory and cybernetics into business management theory. Their book explained management decisions and activities within a three-dimensional system of phases, functions and dispositions in a complex and changing business environment. A research and teaching group, under the guidance of Ulrich and his colleagues, expanded the systems approach while developing a praxis-oriented university teaching programme. The latest model has kept the significant structural and procedural elements, as well as the systems approach, but given more emphasis to systematic reflection on the normative basis (i.e. norms and values), in business management, the divergent interests and demands of stakeholders, the time factor in value-added activities and maintaining resources as a long-term input factor (Rüegg-Stürm 2003: 89).

Another important strategic aspect is the ability of companies, organisations and institutions to manage instability by creating networks that adapt to constant change. The growing complexity and dynamics of our personal lives and the competitive pressures of business management can create anxiety and disorientation as well as new horizons (Kruse 2011: 7–10). Building on the theory of dynamic systems and self-organisation, information and communication technology are powerful instruments to address such challenges. Management must maintain a reasonable balance between stability and instability, between central authority and decentralised autonomy. This requires permanently functioning internal and external structured networks in which everyone can participate and collaborate.

Entrepreneurship, in a broad perspective, aims in a rational and target-oriented manner at market success and profit making and shapes the development of an enterprise or company; at the same time, entrepreneurs have important responsibilities to themselves and their staff and also to society, be it at the local level or on an international scale (Bendixen 2011: 7–15; see Chapter 2, Section 2.3.1). The dimensions of space and time are fundamental to entrepreneurial action because they determine the business culture, strategic thinking and human foresight. An understanding of the cultural developments of the past, as much as the diverse cultural trends of the present, is necessary for developing creative, consistent management systems and understanding how to use them. Successful economies and individual managerial activities deal with scarce resources while acknowledging both the vitality of nature and the underlying forces of culture. These are values that need to be in balance for sustainable development.

In examining the drivers of the past, one discovers what shaped the business framework of the present and may affect companies in the near and distant future (Bendixen 2011: 143). Analysing historical processes helps elucidate the creative tensions between continuity and change, between local and international space and between individual and collective acting. It is important for entrepreneurs to identify and evaluate such tensions so that they can judge whether the balances between them that have emerged (or are still in flux) are a valid basis for sustainable economic development and for competitive, future-oriented business.

Our understanding of the role of management systems, processes and methods evolves. Concrete changes at different historical and cultural stages determine time-specific management practises and theories. A case in our time is the globalisation of management approaches, made possible by new communication technologies, worldwide shipping capacities and improved transport technologies. Internationalisation of lifestyles, consumer demands, education and research systems and the shift to more sustainable procurement of renewable and non-renewable resources are important trends that shape the present situation and the future.

4.1.2 Directive functions and management areas

Taking an analytical view of the individual components and structural elements of management is necessary for understanding corporate systems and assessing the opportunities for entrepreneurial initiatives (Staehle 1992; Ulrich and Fluri 1995: 15–26). Practical training, specific skills and professional experience in different areas of a company are important prerequisites for addressing constantly changing realities. Successful management and productive teamwork require identifying the priority problems of a given context and understanding the connections among the different tasks of management.

The tasks of managers are determined by the level and extent of their directive functions, which allow target-oriented process steering and efficient control of an enterprise or public agency as a sociotechnical system. There are various ways of classifying and describing the directive functions, and it is difficult to sum them up as a consistent catalogue. Important functions that are emphasised in the specialist literature include planning and control, organisation and work scheduling and human resources management (Schierenbeck 2000: 86).

The following discussion is based on four comprehensive directive functions of senior management:

- defining the company's policy and goals;
- implementing the company's planning and control;
- shaping the company's organisation and style of leadership; and
- ensuring a well-trained management staff by supporting the development of individual employees.

Knut Bleicher (2011: 87–94) distinguishes three levels of action directed towards different problems: normative, strategic and operational management. *Normative management* is concerned with the company's general goals – with principles, standards and ground rules that are aimed at making the company's existence and further development possible. The fundamental requirement here is to create a stable basis for the company's activities and its ability to develop in a competitive manner. Normative management defines the meaning of entrepreneurial activities in a specific business context and establishes the general framework for directing and developing business and companies. It includes entrepreneurial convictions and visions, as well as working in a context of consistent company policy. Corporate culture provides the basis for productive relationships both with the business environment and within the company. Above all, collaboration among employees is based on values that should be explicitly formulated and communicated. What matters is how the purpose and justification of entrepreneurial activities are determined, both internally and for the outside world, between the poles of divergent interests and demands.

The central task of *strategic management* is to establish and stabilise positions of excellence that allow a company to achieve above-average results over the longer term. The main drivers are both quantitative and qualitative in nature and relate to the company's ability to respond flexibly and rapidly to technological innovations, changes in market and supply conditions, and measures taken by competitors. The goals and general conditions for *operational management* are set at the normative and strategic level. Economic principles are applied to the direct control of operational value-creation processes. The focus is on effectiveness in implementing specific business solutions through increases in productivity, innovation in competitive production processes and diversification of products and services along the value-creation chain. Major assessment parameters here are turnover, cost-effectiveness and profitability.

Together, the three management levels are concerned with shaping, directing and developing sociotechnical systems (see Figure 4.1). The management tasks on each level need to be regarded as being of equal importance. Deficiencies at one level of action can be compensated for only temporarily and to a limited extent by successes at another level. Management areas or management fields are related to the way in which business is structured, the planning and implementation of entrepreneurial activities and guidance for the behaviour of employees. The structural elements are derived from goals and available resources of the company and have to be constantly adapted to its development. Within these structures, primary and supportive activities take place to achieve corporate goals. Structures and activities are designed in a social context – that is, through the employees. The task of managers here is to guide behaviour such that employees can contribute to achieving the company's goals while pursuing their own legitimate personal goals.

Combining normative, strategic and operational management with structures, activities and behaviour produces a total of nine possible fields to which specific major tasks and guidance tools can be assigned. Managers' challenge lies in achieving an effective and efficient connection between the various tasks and requirements. Integration takes place in the horizontal direction through suitable combinations of structural design, organisation of activities and staff resources. In the vertical direction, the strategic goals move within the framework of company policy, while operational management focuses on implementing them. Managers need to integrate structures, activities and behaviour by coordinating the various fields of activity.

Entrepreneurial success results from the coordination of structures, processes, resources and abilities with the strategic and normative orientation (see Figure 4.2). Adapting a strategy to altered business conditions requires adaptation of the corresponding areas of activity. Strategies can be changed relatively quickly, although the adaptation processes associated with implementing them may take longer. Increasing resources and employee skills may be difficult to achieve. A dynamic company engages in constant adaptation or modification of the existing equilibrium. This steering process is time consuming, particularly since the dynamics of the surrounding conditions constantly require additional action. Complete and stable integration of the various management fields is therefore difficult to achieve. However, the linkages outlined here emphasise the need to analyse and shape company development in a comprehensive and systematic context.

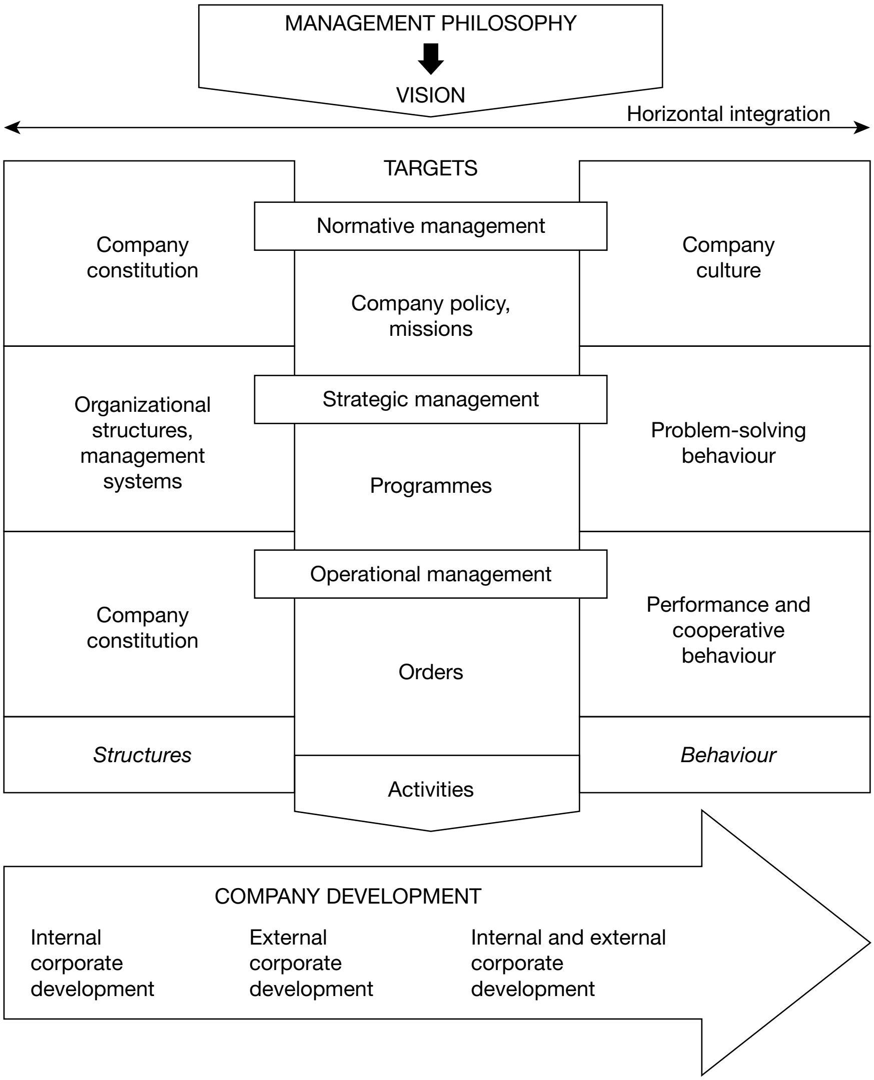

Figure 4.1 Normative, strategic and operational management at horizontal level

Source: Bleicher 2011: 91

4.1.3 Decision-making and problem-solving processes

The task of a manager and his or her management team is to take decisions and develop and implement solutions to problems. Operational decisions in a business are taken in the short term by those directly responsible. Strategic decisions with far-reaching significance for a company are usually prepared by the teams and internal bodies responsible, and are decided jointly as the situation demands. In

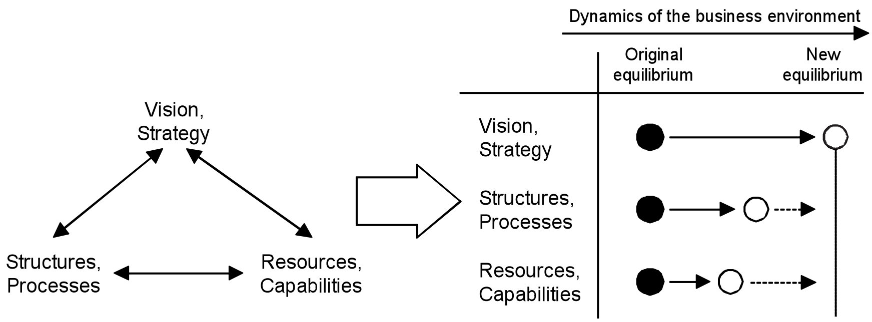

Figure 4.2 Time horizons in coordinating management fields

Source: Simma 2000: 2

some cases, this type of decision-making process can extend over long periods. Two types of decisions need to be distinguished here:

– normative decisions regarding values and aims that are based on processes of consensus development; and
– strategic and operational decisions regarding means and ends, based on analytical information processing.

Business development is based on management processes that build consensus and agreement. The participants' different judgements and arguments are determined by their varying experiences, interests and assessments of the available information. Their fundamental attitudes and the ways in which they individually perceive the problem and its solution may vary considerably. To ensure that processes lead to constructive decisions regarding means and ends, functional knowledge, experience, information and good judgement are needed. The analysis of phases of reaching agreement on a decision can be applied to many entrepreneurial activities. This affects both operational and strategic issues, as well as important functional management areas, such as marketing, recruitment and production (Thommen and Achleitner 2006: 43, 873).

Six characteristic phases in decision-making and problem-solving processes can be distinguished (see Figure 4.3):

– problem definition and analysis of the initial situation;
– setting of goals;
– identification and evaluation of alternatives;
– selection of suitable means;
– identification of appropriate implementation measures; and
– evaluation of the results.

Problem definition and analysis require obtaining and qualifying relevant information to ascertain the genuine causes of the problem being addressed. Only

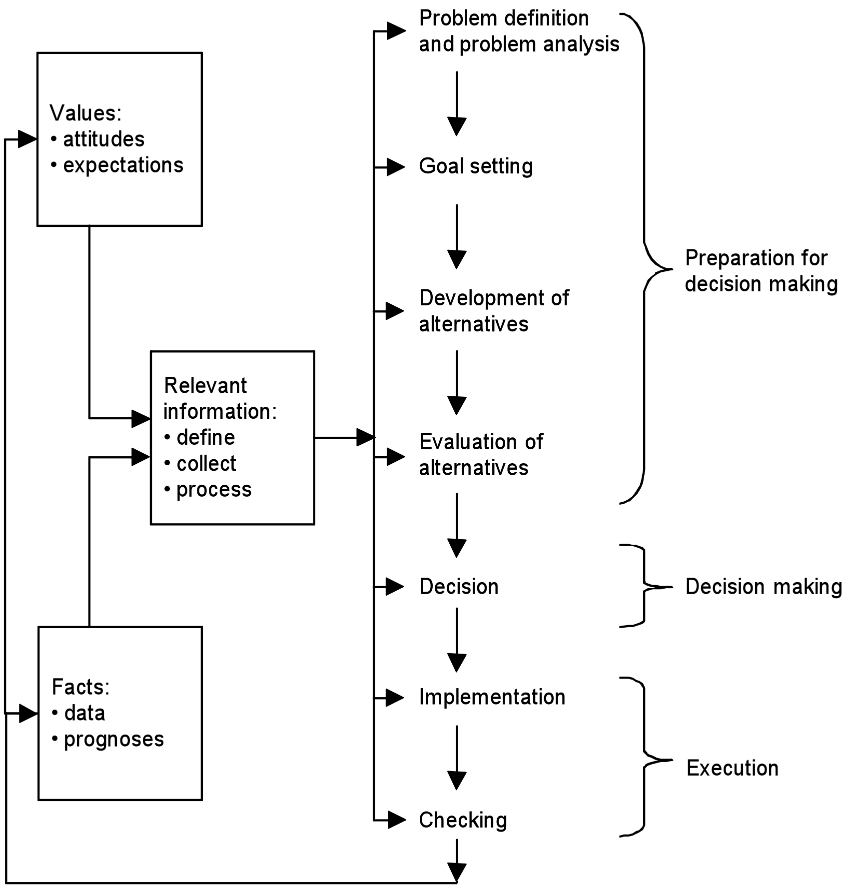

Figure 4.3 Entrepreneurial decision making as an analytical information process

Source: Ulrich and Fluri 1995: 25

then is it possible to set realistic goals and select the necessary measures. Usually, not just one goal but a group of interrelated goals are involved, and a combination of measures may be required. Deciding on a specific approach at too early a stage can cause more appropriate options to be overlooked. Alternatives therefore need to be carefully identified and evaluated. Potential limitations in terms of risk, cost-effectiveness and time should be taken into account, as should the resources needed to implement the selected measures. This involves not only general staffing and financial resources but also new technologies and production processes or organisational changes.

Successful implementation demands a high degree of openness to innovation and considerable personal commitment on the part of employees. This places high demands on human resources management and cooperation among everyone involved. The behavioural aspect is particularly important here. In the context of the evaluation, the results of the implementation process are then compared with the goals that were set. The causes of any divergences have to be investigated with a view to potential improvements or corrections. The information obtained becomes feedback for further problem-solving processes.

In well-formulated problems involving large amounts of data and complex interactions, operations research based on statistical methods can be used to assist decision making (Daenzer and Huber 2002: 429–30; Hausmann *et al.* 2006; Züst 2004). This is the case in operational logistics and production management – for example, for optimising yield in sawmills, getting the right logistics for felling and wood transport and distributing raw material between processing plants. In other management decisions, qualitative aspects of several goals and preferences have to be weighed against one another. The information on which alternative solutions are based is often at least partly uncertain and incomplete.

Complex problems in many cases cannot be managed using a linear processing sequence alone; it is often helpful to use feedback loops. The information obtained is then used to modify the results achieved thus far. This procedure leads to a more reliable analysis and reduces subjective influences when assessing alternative solutions or decisions. An iterative procedure in which team members are constantly kept informed about the current project status and controversial points in the assessment leads to better-substantiated solutions. Early and intensive involvement of everyone concerned makes it easier to achieve cooperation and a common orientation in implementing a decision.

Planning is directed towards the future and, if appropriate and realistically undertaken, promotes the further development of companies and business (Krabbe and Czeranowsky 2003: 81–2). Today's experience is relevant because it provides hints and insights for future activities and development trends. Strategic planning is helpful in preparing for entrepreneurial decisions, assessing alternative goals and transferring tasks and responsibilities to employees at all levels.

With international integration, rapid structural changes and ever-shorter cycles in manufacturing, innovation and sales, the risks associated with incorrect decisions are increasing. For managers, it is becoming more and more difficult to grasp a company's development intuitively and shape it successfully. A systematic approach ensures that decision making has an objective basis and is valid and adaptable to further new developments. Strategic considerations focus on effectiveness – that is, on assessing whether the targets set and the measures adopted to achieve them contribute effectively to fully exploiting opportunities for success.

Strategic plans are implemented through short- to medium-term operational planning. The emphasis here is on setting detailed and achievable goals for individual management areas and specific projects. An important tool is the budgeting process, which indicates financial goals, production quantities, sales volumes and consumption of operating resources, usually for a period of one year. Planning can be elaborated using formalised planning systems, which may exist for both strategic and operational activities. The system sets out which office or management team will work on which plans and when, and which critical factors have to be taken into account. This ensures that the planning tasks are carried out in a timely way, and above all, that plans are updated as needed. Planning usually has some elements of uncertainty, and it is important to evaluate the assumptions about trends and factors on which it is based.

Consistent strategic and operational plans are a prerequisite for applying modern controlling methods. Systematic controlling allows comparisons of projected targets and actual results for individual activities and projects, different management areas and the company as a whole. Such comparisons reveal the extent to which goals have been met and the reasons for discrepancies between anticipated and actual results. The information obtained is indispensable for iterative planning processes and provides further inputs for shaping business development. Modern approaches to controlling are designed to integrate planning with surveillance and monitoring in order to establish a comprehensive system of company control.

A well-structured business information system is essential for entrepreneurial decision making, systematic control and organisation of internal and external communication processes. Information must be available to owners, shareholders, managers, employees and external stakeholders at the right time, at the right place, to the required extent and in the right form (Peters *et al.* 2005: 20–1, 30–1). The design of the information system is a relatively new management task, and its importance is constantly increasing. Information is needed for planning at the operational (budgeting) and strategic level, as well as for controlling. Accounting procedures and formal book-keeping standards quantify economic activity. The system must document changes in monetary values and provide the basis for entrepreneurial finance and investment decisions. Other management areas, such as production control, logistics, human resources development, marketing and customer relations, need additional information.

Information management has to meet two challenges. First, accurate information for various types of business activities has to be generated and made available. Second, substantive qualitative information and quantitative data need to be condensed and irrelevant information identified and eliminated. Obtaining, processing and preparing large amounts of information give rise to considerable and often rapidly growing overhead costs. Rigorous cost-benefit analysis is necessary when designing and formatting such systems. Procurement and use of information should focus on those management areas that are particularly important for the company's value-adding processes and the areas that determine the company's competitive advantage.

Information management primarily involves communication processes within a particular enterprise as well as from outside sources. An important task is therefore to establish clear rules that assign responsibility for obtaining information, making it available and distributing it appropriately. Every information item has a specific appearance, known as information design, which is largely determined by the individuals who supply it. The data must be compiled and converted into a form usable by managers. When external information is combined with internal data, different types of information design may collide. One challenge in information management is to establish well-functioning communication and retrieval processes between inside and outside sources. Recent advances in information technology, such as use of the Internet and simultaneous editing of documents, have made this technically much easier.

4.1.4 Enterprises and stakeholders

In business management, long-term orientation defines both the purpose of entrepreneurial action and the rules needed to achieve strategic and operational goals. The development of a *company vision* provides this type of orientation and fulfils the following tasks:

- It formulates fundamental values and motivating forces for company activities and establishes a framework of guidance that takes priority over the company's goals.
- It allows the development of a consistent, forward-looking company policy against which actual entrepreneurial activity and business success can be measured.
- It serves as the basis for strategic planning and the implementation of strategic and operational measures.

A company's vision represents binding standards that determine the fundamental objectives for entrepreneurial activity. It embraces the whole of a company's operations and promotes an orientation towards common and coordinated activities. The connections between entrepreneurial goals, vision and mission statements, and company policy and culture are illustrated in Figure 4.4.

The content of an entrepreneurial vision is specific for each company and explains how the company is going to implement its goals. Issues and problems to be addressed in structuring a vision statement relate to the following:

- the principal commercial fields of company activities;
- the importance of generating profit;
- customers' needs and market delivery;
- types of collaboration with suppliers creating value added;
- the company's intended position in competitive markets;
- the role of employees and the importance of human resources development;
- a commitment to innovation, research and environmentally friendly technology;
- a commitment to sustainable resources utilisation and closed production cycles;
- a commitment to economic, social and ecological standards; and
- a commitment to corporate citizenship and compliance with law and regulations.

Particularly in medium-sized and large companies, it is useful to record the central points of an entrepreneurial vision in writing a complementary *company*

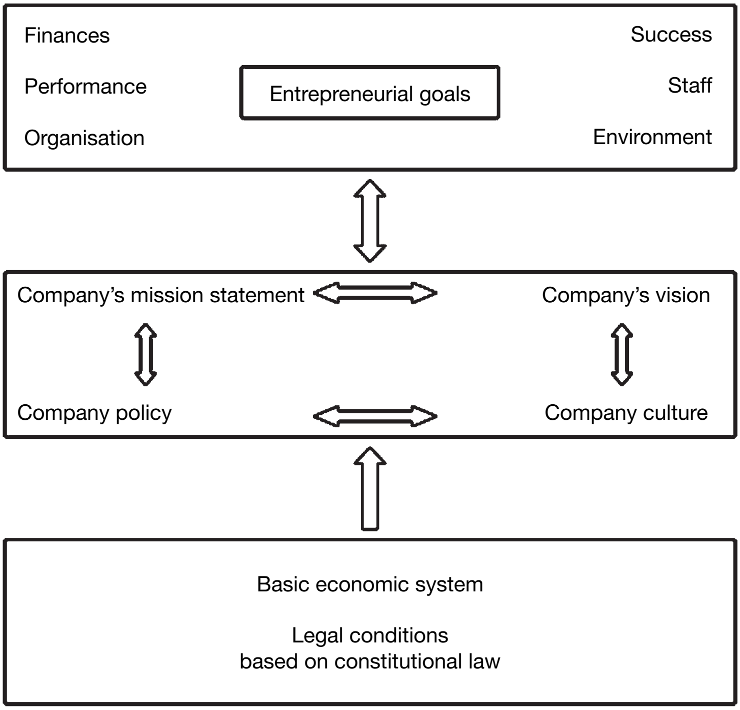

Figure 4.4 Entrepreneurial goals, vision and mission statements

mission statement. Credible communication of normative, strategic and operational statements orienting the company's decisions towards such statements promotes an understanding of the common cause. This provides a foundation for employees to take responsible action to achieve the goals and identify with the company's activities. The process gives rise to a corporate identity to which employees feel committed. It is expressed in a stronger commitment to the company's concerns and how people present themselves to third parties.

Company visions and their articulation in mission statements become effective when the content informs company policies and practices and when the statements and goals influence the actual decisions taken by the company. If high importance is placed on employees in a mission statement, they need to experience this value in their everyday work. Statements of principles regarding multifunctional and careful forest cultivation will be credible if they account for divergent stakeholder interests and if efforts to find viable compromises are genuine.

Mission statements implementing the company's vision, goals and policies become effective if they reach the relevant stakeholders. A substantial proportion of such communication takes place in personal contacts and during everyday exchanges among owners, managers, employees, customers and the media. Companies publish their mission statements in their business reports. Mission statements support the outside perception of the company (its corporate image) and give it an opportunity to document and present its binding values, the principles behind its policies and specific goals to its shareholders, staff, clients, suppliers and the public.

Owners and shareholders are the principal stakeholders of an enterprise. They have direct and explicit control and responsibilities on the company's activities and expect a suitable return on capital they have invested. Within the limits of their responsibilities, senior managers are heavily involved in the company's decision-making processes. Owners, shareholders and senior managers make entrepreneurial decisions and determine a company's goals. They formulate normative statements about future strategies and plans and select business options to be pursued. They have responsibilities for the content and direction of entrepreneurial activities and establish the guidelines for staff and working teams, whether through simple structures or complex and multilayered responsibilities.

At the same time, business owners and managers are faced with demands and expectations of other internal and external stakeholders. Employees are concerned about keeping and advancing their positions and making a living. Their interests are represented through contractual or legally established workers' participation systems. The number of external stakeholders is growing. Suppliers and customers are external stakeholders with considerable interests in the development of a particular company or business branch. Nongovernmental agencies and private or public citizens groups are of growing importance. For instance, consumer protection associations and environmental organisations express concerns and make demands on businesses and industry and influence company strategies through the media and the public.

Stakeholder interests have direct and immediate effects on a company's goals and policy decisions, but they can also influence company activities in an indirect manner. Companies operate in a complex multilayered environment determined by social, economic, technological and ecological factors (see Figure 4.5); they operate more successfully if their goals and activities are compatible with or at least understood and accepted by major stakeholders. A primary concern, then, is how to manage conflicts in the values and demands of the business and external stakeholders or how to reconcile divergent interests among external stakeholders.

Determining relevant stakeholder groups in a particular sector, economic branch or business activity requires several steps, as shown in Figure 4.6 for wood-based industry clusters:

- The identification of stakeholder groups relates, for instance, to the specific conditions of an industry, the spatial scale of operations and data sources that may be used.
- The analysis and assessment of stakeholders may refer to their institutional profiles, their particular interests and demands, their communication patterns and their approaches to cooperation.
- Analysing existing or potential networks among stakeholders involves assessing the possibilities and readiness for cooperation among enterprises

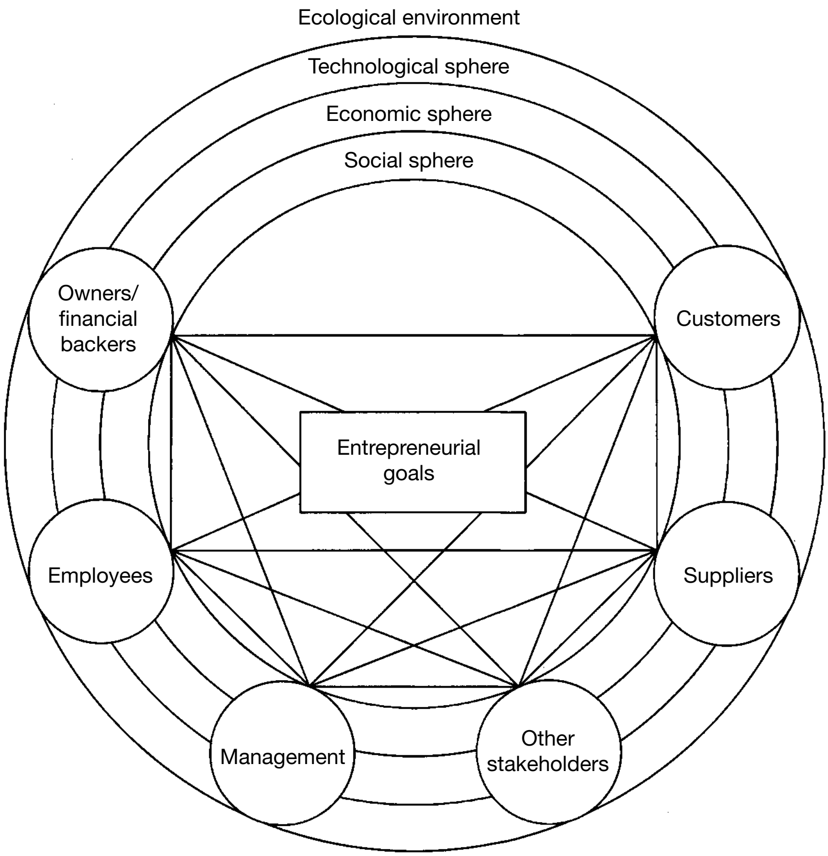

Figure 4.5 Company goals and stakeholders

Source: adapted from Ulrich 2001: 48

and companies within the same industry branch as well as with enterprises and companies in other industrial branches.

– Relationships between industry, nongovernmental organisations (NGOs) and public institutions are examined, and the factors of change that favour or restrain communication and cooperation are identified.

In formulating business strategies, owners and company managers need to take account of the entire business environment and the interactions between the economic, social and political effects of current and envisaged business activities. Credibility in dealing with inside and outside stakeholders is important, in particular in facing the interests of employees, customers, investors and suppliers as well as stakeholders representing public opinion. Conflict management and maintaining a reasonable potential for agreement require careful examination of

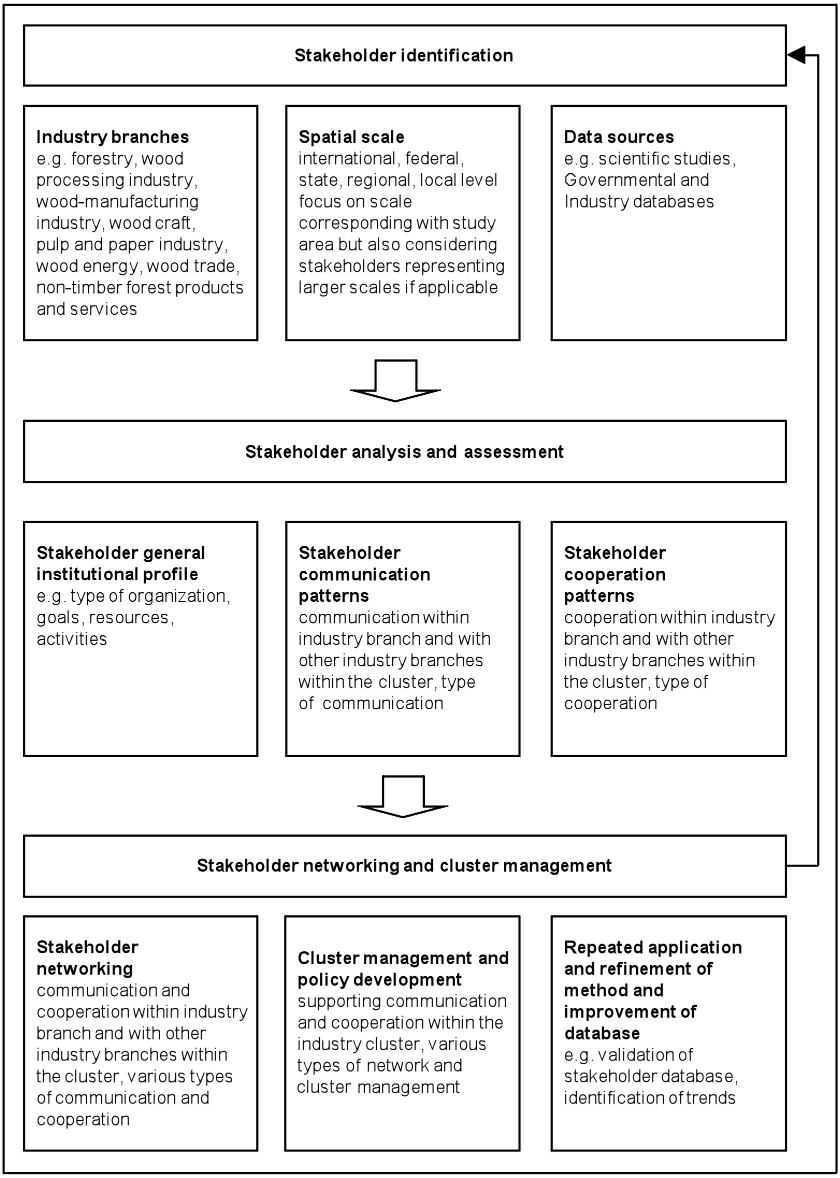

Figure 4.6 Stakeholder analysis in wood-based industry clusters

Source: Mrosek *et al.* 2010: 27

the arguments, demands and proposals from internal and external stakeholder groups. Business goals should be transparent, and the social and ecological aspects of the company's objectives disclosed and communicated. In fact, well-communicated business strategies that are consistent with environmental conservation, sustainable use of natural resources and social advancement are competitive advantages in industry and business management.

4.1.5 Business goals

Goals are statements regarding a desired future situation. They have effects at every level of action, and they convert mission statements into tangible form. They define the degree of effectiveness and profitability of entrepreneurial actions. As important signposts for company management and employees, they make it possible to point structures, activities and behaviour in the same direction. Company goals can be classified according to the three types of content – economic, social and ecological.

The purpose of company goals is to ensure the existence and functioning of the business by using strategic advantages and providing resources necessary to do so – both immediately and in the longer term. This means recognising and exploiting successful strategic positions, initiating innovative developments and surviving in competition with other companies. The purpose of entrepreneurial policy and strategy is to orient the various activities of the company towards general, higher-level company goals and to ensure that business activities are coordinated.

Goals serve important purposes for management (Bea and Haas 2005: 72–3):

- *Basis for decision making*. Goals and objectives are the basis for decision making. They provide criteria for evaluating alternative actions in problem-solving processes.
- *Coordination*. Setting goals and objectives allow subordinate activities to be coordinated in businesses and oriented towards standard reference points.
- *Guidance and controlling*. Goals and objectives provide a measure by which the company's development can be guided and its success evaluated. Specifically defined goals provide the basis for target-performance comparisons in the context of operational controlling.
- *Employee information*. Goals provide information about current processes and shared successes, as well as tasks that need to be solved and activities that are planned for the future.
- *Employee motivation*. Goals – and their achievement – motivate employees and contribute to their identification with their work.
- *Targets for employees*. Goals present targets towards which employees work. This is the basis for the management approach known as management by objectives.
- *Information for stakeholders*. This is particularly important at the strategic and normative levels, where relationships with the business environment are largely shaped.

– *Legitimating function*. Information about the type and extent of a company's entrepreneurial goals ensures its credibility and acceptance in the public sphere. This applies in particular to information about social and ecological goals, as well as their significance for the public and their effects on third parties.

Entrepreneurial goals are the result of a goal-formation process by owners and managers (Schierenbeck 2000: 57–8), who consider alternatives and select those that appear most appropriate and realistic and have the best prospects of being successful. Outside stakeholders may attempt to influence the goal-formation process in their own interests. The extent to which they succeed depends on the company's policy and culture, as well as on the degree to which stakeholders can exert influence. There are two important requirements for formulating goals:

– *Feasibility*. Goals must be formulated such that it is possible to achieve them with the resources available.
– *Organisational match*. Since goals must be feasible, they must correspond to the competences and areas of responsibility assigned to the company's managers.

The operational quality of goals plays an important role (Schierenbeck 2000: 77–8). Goals are formulated in an operational way if they correspond to the following criteria and requirements:

– *Extent*. A limited extent of goal achievement defines a specific aspiration level that is intended to be achieved. If goals are formulated in an unlimited way (minimum or maximum goals), alternative options for goal attainment and the conditions under which the maximum or minimum can be reached should be indicated.
– *Measures*. A measure needs to be defined to assess the extent to which the goal has been achieved. This measure can be based on a cardinal, ordinal or nominal scale.
– *Time context*. The timeframe within which the goal is to be reached needs to be defined.
– *Responsibility*. Responsibility for achieving the goal needs to be made explicit; the organisational context and available resources for goal attainment have to be clarified.
– *Geographical applicability*. In companies operating with a territorial management and implementation structure, it is necessary to set geographically differentiated targets that adjust to differences in the external conditions.

General economic performance goals relate to all types of entrepreneurial activity and measure the commercial and financial success of companies. General criteria used to assess business success are profit, return on sales, profitability and cost-effectiveness (see Figure 4.7). These goals serve not only to guide the

Profit = earnings – expenditure

$$\text{Cost-effectiveness of sales} = \frac{\text{Profit}}{\text{Turnover}} * 100$$

$$\text{Cost-effectiveness} = \frac{\text{Profit}}{\text{Capital invested}} * 100$$

$$\text{Profitability} = \frac{\text{Return}}{\text{Costs}} * 100$$

Figure 4.7 Ratio for measuring general business goals

financial management of the company, but also for communication with investors via the stock markets or banks and bond issuers. For that reason, accountants have developed, in accordance with the prevailing legal regulations, rigorous standards for financial indicators so that they can provide unbiased information to their clients.

Profit shows the financial result of business activities and is calculated as the absolute amount resulting from the difference between income and expenditure. Profit, of course, is necessary for the company's continued existence and operation. Return on sales represents the ratio between turnover and profit. Other important indicators are the profit margin and profit-turnover ratio. Knowing the level of return on sales is important because it is not the level of turnover that decides a company's success, but the profit obtained through the turnover.

Profitability represents the level of financial return relative to capital invested in business activities. A company's profitability provides investors with important information and allows comparison with alternative types of investment. Return on assets (ROA) or return on investment (ROI) indicates the ratio of profit to total capital invested. Return on equity (ROE) represents the ratio of profit obtained to equity capital invested (Schellenberg 2000: 150–1; Seiler 2003: 22–3).

Cost-effectiveness measures the efficiency with which available input resources have been used in creating output. Maximum profit and maximum profitability are achieved when the available resources are used in accordance with the economic principle. Three versions of the economic principle may be distinguished:

– *Maximum principle*. The greatest possible benefit (output) is achieved with a given quantity of resources (input).
– *Minimum principle*. The cost in resources (input) required to achieve a specific benefit (output) is kept at the lowest possible level.
– *Optimum principle*. The ratio between benefit (yield) and input resources (costs) is kept as favourable as possible.

Material business goals are sector and company specific. They are related to the company's objectives and specific management areas, and to the input and output processes for the production of goods and services in which it is engaged. Distinctions may be drawn among performance goals, financial goals, management and organisational goals and social and ecological goals (see Figure 4.8).

Material performance goals specify the way in which the company is run. They are related to the production of goods turnover and specify which products and services will be supplied to which markets. They determine the resources, locations and technology for developing, producing and marketing products and services. *Financial company goals* determine the financial business framework and relate, for example, to solvency (liquidity), capital structure, relative share of equity and debt and the formation of financial reserves. Overall, performance and financial goals determine what needs to be achieved in a company or business.

Management and organisational goals provide statements about the company's capacity to operate successfully, the ability of owners and managers to solve problems, the responsibilities of managers and staff and the organisational

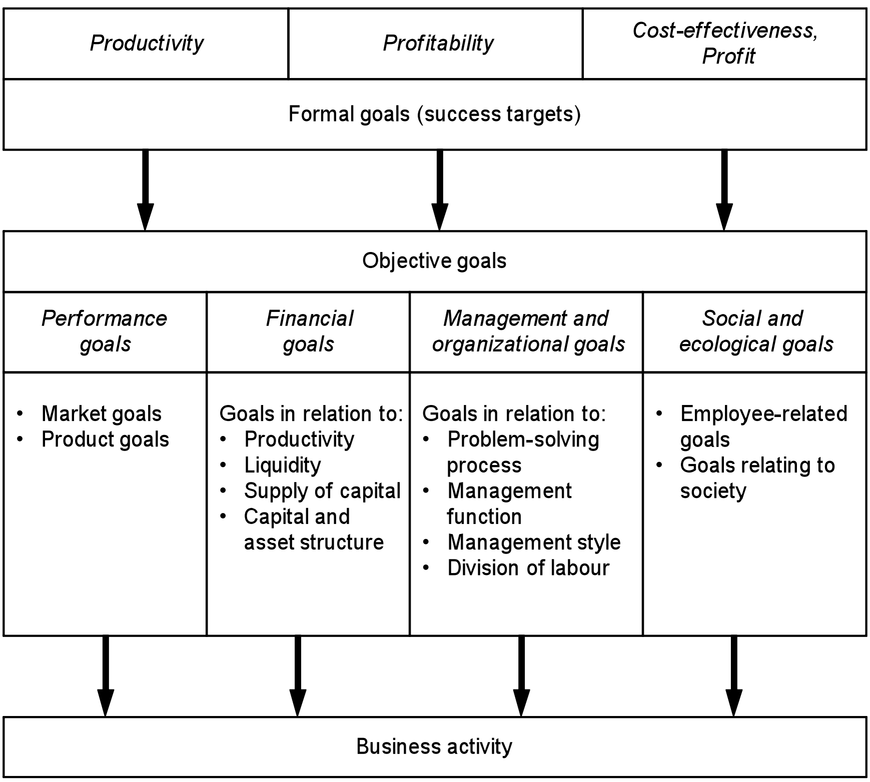

Figure 4.8 Overview of material business goals

Source: Thommen 2007: 122

structure and functional processes through which the company operates. This involves prioritisation of management issues and decision-making processes, definition and demarcation of management responsibilities and development of a suitable leadership style based on effective collaboration among employees and business units. Altogether, management and organisational goals characterise the ways and means in which the economic and financial performance goals will be attained.

Social business goals add a moral and ethical aspect. Since the employees of an enterprise derive their livelihoods and personal satisfaction from their positions, they have their own legitimate values and interests, which are protected by contractual and legal provisions but also need to be acknowledged, supported and respected. Social goals relate to issues of fair pay, working conditions, safety, job security, career development and having a say in pursuit of business goals.

The effects of business activities on the environment, and thus the importance of *ecological goals*, are increasing in the economy. This type of goal has been important for a long time in wood production and forest management in Central Europe. The resulting requirements include choosing tree species appropriate to the site, avoiding clear-cutting and protecting endangered species. Today, ecological goals have become even more important, considering the public interest in biodiversity, protection of nature and landscape and climate change mitigation.

There is a relationship of means and ends between general economic performance goals and material business goals – in other words, material goals are the means by which economic success is achieved. There are means-ends relationships within material goals. For example, wood production and multifunctional forest management are achieved by practising specific forms of silviculture. At the same time, an appropriate investment regime, an effective field organisation, ecological working processes and suitable technical equipment are needed to reach the material goals.

The relationships between various entrepreneurial goals may be complementary, indifferent or competing in nature:

- Relationships between goals are complementary when achieving one goal has positive effects on the achievement of another. For example, avoiding product waste can lead both to a higher yield of raw material and to lower costs for waste disposal and recycling. Higher productivity on the one hand and better use of materials on the other are complementary goals here.
- An indifferent relationship between goals exists when achieving one goal has no effect on the achievement of the others. Establishing recreational facilities in a forest usually has minimal or no effect on the productivity of timber in forest stands.
- Goals are in a competing (trade-off) relationship when the achievement of one goal obstructs that of another. Typical competing goals are the owners' goal of achieving profits and employees' demands for increased pay; another pair of competing goals is maximising wood production and conserving biodiversity.

When goals are in competition, priorities for the company as a whole have to be determined. It is necessary to distinguish and reconcile major and minor goals in formal decision-making processes, or on a case-by-case basis by the managers responsible. Defining effective and efficient means-ends relationships leads to entrepreneurial hierarchies among individual goals, arranged according to their importance. A distinction between major, intermediate and more specialised goals often corresponds to organisational structures and human resources distribution patterns. The goals set for functional management units or regionally operating divisions represent means for achieving the higher-level company goals.

Formulating an operational and consistent goal system allows rational entrepreneurial action, as the system can then be applied to precisely formulate quantitative and qualitative tasks and outputs. The formal structure of goal systems can be assessed using various criteria:

– *Order*. The relationships among goals have to be clarified. This applies both to their hierarchy and to the setting of priorities.
– *Consistency*. Goals should be consistent and coordinated with each other. Conflicts between goals may nevertheless arise, but the important point is that there are clearly determined procedures for conflict resolution.
– *Completeness*. Important issues, targets and tasks should be addressed by effective business goal systems. Gaps and grey areas lead to false priorities and to manifested or hidden conflicts.
– *Topicality*. Goals systems should reflect the current state of consensus building in companies; they should not include obsolete goals or goals that have already been abandoned.
– *Transparency and verifiability*. A goal system should be clear and transparent. Goals should be capable of being verified through written documentation.

Goals and strategies have a reciprocal relationship. The development of strategy leads to determining the goals that need to be reached in order to implement it. And achieving important business goals requires that they are well integrated in a consistent and effective strategic framework. The approach to formulation of a competitive business strategy, developed by Michael Porter and other colleagues from the Harvard Business School and presented in Figure 4.9, shows how strategy, goals and policies are interconnected (Porter 2004b: xxiv–xxv).

In the centre of a business strategy are the goals that determine the economic and material objectives and the ways and means (methods) in which a company is going to compete. The spokes indicate the major fields of business domains and the policies that need to be pursued to reach the goals. Policies that relate to major activities along the value-added chain are: (1) the choice of a product line and target markets; (2) the ways and means of satisfying demand (marketing, sales and distribution); (3) production (manufacturing, labour and procurement); and (4) functional policies (research and development, finance and control). Depending on the nature of the business, the specification of goals and policies in different economic branches and business domains vary, but all are necessary within a

Figure 4.9 The wheel of competitive strategy

Source: Porter 2004b, Figure 1.1, p. xxv. Reprinted with the permission of Free Press of Simon & Schuster, Inc., from *Competitive Strategy: Techniques for Analyzing Industries and Competitors* by Michael E. Porter. © 1980, 1998 by the Free Press. All rights reserved.

structured and coherent strategic framework. And just as a wheel is made to turn and roll in a desired direction, effective strategies are put in motion to react to changes in a competitive business environment.

4.1.6 Considerations influencing goal setting in forestry

The principles of modern management approaches are applicable to all organisations, enterprises and economic sectors, but the particular opportunities and risks are sector-specific. They are determined by strengths and weaknesses of a company and by the challenges and threats of its business environment. This implies that the choice of management tools and analytical processes depends on the specific conditions of a company's internal and external environment. Options for setting and implementing business goals are thus determined by many interdependent factors, the significance and weight of which are constantly changing. To respond adequately, managers must systematically analyse the context in which the company operates. Assessing and taking advantage of the possible scope for action requires taking into account internal factors as well as the forces influencing economic opportunities from outside.

Important considerations that are relevant, for instance, to *entrepreneurial action in forest management and wood production* are the following:

- the relatively long time required for production, compared with other sectors;
- the fact that a large part of the company's assets are tied up in the form of forest stands for long periods;
- the variability in the classification of products and their degree of maturity;
- frequent joint production and market offers of outputs; and
- interactions between production and productivity.

Long-term nature of forestry production: The time required for wood production in the northern hemisphere represents a special challenge for landowners. Value creation in agriculture and industry, in contrast, is much faster and allows shorter decision-making horizons. On the other hand, demand from customers in the forestry industry is subject to short-term market influences determined by new requirements, changing styles and technological innovations.

Tying up of business assets for long periods: In business terms, the management problem is that a large part of the forest capital is tied up for an extended period. The rate of inventory turnover and the degree of flexibility for planning measures are largely predetermined by considerations of sustainability. As with today's economic setbacks, short-term business success and its rewards are difficult to achieve with long cycles of biological production. Forests simply do not respond to the rapid changes a modern management approach might generate.

Variability in the classification of products and their degree of maturity: Individual trees and entire forest stands provide a variety of outputs. A tree may be used as industrial wood for pulp and paper at an early stage or produce high-quality sawlogs when mature. A forest stand may be primarily defined as protective vegetative cover, yet its wood may be harvested under a restrictive harvesting regime and with appropriate sustainable silviculture practices. The maturity of the product is subject to temporal flexibility. Several options in multifunctional forest management for shaping the production programme of goods and services are usually available to a forest manager. The results that can be obtained with immediate uses have to be weighed against the potential future yield and the expected risks.

Joint production of outputs: Wood is harvested in the form of whole trees, and it is during the process of sorting species and quality grades that market demand for specific products – lumber from sawmills, paper from pulp mills – can be satisfied. However, joint production in forestry extends much further. Wood can be harvested in protective forests in mountainous locations, but the main output consists of cultivating and maintaining the protective forest cover. The same applies to forest tending that is carried out in connection with output goals involving the protection or conservation of nature, biodiversity and open space.

Interactions between production and productivity: Wood harvesting and forest management have direct effects on the remaining forest stands and their future production potential. Depending on current price–cost conditions, thinning in young forest stands may involve the production of material whose commercial value barely covers the costs. However, such interventions increase the future value of the remaining trees. Conversely, harvesting in older stands yields larger amounts of higher-quality types of wood. At the same time, it creates areas for reforestation, from which no commercial yield will be obtained for long periods. The associated costs have to be taken into account in entrepreneurial decisions when calculating products' selling prices. A similar decision-making problem arises when areas are newly afforested and the rotation times are long. These forests require high levels of initial investment and tie up capital for long periods – consequences that have to be taken into account in relation to imputed interest charges.

An important point in decision making in forestry is the overlapping time horizons for using and managing forest resources. Working with different time horizons in forest management and wood production and coordinating them is possible only to a limited extent. The consequences of strategic and long-term land-use decisions versus short-term operational wood harvesting and silvicultural interventions are difficult to be assessed. The same applies to product policy: it is difficult to predict what dimensions and quality grades of wood are going to be in demand 10, 40 or 80 years from now. Which tree species will be rare and which will be plentiful? What role will wood play as a renewable resource, as structural building material, as a source of renewable energy and as raw material for the chemical industry? Despite the transgenerational implications of sustainable forestry, entrepreneurial action cannot be seen in isolation and requires management decisions now, based on the best available information, constant feedback processes and critical assessments of entrepreneurs and managers. At the same time, the logic and dynamics of markets and customers are the decisive factor for wood-based enterprises, just as they are for other economic entities.

The long-term nature of sustainable production, particularly against the background of the increasing integration of the European forest sector into international markets, requires forest owners to respond to changing economic conditions and more diversified patterns of land tenure. When it comes to entrepreneurial decision making, the unique challenges of forestry are several: the close interconnection between ecological, technological and economic factors in managing renewable natural resources; the financial implications of producing a combination of many goods and services; the extended areas of forest cultivation; and forests' susceptibility to external, unpredictable natural risks and calamities. Sustainable forestry thus represents a special management challenge and requires appropriate conceptual approaches and management tools. The successful production and silvicultural practices of the past need to be combined with today's efficient commercial practices and management principles.

Biodiversity, environmental protection, nature preservation and countryside conservation have become requirements for continuing forestry activities and profitable wood production. Forcefully articulated by a largely urban population and by NGOs, these environmental demands need to be carefully examined in forest management planning. Resistance to felling and wasteful use of tropical virgin forests have in some cases reduced market demand for certain high-grade species and led indirectly to the promotion of wood production in reafforested areas and wood plantations. In the wood-processing industry, environmental standards increasingly impose the obligation to procure timber from sustainably managed and, in many areas, multifunctional forests. This obligation is now incorporated into the mission statements of farsighted and competitive companies and explicitly codified in their business policies. For example, the growing demand for recycling of waste paper and paperboard, which has been a low-cost raw material available in great quantities and close to markets, has led to a marked change in production and consumption processes.

4.2 Personnel management

4.2.1 Willingness and ability to work

Personnel management, a fundamental task for managers, is a cross-sectional task that intersects with other management activities (Becker 2009; Luczak and Volpert 1997). Workers' participation and the regulations applying to staff representation play an important role in human resources management. The economic success of companies and businesses depends to a great extent on their employees' commitment and willingness to work, as well as their qualifications, abilities and expertise. Good qualifications, high motivation and active participation of managers and employees contribute to a company's success and make the difference between a good company and an outstanding one (Collins 2006).

The central task of human resources management is to find a productive way of balancing and channelling the tensions between the company's goals, employees' individual goals and general social goals and standards (see Figure 4.10). The

Figure 4.10 Target dimensions in human resources management

challenge lies in influencing employees' behaviour in such a way that the company's goals are reached while creating a professional environment in which they can pursue their own personal goals and develop their own personality (Ulich 2005). It is only when one succeeds in harmonising the employees' goals with those of the company that the workplace allows effective collaboration among all staff and ensures their personal satisfaction. And in the long term, it is only satisfied employees who can make the best possible contribution to the company's success.

The tasks involved in personnel management can be divided into two broad areas:

- Designing systems that provide a framework for regulating human resources issues. This includes establishing the company institutions and information systems needed to create effective incentives, devise fair pay schedules, carry out staff planning and select and recruit personnel.
- Qualifying employees at all levels to exercise their responsibilities in a professional manner, promote a productive and cooperative work atmosphere, ensure a transparent information flow and provide adequate staff training and human resources development. These aspects are dealt with in Section 4.2.5.

Certain conditions have to be met for employees to fulfil the tasks and to attain their targets:

- Employees must have the necessary premises, materials, tools, safety equipment and training, authorisation to act and make decisions and other objective prerequisites.
- Employees must have the knowledge and personal capacity required to carry out their tasks.
- Employees must be willing to make the effort to do the work for which they have been engaged.

Because of the growing complexity of business tasks, standards for work performance have been constantly increasing. Ability to work involves factors that affect the type, quality and quantity of work that can be done by an employee, such as his or her suitability, competence and professional experience. 'Suitability' or 'qualification' usually sums up the characteristics that enable an individual to carry out a specific task or activity. Four areas of suitability can be distinguished:

- knowledge and understanding;
- mental abilities to apply information, understanding and experience to specific tasks;
- physical abilities, such as dexterity and strength, and skill in using them; and
- personality characteristics such as perseverance, ability to concentrate, patience and ability to communicate.

Working behaviour is a response to the reality that employees perceive and experience. Both may be influenced by interests, motivational structures, personal knowledge and the type and quality of specific stimuli. The combination of factors in an employee's positive and negative experiences at work plays an important role in his or her working behaviour. During the course of their employment, individuals develop a conception of themselves and a self-assessment of their own performance, values and qualifications. How job-related experiences shape the self-concept of a collaborator is determined by the work situation and individual personality characteristics. Social values and attitudes to work, derived from school and family, play an important role. The same is true for economic circumstances that influence employees' attitudes to their work, notably the unemployment rate and the likelihood of getting another job.

Performance-related factors can be differentiated as willingness to work and ability to work. These factors are interdependent and influence each other. Willingness to work is influenced by role expectations and behavioural standards that are established by a company and the external social environment. These specify how members of groups should behave in specific situations (Berthel and Becker 2007: 40–4). Determining factors include motivation, attitudes and values, personal preferences and expectations, personal experience and perceptions, as well as individual personality. Work performance and willingness to work are decisively influenced by a group's standards, not just by individual stimuli offered to an employee.

Motivation is the behavioural disposition to be willing to attain specific goals. Extrinsic motivation is present if the individual behaviour is initiated and guided by external stimuli, such as wages or salaries, profit sharing, social services, job security and opportunities for promotion, career development and professional prestige. Intrinsic motivation is present when behaviour is based on the employee's own personality and disposition. Intrinsic motivation may include a desire for social contacts, the recognition associated with achievements, enjoyment of meaningful and varied work and self-fulfilment through work in general. It is difficult to distinguish between external stimuli and inner motivations to produce work without knowing the individual and his or her reaction in a specific situation. There are both mutually reinforcing and mutually detrimental relationships between extrinsic and intrinsic motivations.

Attitudes have a considerable influence on people's willingness to work. They are acquired dispositions in relation to specific circumstances and objects, which remain relatively stable over time. In contrast to motivations, attitudes and values are more general in nature and less directly related to a particular action. Specific circumstances, objects or situations are evaluated on their basis, and the result then influences a person's observable reactions and behaviour.

Values and norms are assumptions about the benefits of achieving a goal or the effects of a specific form of behaviour; they influence how stimuli are perceived, selected, compared and prioritised. Like motivations and attitudes, they are influenced by an individual's sociocultural conditions. Similar processes take place in companies and personal life. The result of such processes is known as socialisation – that is, adaptation to specific social conditions. This can be seen, for instance, in the behaviour of employees who have worked at a company for a long period and have gradually developed a focus on specific material and immaterial stimuli. It leads to the recognition of principles and standards that are experienced as being useful, appropriate and effective. Acquired attitudes of this type are often associated with specific positions in a company or with professional education and experiences, or they may be characteristic of certain business activities and branches of the industry.

Expectations influence employees' assessment and judgement of the extent to which their performance will be attributed to their own efforts and abilities or to other causes. This type of assessment is based on an employee's own experience as well as that of other workers and requires a clear perception and understanding of the difficulty of the tasks and the employee's ability to accomplish them. An expectation of associated consequences is based on the connection that an employee sees between his or her own work and the achievement of personal goals, such as promotion. The attitude of expectation makes it clear that work and commitment are regarded by a company's employees as tools for achieving their personal goals.

Combined, such factors affect the intensity of work efforts. Commitment increases in proportion to intended positive perception of the activity, improved conditions for the employee's work, favourable expectations relative to the effort actually made and substantial and verifiable performance improvements that can be experienced by the employee as well as by his or her colleagues. Interactions among the factors determining willingness to work are shown in Figure 4.11.

Assessment of suitability is based on a comparison between the tasks associated with an established work position and the employee's achievements. Comparing job specifications with an employee's personal suitability profile presupposes that the significant characteristics of a particular work position are clearly defined and that accomplishment of the tasks can be definitively attributed to the responsible individual. Another important aspect is whether suitability characteristics that employees lack can be acquired in an appropriate time and with reasonable cost and effort.

The behaviour of staff towards work commitment and responsibilities can be seen in a broader perspective of the hierarchy of human needs, developed by Abraham Maslow (1954). In his paper, 'Theory of Human Motivation', published in 1943, and later book, *Motivation and Personality*, he explained factors that influence human behaviour and values, attitudes in personal life and in working together, as well as in cooperating constructively in organisations and society.

Maslow's theory is usually shown in the form of a pyramid, which starts at the bottom with a first level of the most immediate physiological needs: air, water and food, clothing and shelter, sleep and rest and sex. The second level relates to personal and collective needs, such as safety of the body, health, employment, resources and property. Level three concerns the human need for love and belonging, expressed, for instance, through friendship, family and sexual intimacy. The fourth level addresses personal esteem, which manifests itself through self-respect, confidence, achievements and respect both of and from others. On top of the pyramid, the fifth level is the level of self-actualisation as expressed, for

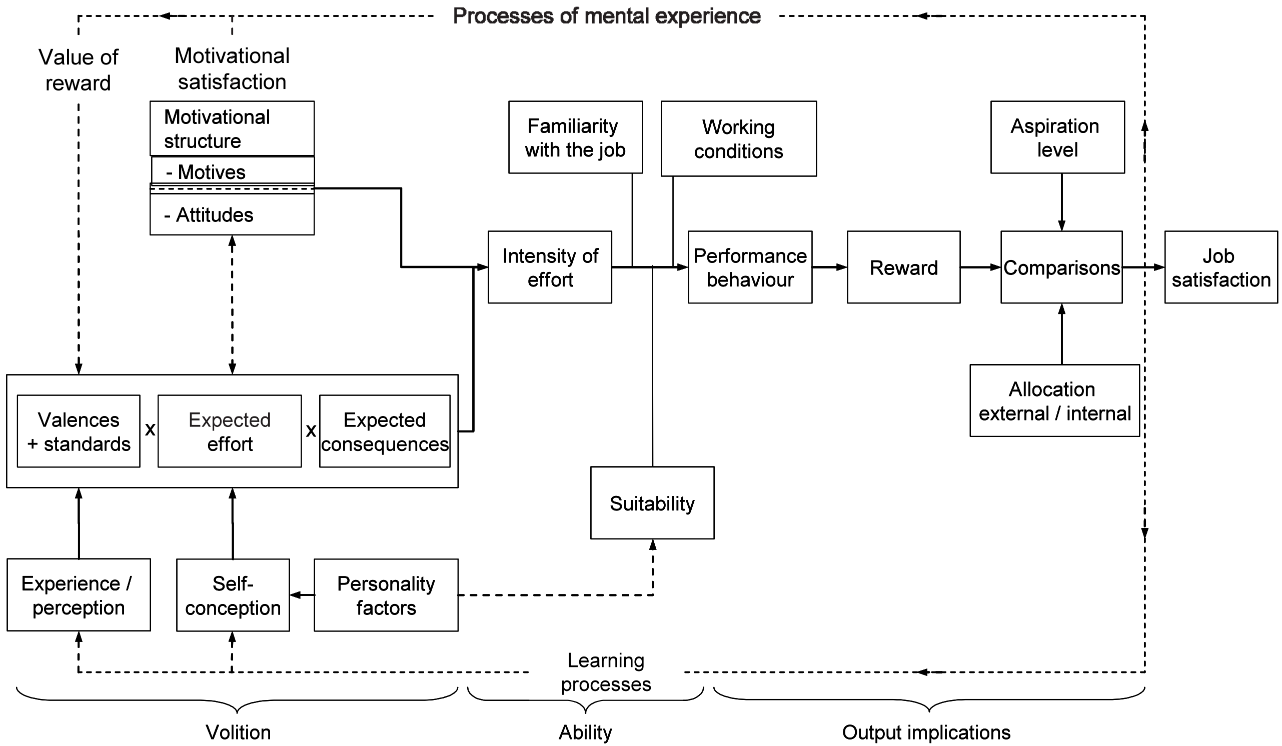

Figure 4.11 Interplay among performance determining factors

Source: adapted from Berthel and Becker 2007: 39, © 2007 Schäffer-Poeschel Verlag für Wirtschaft, Steuern, Recht in Stuttgart.

instance, in a person's capability to articulate his or her essence in moral and ethics, creativity and spontaneity, lack of prejudice and acceptance of facts.

4.2.2 Working conditions

Working conditions have a strong influence on work performance. A distinction needs to be made between conditions that can be influenced by the company and those that cannot; here we focus on the former. These conditions are the external factors that allow an employee to carry out tasks efficiently. A given job specification has implications for the appropriate working conditions (Berthel and Becker 2007: 422–3, 445–6, 540). These affect the working process, the organisation of work groups, regulation of working hours and equipment and installations provided in the workplace. Important measures include improving the cost-effectiveness of processes, designing workplaces that are functional and economical and avoiding unnecessary individual stress, frustration and strains. The design of working conditions covers ergonomic, psychological, organisational and technological measures.

The aim of ergonomically appropriate workplace design is to optimise working processes, conditions and tools while taking human capacities into account and allowing productive and efficient working organisation (Bullinger 1994).

- *Anthropometric* workplace design involves adaptation to the size of the human body. Workplaces should be as stress-free and nonfatiguing as possible. This involves coordination of movement distances and spaces, and the functioning and arrangement of tools and control panels.
- *Physiological* workplace design coordinates working methods and working conditions with human capacities and abilities. Regulation of environmental lighting, air-conditioning and noise reduction plays an important role.
- *Psychological* workplace design creates a comfortable and stimulating working environment through visual and acoustic measures, as well as by avoiding monotony, stress and excessively easy or excessively difficult tasks.
- *Information technology* organises task fulfilment to make processes easier, speed the transfer of required information and reduce potential errors in the use of information.
- *Safety-related* workplace design complies with health and safety standards, prevents work accidents and takes other measures to maintain and protect employees' health. Responsibility for safety at work and for health protection primarily lies with company management.

Designing appropriate working conditions involves making use of specialisation and efficiency advantages. To increase employees' motivation and productivity, work tasks should be interesting, varied and adequately demanding (Scholz 2000: 515–16):

- *Job rotation* involves systematically exchanging workplaces and varying tasks both to expand employees' experience and knowledge and to avoid monotony and repetitive stress.

– *Job enrichment* involves qualitative broadening of job profiles, with higher-quality activities that provide employees with more challenges and allow them to acquire additional skills.
– *Job enlargement* refers to the subdivision of the working steps by adding equivalent tasks and giving employees a more comprehensive range of tasks.
– *Semi-autonomous work groups* have defined responsibility for the preparation, planning and execution of group activities according to determined production and performance standards. When conditions are right, this approach can stimulate a better quality of work, reduce absenteeism and increase motivation.

Regulation of working time includes schedules of working periods, daily working hours and required breaks. The distinction between fixed and flexible working hours is important here. Work models include the following possibilities (Berthel and Becker 2007: 430–1):

– flexible work hours (flexitime);
– variable working hours;
– shift work, with alternating types of shift and flexible shift lengths;
– part-time working arrangements;
– annual working times, with minimum and maximum hours per month; and
– job-sharing arrangements.

Technological considerations regarding workplace design include the complexity of production technology, the extent of mechanisation, new information technology and efficiency and quality of production standards. Intelligently applied, workplace design can make working conditions easier in many areas; reduce difficult and dangerous work, tiring routine activities and demanding work operations; and adapt working processes to employees' abilities. The forest sector has seen considerable technological progress through mechanisation and protection from sound and vibration. Self-managed teams now control the use of machines worth millions of Euros, not just driving them but making operational decisions about employment and schedules.

Peronnel management is concerned with the various components of remuneration from four principal points of view (Berthel and Becker 2007: 447–8):

– *Fair pay*. Salaries and other payments to employees should correspond to the contribution the employee makes to achieving business goals (the principle of equivalence). This is measured by due claims resulting from the tasks assigned and performed.
– *Incentives*. Built into the company's payment system, incentives influence behaviour, increase employees' interest in their work and performance and lead to increased labour productivity.
– *Personnel costs*. Wages, salaries and benefits are subject to company planning and controlling procedures and the necessary cost information in the human resources field serve as aids to budgeting.

– *Sources of personnel costs*. These costs are usually an important part of total expenditure, and it is indispensable to analyse in detail such sources as labour and management inputs.

Salaries and other payments to employees include direct remuneration, profit-sharing and fringe benefits (social benefits). Remuneration payments include time pay (day work), performance-related pay, premium bonuses and monthly salaries and wages. Two important questions arise when differentiating remuneration:

– Which payment methods are used for the different categories of employees?
– What are the principles by which individual wage rates and salaries are set?

In *time pay*, the period of time worked is the basis for remuneration. Employees do not influence their pay level directly except through overtime. They have no immediate incentive to increase productivity per time unit; on the other hand, there is security against performance-related variations in pay. Time pay avoids creating incentives for workers to take health and safety risks. Some modifications are possible through combining time work with incentive bonuses based on performance assessment.

In general, time work is appropriate in these circumstances:

– The work requires high-quality standards.
– Work output is not measurable, or only with difficulty.
– The content of tasks is frequently changing.
– The working process is often interrupted.
– Most of the work involves purely checking tasks.
– Employees only have a slight influence on productivity per time unit.
– Working processes tend to involve health and safety risks.

Piecework pay is based on a demonstrable connection between the intensity of work and the resulting amount of work achieved. In *cash piecework*, the level of remuneration depends directly or largely on the quantity produced (e.g. a harvesting team paid per cubic metre harvested). In *time piecework*, time requirements per quantitative unit are set; when these are undercut, it leads to an increase in pay, and when they are exceeded, it leads to a reduction in pay. The two types of piecework are closely connected, and one can be converted into the other. The basis for calculating the actual level of pay is the basic piece rate, which consists of a minimum pay rate and a bonus increment. The assumed basic rate is the hourly rate of an employee at a normal output rate that needs to be determined by scientifically based systematic work studies.

An indispensable prerequisite for staff remuneration based on performance-related pay is that the quantity produced can actually be influenced by the employee. If this is ensured, the performance incentive gives employees an opportunity to increase their earnings through above-average effort. However, performance-related payment systems are associated with a risk of poor-quality work, excess stress on employees and neglect of industrial safety. To prevent this, an upper limit can be set on piecework rates; a lower limit at least partly protects the employee's earnings. Because wages are largely dependent on the amount of work, special measures need to be taken to provide for quality assurance. In the field of wood harvesting, for example, this is the usual procedure in the piecework agreement for wood skidding. If the remaining stand is damaged, pay cuts are made. Thorough training and inspection may be necessary to ensure that safety rules are not ignored if piecework remuneration systems might encourage shortcuts.

Bonus payments are a flexible and differentiated method for designing wage systems. They consist of a requirement-related basic pay rate and performance-related bonus payments. In contrast to piecework, bonuses can be awarded not only for additional quantity output, but above all for maintaining the quality of work (quality bonuses), for saving raw materials or for increasing use of production capacities (usage premiums). Premium bonuses are appropriate for specific incentives, quality assurance purposes and increasing employees' commitment and production efficiency. Criteria for differentiating wages and salaries can be established depending on requirements, performance and context. When determining requirement-related (basic) pay, it is necessary to measure and evaluate the degree of difficulty of the work. The performance-related component is based on the average output capacity of a group of workers, or on specific tasks carried out at a workplace (Scholz 2000: 735–6).

In many areas of industry and public administration, performance-related output is measurable and can be assigned to individual employees, work groups or teams. It is more difficult in connection with working processes and work that contributes generally or only indirectly to a measurable output. Along with other factors, such as the extent of individual employees' responsibilities, this is one reason why success-oriented systems for staff remuneration are more widespread in many fields of management. For example, financial incentives for managers who are not involved in physical production may take the form of management bonuses, commissions and profit sharing.

Participation and cooperation rights: Regulations that apply to employees' participation and cooperation rights may be based on public law, contractual agreements between owners and workers' associations (e.g. through binding wage and salary conventions established by trade unions) or through voluntary agreements between employers and employees.

Workers' participation and cooperation rights in company decision making have several purposes:

- to protect employees, who are generally in a weaker position compared with employers when negotiating employment contracts and working conditions;
- to establish stable conditions for company policy making by defining a behavioural and procedural framework for dealing with differences of opinion and conflicts between parties;

- to allow employees to take part in consensus development by having a right to be consulted on and contribute to regulating operational measures (e.g. regulations for workplaces and working hours);
- to allow employees to participate in strategic decision-making processes that affect the company as a whole and thus their own futures.

In general, legal and collective bargaining standards, including options for workers' participation, set guidelines for how employers treat employees. Such guidelines contribute significantly to good and productive working conditions. Workers' participation rights in particular enable employees to affect their own working conditions. In the majority of cases, the interests of employers and employees are more balanced than would be the case without any worker participation.

However, establishing and observing legal and contractual regulations for employee participation do not automatically constitute good human resources management. The applicable standards only specify a procedure for reaching decisions. Intelligent ways of organising employment conditions demand joint and consensual efforts from both the employer and the employees. The quality of human resources management at a particular company can ultimately be judged only by considering the balance that has been reached between their divergent interests.

Employees' and workers' associations (trade unions) and employers' associations play an important role in connection with participation and cooperation rights. Trade unions and other professional associations, with voluntary or corporate membership, represent collective interests relative to individual employers, employers' associations, state institutions and other social groups. They may be organised according to job categories, industrial sectors or geography. Umbrella organisations represent their members across various sectors and at the national level. Employers' organisations have similar organisational and structural arrangements.

Structures for workers' participation are seen in many countries, but there are substantial national differences, as the following criteria indicate (Niederhoff 2005):

- Basic types: purely employee-elected representatives, mixed representatives or trade union representatives.
- Legal basis: legally established regulations, based on a collective labour agreement or voluntary agreements between employers and employees.
- Threshold value: the minimum number of employees at which an employee-elected representative committee must be set up.
- Enforceability: regulations stating whether the employees' representatives have participatory rights, veto rights or initiative rights.

At the EU level, regulations make it possible to form a European works council under specific conditions. These are important for cross-border mergers and relocations of company headquarters within the EU. At the national level, there are substantial differences both in the extent of workers' participation rights and in the major emphases placed on them.

Compared with other European countries, Germany has a very extensive system for workers' participation in company decision making. It is regulated in detail and connected with a substantial number of organs for employee representation. Central elements of German collective labour law can be summed up under the terms freedom of association, autonomous wage bargaining, right to industrial action, framework for industrial relations (in a company), company participation and representation of interests to the state. Participation at the site and company level by groups of employees, covered under the term collective labour law, is distinct from the legal basis for participation at the workplace, which is referred to as individual labour law (Däubler 2004; Scholz 2000).

Freedom of association is guaranteed by Article 9 of the German Basic Law (constitution). This allows employers and employees to form associations to promote conditions for labour and business. Freedom of association is the legal basis for the formation of trade unions, professional associations and employers' associations. Trade unions are in an unusual position, as only they have the right to make collective wage agreements on behalf of employees (autonomous wage bargaining) and take industrial action. Because the right to strike is an extremely effective tool for industrial action, the standards applying to the legality and conduct of strikes have special importance. These are largely regulated not by law but through court decisions, particularly those of the Federal Labour Court. Strikes are defined as the last resort in pay conflicts. In addition, 'political strikes' – that is, stoppages of work intended to influence the legislative process – are illegal. The right to strike thus not only gives employees an opportunity to assert their interests, but also protects employers and thereby contributes to stable business conditions.

Participation in plant-level concerns allows employees to express their interests to the employer through elected representatives, who are members of the works council (or in public entities, the staff council). The existence of works councils is a special aspect of employment law in Germany and Austria. Members of works councils have obligations only towards their legal duties, are largely protected against unlawful dismissal and cannot be obliged by trade unions, for example, to carry out any specific activities. Rights to participatory consultation apply in connection with job advertisements, selection guidelines, social plans for alleviating hardship during industrial restructuring, social matters and individual staff measures. Rights to participatory activity exist, for example, in connection with personnel planning, job advertisements and business matters and restructuring.

Members of the works council, as representatives of the employees, may address a large number of company issues and can develop their own positions and ideas. Particularly in relation to difficult business decisions, such as closures and restructuring, they can contribute to managing the challenges by confirming the operational necessity for the proposals made by the employers and explaining the decisions to employees. The coordination processes needed here may be time consuming. However, strategic entrepreneurial decisions, particularly with regard to investments, relocations and closings, cannot be prevented by works councils.

Participation rules in the private sector apply to public limited companies – that is, limited-liability and joint-stock companies. In companies with more than 2,000 employees, half of the board of directors consists of employee representatives. In companies with 500 to 2,000 employees, the employees form one-third of the members of the board of directors. Workers' participation has practical value in that employee representatives receive extensive access to company information (reducing information asymmetry). However, operational and business secrets may not be passed on to third parties. By contrast, decisions taken by the 'capital side' in the board of directors are usually not obstructed by the employee representatives.

There are minimum standards – for example, for periods of notice for dismissal and the employer's duty of care – which may not be undercut in an employment or service contract. Legislation and collective bargaining agreements ensure that employees and selected groups of employees have additional protection. Examples include regulations on sick pay, holidays and special protection measures for minors, mothers and disabled employees. An employee has the right to be heard and to make proposals on matters affecting his or her own person or workplace. This includes the right to see one's personnel file and the right to make suggestions regarding how one's workplace is organised. The employee also has the right to receive information about any work-related risks. Minimum standards for terminating employment are defined, such as minimum periods for giving notice and regulations regarding protection against wrongful dismissal.

4.2.3 Personnel planning

The purpose of personnel planning is to calculate the future staffing levels needed to achieve the company's goals – in terms of quantity, quality and time horizons (Berthel and Becker 2007: 167–6, 439; Hentze and Kammel 2001). From the qualitative point of view, this involves comparing workplace requirements with the available range of training and educational profiles, qualifications, attitudes and experience of staff that can be recruited. From the quantitative point of view, the number of employees has to be calculated, and on the basis of differences between actual and target figures, the necessary human resources measures are taken.

Personnel planning takes place at various levels (company, business area and workplace) and for different time horizons (short, medium and long term). Gross staff requirements, indicating the overall target staffing level, are calculated from the total number of employees required and according to quantity and quality. Net staff requirements are calculated by comparing the target and actual levels – that is, by comparing the gross staff requirements with the actual number of people currently employed. In the short term, the net staff requirement is determined mainly by changes in the current staff level. In the long term, it is mainly determined by the company's development policy and its strategic targets. The following indexes can be used to assess staff requirements:

- turnover per unit;
- production quantities per employee;
- proportions of specific groups (e.g. male–female ratio);
- average age of employees;
- period of employment with the company;
- average sickness rate; and
- foreseeable fluctuation in staffing.

An important factor for quantitative considerations is the time required to carry out a specific volume of work. Relevant data can be calculated from ergonomic studies, and standardised assessment procedures have been developed in the field of industrial manufacturing. Assessments at the management level focusing on strategic and operational decision making and controlling activities are more difficult. Average times required for completing defined categories of managerial tasks, or evaluating the proportion of total working time required for specific management activities, can be calculated using activity sampling studies. The figures can then be extrapolated to other activities, by analogy.

In practice, assessing the extent of managers' tasks is based on time inputs, which are estimated on the basis of findings from analytical questionnaires and empirical observations. Global assessments of staffing patterns over the longer term require that human resources managers have considerable experience in making and interpreting such estimates. With regard to future staff development measures, prognoses regarding expected decreases or increases in employee numbers and changes in the technical and managerial job profiles are particularly important.

An analysis of the current staffing situation is the starting point for human resources policy, programmes and planning. It involves assessing the current staff in terms of functional levels, quality and quantity and comparing those factors with the expected future staffing levels. Important factors influencing staffing requirements are summarised in Table 4.1.

Industrial sectors and companies with seasonally varying work have special demands for short- and medium-term work planning. In forestry, for example, work processes and volume change from season to season with weather, silviculture and ecological considerations, and labour availability. The same applies to certain branches of the wood industry: companies directly related to the building industry operate at varying capacities in the different seasons. Employment conditions therefore need to be flexible to compensate for short-term undercapacity or overcapacity.

Qualitative planning is based on a comparison of job requirements and capacity building for new professional challenges. Planning tools include job descriptions and workplace specifications, which allow differentiation in accordance with vocational training, groups of qualifications and fields of activity. Higher

Table 4.1 Determinants of personnel requirements

Staff requirement components	*Factors influencing staff requirements*	*Subject of planning*
Quantity	Economic situation, trade cycle in combination with planned sales	Volume of work, categories of employees and staff, ratio between temporary (or agency) staff and permanent staff
	Period of work	Temporary and permanent staff
	Degree of mechanisation in combination with labour productivity	Work requirements and job profiles
	Fluctuation	Replacement rates
	Level of business organisation	Management requirements
Quality	Production (working) procedures	Content of tasks
	Rationalisation plans	Changes in tasks
	Job descriptions	Target qualifications
	Job qualifications (employees)	Actual qualifications
	Gaps in qualifications	Content of training courses
	Further training and education programmes	Changes in the state of actual qualifications
Time	Age structure	Timing of job transfers and replacements

Source: adapted from Berthel and Becker 2007: 233, © 2007 Schäffer-Poeschel Verlag für Wirtschaft, Steuern, Recht in Stuttgart.

managerial qualifications and employment in research and development demand particular attention to the qualitative aspects of human resources development. Efficient information systems are a prerequisite for competent human resources management that meets both the quantitative and the qualitative requirements. Staff appraisals evaluate the character traits – such as manual skills, intelligence, willingness to work and creativity – that are relevant to fill specific work requirements.

The recruitment of new collaborators is an important stage in renewing and expanding qualified staff on all levels of a company. In recruitment practices, candidates' abilities, educational profiles and work experience are compared against the requirements of the position to be filled and the company's overall policies and goals. Candidates are sought via appropriate media and specialised personnel consultant companies, formal applications are evaluated and personal interviews are conducted with potential shortlisted candidates; once a candidate has been chosen, an employment contract is prepared and signed. The new staff member is then introduced and initiated in the position's tasks and responsibilities.

The personal interviews with shortlisted candidates are of particular importance. This step demands a well-reasoned and structured approach, experience in personnel management, good preparation and sensitivity about what is said and what is not said. Several persons from the management side may participate to capture a range of impressions. Three stages of a well-structured job interview should be distinguished: the preparation phase, during which the available information from the candidate's application is evaluated; the actual interview, deriving personal and factual information from the candidate; and a final deliberating phase for making a decision.

A traditional job interview starts with a short presentation, followed by questions posed to the applicant; the interviewers then profile the organisation and describe aspects of the employment position. A more open form of interview gives the candidate better opportunities to describe his or her experience and express opinions on general business issues or the position; this usually provides more insights into the candidate's attitudes and ability to address a specific subject and communicate with others. 'How and why questions' let the candidate display his or her reasoning, experience and convictions and participate actively in the interview. A friendly atmosphere – which does not mean avoiding tricky and difficult subjects – helps both the interviewers and the candidate handle a difficult situation in a constructive manner.

Recruitment of personnel from different cultural backgrounds who have knowledge of various countries, speak more than one language and bring a variety of professional and educational experience can promote the development of an enterprise in an age of globalisation. It may as well pose problems, at least at an initial stage; managers in charge of personnel planning, recruitment and training of new employees need to reduce the risk of conflicts that may result from different values, attitudes, expectations and working habits. Diversity management is a useful, and in many ways a necessary, requirement in personnel recruitment.

Altogether, personnel planning and staff recruitment are central elements of implementing the management strategies of a company (Olfert 2011: 98). Human resource managers undertake the following tasks:

- determining whether positions will be filled through external recruitment from the labour market or filled internally through promotion of qualified employees;
- introducing and promoting social innovations, such as performance incentive systems and acknowledgement of employees' input into business improvements;
- introducing flexible working schedules, sliding work hours, job sharing and improved personnel capacity management;
- improving work productivity through communications technology, teamwork and increased formal responsibilities for working teams;
- improving the working environment and individuals' willingness to work through more transparent and cooperative relationships between management and staff;

– reducing labour costs through temporary layoffs, rationalisation and more effective combinations between labour, technology and equipment;
– creating more attractive working conditions and consistent personnel planning measures to reduce staff turnover; and
– improving salary systems through new standards of job evaluation and transparency about the level and composition of remuneration and benefits.

4.2.4 Personnel development

Personnel development focuses on measures of education, promotion and advancement that are systematically organised, practised and evaluated either by individuals or by an organisation (Becker 2009). The significant aspect of the term *personnel development* is that it places in the centre of its considerations the importance of the human factor, formed by individual workers operating with different levels of responsibilities. Managerial and executive staff and a workforce engaged in strategy implementation are valuable and creative driving factors of change in business development. In the English-speaking literature, the terms *human resources* and *human resources development* are currently used with a somewhat different connotation, putting emphasis on staff and collaborators as an indispensable resource factor in organising business activities. It is thus a broader and sometimes more diffuse concept that concerns personnel management strategies.

In personnel development, education may include professional and academic learning, in-service training and life-long learning, acquiring capabilities for new positions and gaining additional management insights – for example, through specialised master programmes (Becker 2009: 4–5). Promotion and advancement measures may comprise education and training for a new, higher position; cultural programmes for learning new languages and conducting business in other countries; courses in structured communication with collaborators and work teams; and in-service training on performance assessment and coaching practices. Advanced capabilities in organisational development may concern team development, project organisation, managing change and establishing operational communications and collaboration networks in staff development.

It may help to understand the many activities that can be considered personnel development in business by considering the links among qualifications, competence and performance as a system (Becker 2009: 6–15).

Qualifications in the present context can be analysed according to two criteria. Functional qualifications are the requirements needed to perform certain tasks and carry out responsibilities in a satisfactory and efficient manner. Knowledge, abilities and skills are functional qualifications. Extra-functional qualifications are actual or potential abilities that enable a person or team to have useful work inputs in other domains. These include such abilities as speaking foreign languages but also such intellectual abilities as communicating with other people, problem solving and developing alternative and creative approaches to an important issue.

Competence is an interesting expression with two important connotations. In the context of work science and psychology, it means foremost the capacity of a collaborator to mobilise the qualities necessary for performing a task well. In a more organisational perspective, however, competence means the formal right of a person to exercise the activities and responsibilities that are commensurate with the position and have been attributed to him or her. And obviously, there are important links between both meanings. One has to be competent to be formally entrusted with the right to exercise certain activities and responsibilities; and one can only use one's personal competences if one has been entrusted with the necessary formal competences.

Another way of looking at the meaning of competences is to distinguish between different qualities of competences. Key competence, for instance, enables a collaborator to understand the economic, organisational and human pattern of a company in which he or she works and comprehend the strategies and goals to which the work input contributes. Professional competence refers more to the individual abilities that are necessary for exercising a particular professional activity. Methodological competence is a qualification for the versatile, flexible employee who performs different jobs. Social competence is a significant value in collaborating in teams and in an enterprise or organisation. And personal competence means the capacity of an individual to organise work and personal life in a self-reflective and consistent manner. The point in differentiating competences according to different viewpoints and human qualities is of course the acknowledgement that all are necessary in different combinations, depending on the job and the goals to be reached.

Figure 4.12 shows the links between qualifications, largely based on learning achievements (competences) that determine a person's capacity to perform. The results of both qualifications and competences are collaborators who can achieve their goals in a professional and business-driven environment. The figure shows as well the need to evaluate the competences and qualifications of a job candidate strictly from the point of view of the specific requirements. In other words, someone who does not meet one set of demands may be an ideal candidate for another job.

Staff development enables employees to achieve strategic and operational business goals and create value added in a company. It is also essential for ensuring employees' personal satisfaction and enabling them to achieve their own legitimate goals in their everyday activities. Integrating these two aspects – achieving an orientation both towards the company's goals and towards those of the employees – is the central challenge for effective leadership. It is important to have a firm grasp of employees' training levels, work experience and expectations for promotion and career development.

Disciplines such as psychology and sociology provide important insights. At a high level of abstraction, they offer findings and general concepts or models of human behaviour in businesses (Scholz 2000: 877–8). In specific situations, it is only real actions or omissions by individuals that can be observed. Similar behaviour by different people may well have different causes, and conversely,

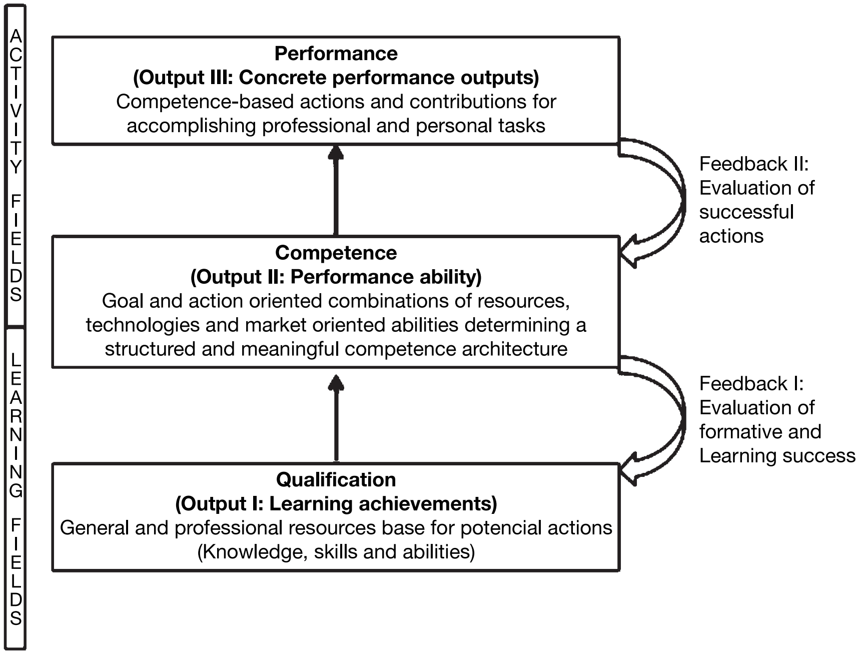

Figure 4.12 Links between qualification, competence and performance

Source: adapted from Becker 2009: 13.

people in similar situations may react differently. It is thus not possible, even for a synthesis of various explanatory approaches to human behaviour, to say exactly how individuals or groups will react in a specific situation. But behavioural research results and models can provide useful suggestions and food for thought in dealing with demanding tasks of personnel management.

An important point of view in assessing companies' and businesses' potential success is the quality of its staff development policy. Providing sufficient numbers of well-qualified managers and specialists to ensure the continuity and expansion of the company's activities is a fundamental task of staff development. The focus here is on staff selection, individual support and training, continuing education opportunities and systematic and sustained measures of career development. Needs and stimuli for staff development arise for a variety of reasons (Hentze and Kammel 2001: 339–40):

– New economic challenges and technological innovations mean that a company's employees have to adapt and improve their qualifications. A stagnant industry with a reputation for conservatism and low profitability will find it hard to attract well-qualified and dynamic staff. The social charisma of a profession and the location of the company (in an urban or a remote rural area) play a role.

– Giving suitable employees more or new areas of responsibility motivates them and contributes to increased work satisfaction.
– Employees' specialist and personal qualifications have to be increased through additional education and training.
– Systematic career development programs give staff incentive and ability to attain ambitious personal goals and reach higher levels of responsibility. Career development measures therefore need to be coordinated with employees' individual expectations, inclinations and family situations.
– Maintaining or increasing employees' qualifications and abilities is decisive for the company's future success. Targeting educational and training programs is strategically important.

Figure 4.13 provides an overview of various approaches to staff development measures. On-the-job measures, such as introduction to new activities and provision of additional qualifications, occur in the workplace in the form of planned workplace changes, temporary replacements and assignment of special tasks. Near-the-job measures consist of workplace training and off-the-job measures cover the area of further training. Preparation for retirement can be achieved through out-of-the-job measures.

Career development is a special part of on-the-job measures and covers a number of subordinate activities that can be arranged in a sequence (Scholz 2000: 506–7):

– identification of the skill that is lacking;
– determining the development potential;

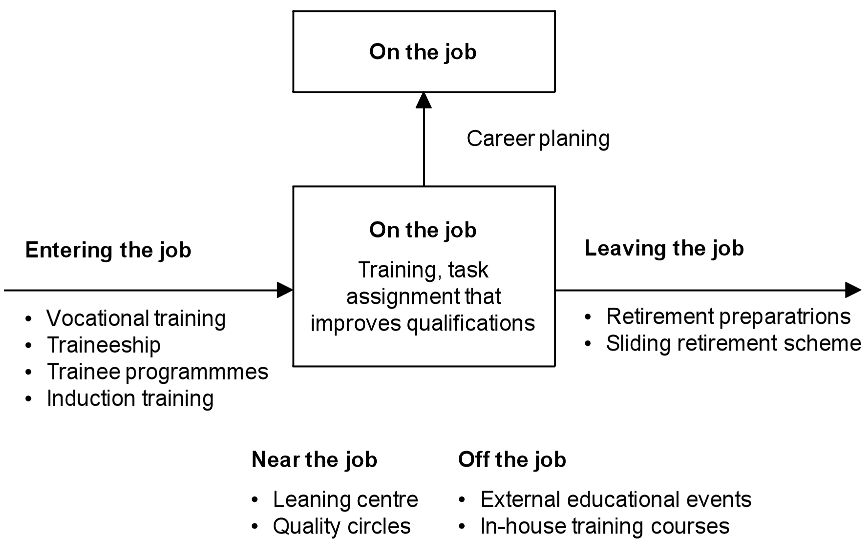

Figure 4.13 Personnel development measures

Source: adapted from Scholz 2000: 511

- determining the development volume;
- establishing a specific group of candidates;
- establishing specific measures for individual cases;
- carrying out the development measures; and
- confirming that the established goals have been achieved.

Targeted staff development involves high-level and specialised expertise at considerable cost. Formalised procedures with interviews and aptitude tests are used for staff selection, career development and promotion. Assessment centres set up in large companies and advice from specialised outside consultants facilitate such decisions. Staff assessment procedures have become common for new employees but are not yet used intensively in systematic career development, where they have considerable potential. Difficulties arise when qualitative criteria, which are difficult to measure, form the basis for decision making. The same applies to the assessment of employees' development potential. The scale of human resources development programmes, the size of candidate groups and the type and frequency of measures used are often determined by the available resources, the company's development strategy and the employees' individual goals.

Responsibility in the area of staff management is often approached using the principles of coaching (Brounstein *et al.* 2007; Whitmore 2006). This involves asking questions that stimulate a team in the following ways:

- thinking about goals and identifying with them;
- testing the measures taken critically for their effectiveness in achieving the goal;
- aiming for effective delivery of outputs;
- acting on their own responsibility within the area of their competence; and
- developing motivation to work as a valuable member of the team.

Professional competence is based on manual, technical and academic education, practical training and special courses, regular use of complementary information sources, experience acquired in different work positions and systematic career development programmes. In most cases, the qualifications to fill a professional position and exercise a defined level of management responsibilities must be proven by formal evidence and certificates that confirm the applicant's acquisition of obligatory education or specialised training. Modern forms of employee recruitment (e.g. assessment centres) put emphasis on applicants' suitability and professional competences and develop and use specialised selection tests.

Professional experience is based on knowledge and understanding how existing suitability characteristics are applied in specific work situations. Professional experience involves the specialised ability related to appropriate procedures and courses of action to complete particular tasks and fulfil responsibilities. This is recognisable, for example, in how employees and managers define the tasks and what areas of emphasis they choose. Professional experience is above all the result of induction training in completing tasks, achieving goals and adopting position-specific roles.

Performance evaluation is concerned with how well job tasks are carried out and how an employee contributes to the company's activities. Distinctions need to be made between performance evaluation in the strict sense, related to past employment periods, and an assessment of future potentials and further improvements that can be expected. The quantity and quality of work and the employee's qualifications, development potential, management capacity and social behaviour may be assessed depending on the particular situation and the purpose of an evaluation.

Employee assessments may be made for several reasons:

- to differentiate salaries and wages according to individual performance;
- to allow counselling of employees according to their personal abilities, motivations and attitudes;
- to support employees in connection with measures for staff development;
- to prepare for internal selection decisions with assessment of qualifications and development potential;
- to check selection decisions in recruiting processes and assess the suitability and reliability of the selection methods used;
- to promote communication between managers and employees; and
- to provide employees with information about how their managers regard them (personal feedback).

The assessment procedure has to be transparent and fair for everyone involved, including the subjects of the evaluations. Assessments must be in writing, related to a specific time period and carried out independently of any previous assessment. Employees have the legal right to see their personnel files and to have the evaluations explained to them. A competently conducted assessment requires the supervisor to be familiar with the assessment rules and impartial, regardless of his or her personal or private contacts with the person being assessed. Important prerequisites are qualities such as keen observation, a good memory and abilities to judge complex situations as well as expert knowledge regarding the tasks to be accomplished. Employee assessments are not a one-way street but can involve give and take. It is useful and sometimes revealing to have employees assess their managers; this can create a comprehensive picture of everyone's performance in a company or a public institution.

Personal assessments should be objective, reliable and equitable: incorrect assessments may have severe consequences not only for employees but also for the work atmosphere and the company as a whole. One danger is that an evaluation may focus on recent actions and mask an employee's general abilities and characteristics (the eclipse effect), giving excess weight to certain events – positive or negative – and leading to unjustified or false conclusions. A good assessment should do justice to the whole assessment period, weigh the employee's overall performance and characterise his or her general behaviour and commitment.

Personnel assessments should take place at regular intervals, be carried out using standardised criteria known in advance, and be undertaken in a transparent manner. Involving the employees (or their trade union representatives) in the design of the assessment system and of the criteria to be used is useful and necessary. It leads to greater objectivity on the part of management and greater acceptance on the part of employees. Having managers' performance assessed by the employees gives senior managers important information about how supervisors exercise their responsibilities and the effects on the work and perceptions of employees. Such assessments have to be arranged methodologically and practically in such a way that the employees are protected from negative repercussions.

Work satisfaction is one of the central factors in personnel development targets. Its importance stems from the positive connection between employees' degree of satisfaction and their willingness to produce work. A high degree of work satisfaction thus has a positive effect on business results. Equally important is that all employees in a company represent personalities with independent values, whose individual needs, interests and demands should find a place in the working world.

Work satisfaction arises from the balance between individual opportunities for action and one's perceptions of one's own experiences in the workplace (see Figure 4.14). Work satisfaction can be measured using empirical information from personal interviews, standardised questionnaires and psychological tests. Its increase or decrease over time can be studied through multiyear comparisons for specific employee categories.

The starting point for analysis is a comparison between the existing work situation and employees' specific needs and expectations. Factors such as positive feedback and recognition, as well as negative experiences and criticism, play an important role, as do the employee's individual aspirations and the connections between events and their causes. Success or failure may be attributed to one's own strengths or weaknesses or to external circumstances, unforeseen events and conditions beyond personal influence and control. A correspondence between personal expectations and actual output initially leads to a feeling of work satisfaction. Subsequently, aspiration levels may either stabilise or rise, creating a new starting point for judging and evaluating future work challenges by the employers. The course along which work satisfaction develops is generally positive as long as the employee's aspiration level is met and his or her abilities are commensurate with the work requirements.

If work situations do not correspond to employees' needs, expectations and abilities, the result is a diffuse form of dissatisfaction. From the point of view of both the company and the employees, this situation is always problematic. When employees have a constructive attitude, their attempts to resolve the mismatch can lead to fresh commitment and increased motivation. By contrast, unsuccessful efforts to change the work situation inevitably lead to acute dissatisfaction and ultimately to resignation. Constant dissatisfaction reduces people's motivation to work, and well-qualified employees then seek to improve their job situation by

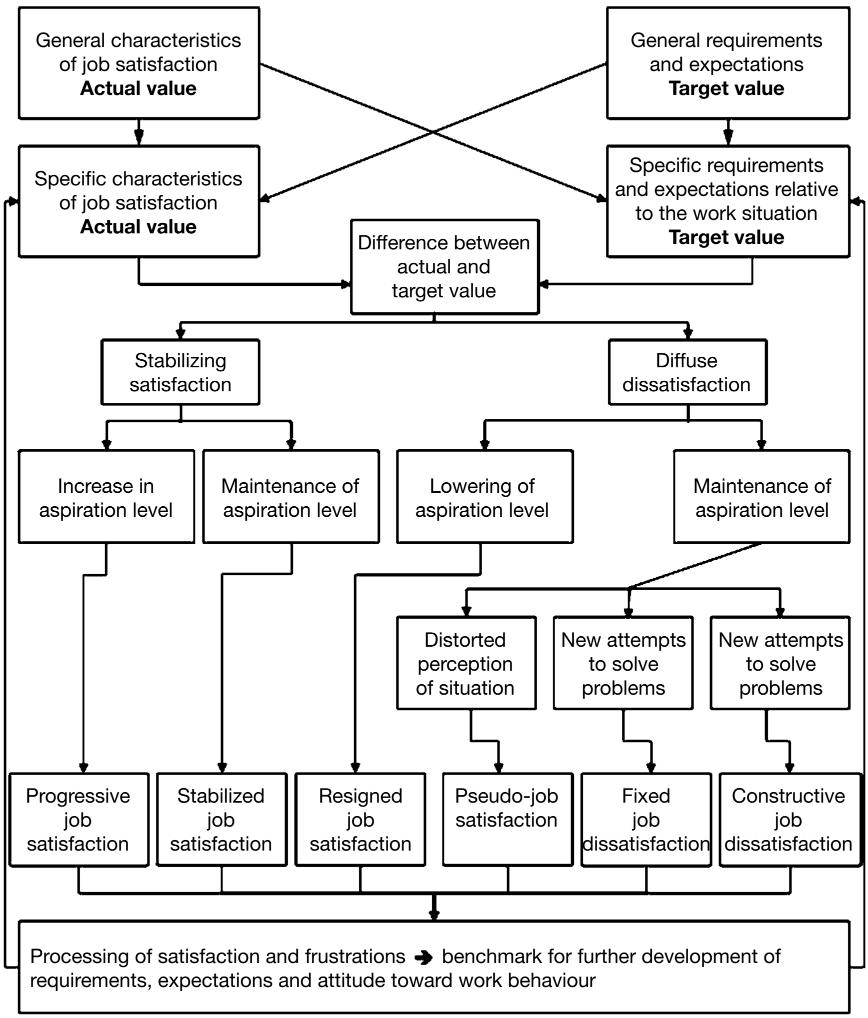

Figure 4.14 Job satisfaction as a result of personal considerations and experiences

Source: Bruggemann *et al.* 1975: 134–5.

changing to a different employer. Staff losses to competitors and efforts to move to other business units in the same company may be an indication of a lack of work satisfaction.

4.2.5 Leadership and management techniques

Leadership is a highly complex social phenomenon that is marked by character strength, sensitivity and observation, feelings and emotions, external and internal circumstances and personal perceptions, experiences and convictions. It becomes manifest in different and often unrepeatable individual attitudes, decisions and communication manners. How leadership is exercised by managers determines, to a great extent, the attitudes, motivation and behaviour of employees. Competent leaders make a vital contribution to meaningful integration of work goals (as assigned to the employees through their positions and through specific instructions) and the attainment of employees' own personal goals within the company. Managers thus have to balance work goals with employees' goals through organisational arrangements. Their duties cover complex and sometimes sensitive processes of behavioural steering and control, for which there are no easy instructions or patent solutions.

Competent personal management includes two important dimensions that need to be considered (Ulrich and Fluri 1995: 226–7):

– The *task-oriented dimension* consists of defining and structuring business goals, ensuring efficiency, establishing appropriate communication structures, and initiating and controlling effective decision-making processes in which employees can actively participate.
– The *group-oriented dimension* ensures integration. Open communication among employees and within a working unit promotes team collaboration and development of a group culture. Individual employees must be offered opportunities for counselling and personality development.

The two dimensions are successfully integrated if the employees' goals and task orientation are coherent and mutually support each other. If the company's goals then become personally motivating goals, work satisfaction increases substantially. Group integration gives the company a substantial performance advantage, the extent of which depends on the tasks that have to be completed, the company's internal and external environment and above all on managers' behaviour and employees' attitudes. Management behaviour and organisational regulations are closely connected with each other. Planning, organisation, disposition and controlling are carried out by individual people and in most cases in collaboration with colleagues. Conversely, management processes and their outcomes have a strong influence on the behaviour of employees.

There should be coherence between a company's organisational patterns and staff management tasks. Special approaches may be needed, particularly in larger organisational units that take the form of management guidelines. The company's managers use guidelines to establish regulations that effectively support the achievement of task goals and employees' goals (Ulrich and Fluri 1995: 242–3). The guidelines set a binding framework for managers' behaviour, for employees' rights and duties and for collaboration between individuals and work groups in business units. They provide suggestions and instructions on the type of management style desired, the application of management techniques, the forms of collaboration to be practised and the appropriate procedures for managing conflicts. Management guidelines are binding for all employees, but at the same time they can stimulate employees to shape their behaviour in accordance with their personal abilities.

Leadership style is how managers exercise their duties and behave towards their employees. It involves behavioural patterns that are relatively stable over time and consistent in relation to specific situations. In principle, employees' behaviour can be influenced by authority of position, authority through expertise and authority of personality (see Figure 4.15):

- *Authoritative leadership style*. The manager largely depends on the authority conferred by his or her formal position and the associated opportunities for positive and negative interventions. The manager mainly behaves in a task-oriented way, makes decisions independently and determines whether they have been carried out.
- *Participatory leadership style*. The manager uses his or her professional competence and personal authority to achieve the integration of targets required. She or he motivates employees, works with them on a basis of trust, is open to objective criticism and can be persuaded by valid counter-arguments. Decisions are made in a transparent fashion and undertaken jointly with the employees who will carry out the tasks.

A participatory management style presupposes group-dynamic behaviour and is more demanding than a management style that depends on hierarchical authority. A cooperative attitude is an indispensable foundation for participatory management, the core of which involves mutual recognition among those responsible for carrying out specific tasks. The variety of behaviour of managers in a specific situation shows that each management style is strongly determined by the

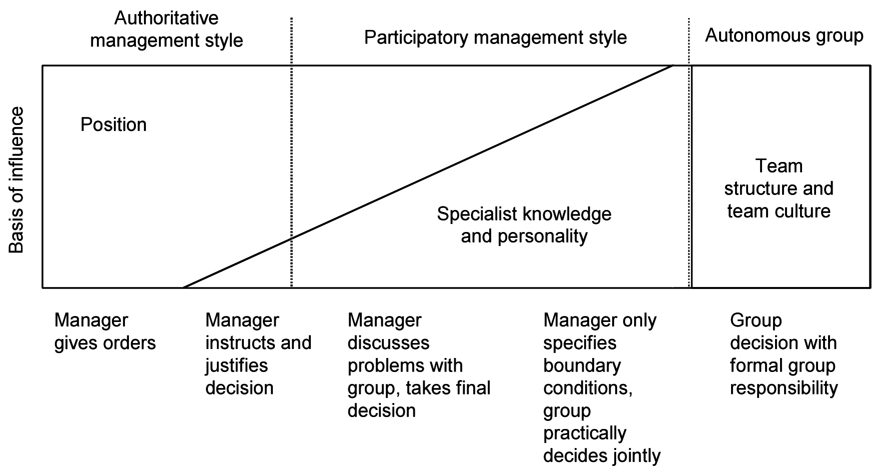

Figure 4.15 Leadership styles and the basis of their influence (modified)

Source: Ulrich and Fluri 1995: 232

individual's personality. Management styles are thus capable of being learned only to a limited extent.

Management techniques are coordination mechanisms that can be combined with a specific leadership style. Their purpose is to regulate in advance the kind, intensity and timing of an intervention and the person who has formal responsibility and authority for a particular action or problem. Applying recommended or prescribed management techniques purely on the basis of textbook knowledge is a useful but insufficient prerequisite for exercising responsible management and competent leadership and avoiding managerial mistakes (Lehky 2008). These techniques make managerial behaviour predictable for individual employees, who can then identify their own areas of competence for action and decision making and exercise such competences more deliberately.

Situation-specific factors determining flexible and effective staff management include the extent to which managers invite participation and employees' ability and willingness to respond (see Figure 4.16). Other important factors are specific to the task – whether it is routine, low priority or urgent and whether it is simple or complex. Management style must be flexible and adaptable to specific situations. This requires empathy and sensitivity in one's approach and in personal communications. Employees expect a manager to show consistent and predictable behaviour in similar situations (consistency within variability), but not necessarily identical behaviour in different situations.

One modern management technique is known as *management by objectives*. It is based on the principle that a business goal will be achieved faster the more precisely it is formulated, the more an employee identifies with it and the more

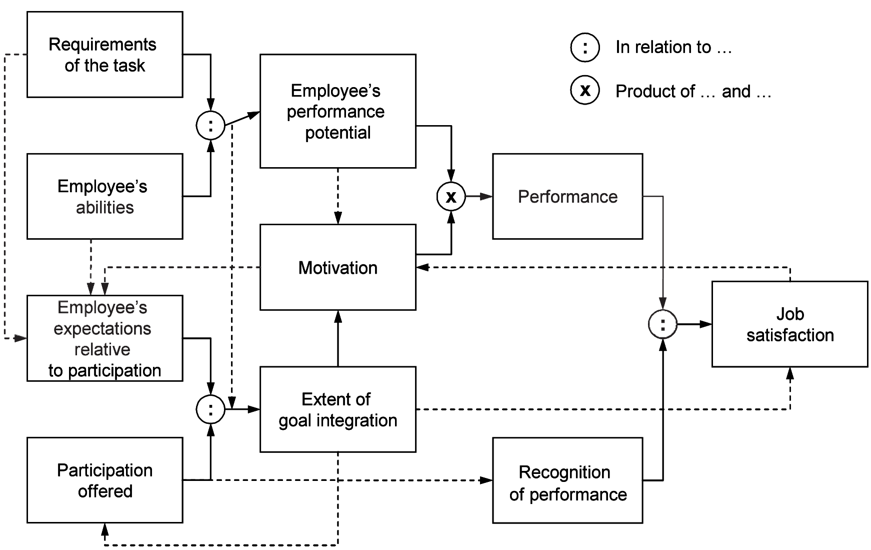

Figure 4.16 Determinants of participatory management styles

Source: Ulrich and Fluri 1995: 236

precisely the expected results can be demonstrated and verified. Leaders focus on setting goals, leaving collaborators considerable latitude in the ways and means to reach them. The practice of management by objectives is nowadays found in many companies and is increasingly used in public administrative bodies as well. Within a large forest administration, for example, management by objectives combines consistent and extensive delegation of tasks along with systematic control. Local foresters are given targets for removals or profits, assigned resources (people and machines) and encouraged to set their own schedules. Particularly in the case of geographically extensive administrative and operational structures, determination of goals to be reached makes it easier to coordinate and accomplish tasks in subordinate districts and offices.

Target agreements between managers and employees involve qualitative and quantitative definition of the overall goals to be attained and the responsibilities to be exercised. How the goals are attained is mainly left to employees. Intermediate stages and progress are regularly checked jointly by managers and employees. Corrections and improvements that may be needed are discussed, and, if necessary, the targets or agreements are modified. This type of management approach facilitates a consistent orientation and guidance of a company's subsystems to overall business goals. It increases employees' motivation, since they are consulted and actively involved in formulating and implementing the goals to be attained.

Management by exceptions is an approach based on the delegation principle, according to which no decision should be taken at a higher level of authority if it can be done equally well at a subordinate level. This leads to a situational management style, one that is adapted to both the existing situation and the new ones. Management by exceptions distinguishes between routine and exceptional events. Employees have the competence to act and make decisions in connection with routine tasks, as defined in their job profiles. Exceptional cases – those that cannot be assessed in accordance with the established criteria – are presented to the responsible manager. A more far-reaching approach known as management by decision rules involves regulations that further reduce the amount of routine feedback to managers. The rules address potential effects in exceptional situations and anticipate how to proceed and who should be contacted and involved in such cases.

In all management techniques, problems may arise in defining the span of delegated responsibilities. How precisely are employees' responsibilities delineated, for example, and how much time is allowed for the goal to be achieved? It may be difficult to agree on objective standards that define success. Conflicts may arise between the deductive way in which goals are established at higher levels of a company and the more inductive process in which goals are attained through participatory approaches. Rules and procedures should determine how critical issues will be clarified and how conflicts between management and employees will be resolved, covering individual work agreements, arrangements within working teams or the relationship between business units and higher-level management.

Personal conflicts occur in any organisation. Methods for conflict resolution, with transparent and well-functioning arbitration procedures, need to be established. In some cases, conflicts can be addressed by the parties directly; in others, complaints and procedures for recourse have to be taken up at a higher level. Preventing arbitrary decisions, clarifying possible and actual misunderstandings, recognising the reasons for latent or overt conflicts and finding balanced solutions are important managerial tasks.

Traditional frameworks of organising leadership, with a trend to separate economic decision making from operational responsibilities according to professional groups and different levels of an organisation, has a number of inconveniences: it may lead to growing overcharge of leadership functions at higher levels and to a lack of sufficient responsibilities preventing operational staff to use fully its abilities and experiences; and it may curtail well-functioning processes between strategic and operational decisions. Information flows between market demand, production and procurement along the supply chain cannot be sufficiently practised due to rather formal barriers at different working levels. Management techniques resulting from a traditional understanding of leadership do not provide many opportunities allowing versatile and efficient communication of the many links between organisational units, decision-making networks and jointly undertaken work projects.

The transition to modern management models acknowledging participatory management techniques usually passes through different stages and shows a diversity of approaches that become more adapted to specific business objectives and tasks to be accomplished (Perchthaler 2012: 38–41). Organising performing leadership and management techniques needs a well thought and effective attribution of performance and responsibilities that is commensurate with the overall set of tasks to the goals to be reached at determined localities and work positions, adjusted to the capabilities of the persons in charge and with the available resources of an organisation.

Among the criteria for shifting to a performing leadership and management model in a situation of transition, the following issues should be considered:

- definition and elaboration of goals and assessing the performance in goal attainment;
- high qualitative competences in judging branch- and company-specific problems and opportunities;
- involvement of a broad spectrum of staff in leadership decisions to facilitate fast, rational and well-founded decision-making processes;
- open and flexible patterns of organisation with well-defined and measurable distribution of responsibilities;
- delegation of strategic and operational responsibilities to the level of profit and cost centres;
- congruence between tasks, competences and responsibilities;
- a reasonable leadership span between different decision levels, with a limited number of immediate collaborators for each organisational level; and
- a clear definition of the roles of collaborators, work units and project groups and their responsibilities for requesting and delivering the required inputs.

The modern view is that managers have a chance to be successful when they see themselves as part of a team. Of course, hierarchies exist in a management team, and final responsibility remains with the manager at the level at which the decision is taken. However, if a manager succeeds in convincing employees that the goal must be achieved jointly, decision making becomes more transparent and comprehensible for the collaborators and provides a solid basis for achieving success. Management therefore requires leadership and motivation skills. Foremost is the ability to create suitable conditions for teamwork, in which all participants contribute their skills and abilities. Team members need to participate in the decision-making process and be persuaded of the necessity and appropriateness of the decisions that they will give.

The role of managers thus involves acting within defined organisational structures and using formal decision-making pathways; it demands targeted and creative interpretation and systematic use of the available scope for action. It is associated with direct responsibility for the consequences of decisions taken by the management staff. It is based on stimuli and incentives in case of success and on sanctions in case of failures and wrong decisions. It can work only if managers are individually responsible for the success or failure of specific actions.

4.3 Organisation

4.3.1 Structures and processes

Organising means systematically checking and deliberately changing the structures and processes of private and public entities to increase consistency, effectiveness and efficiency and thereby ensures their adaptation to their constantly changing internal and external environment. Appropriate organisational forms are a prerequisite for managing complex output processes, maintaining a competitive position and promoting business dynamism and innovation. The instrumental concept of organisation of enterprises and companies refers to the specific forms in which system elements are used and linked. In a broader institutional concept, companies and businesses can also be understood as institutional and social systems that achieve specific goals and are oriented towards development and progress in their economic environment (Hill *et al.* 1994; Hill *et al.* 1998; Kant and Berry 2005b; Peters *et al.* 2005; Ulrich and Fluri 1995: 161–2).

An effective organisation simplifies the work of a company and enables it to use its management capacity productively to achieve its goals. However, every organisational design leads to a formalisation of work processes, with the risk of limiting flexibility and scope for personal initiative. It is therefore important to ensure sufficient freedom for individual arrangements, initiatives and responsibilities. Evaluating the requirements for and distribution of personal and financial resources is a major aspect of organisational planning. Decisions about such strategic and operational issues usually take up a considerable proportion of managers' and employees' energy and attention (Peters *et al.* 2005: 23–4, 121–2). Changes in strategic and operating goals and new developments in the surroundings lead to changes in existing organisational forms. Establishing or transforming an organisation and organising current work and decision-making processes is not an end in itself, and there is no organisational model that can be applied unaltered in all cases.

From the instrumental point of view, organisations are a means of solving problems and mainly have an internal focus. The focus of analysis and problem solving is on centralisation or decentralisation, the assignment of authority to issue instructions, standardisation of organisational regulations, definition and design of procedural processes and measures for organisational development. Organisational design covers the planning and implementation of formal or structural foundations and ensures that businesses and companies are functional and efficient. The aim is to combine structural elements in such a way that they form an appropriate framework for achieving the company's goals (Bühner 2004: 12–13). Long-term formal structures are required for handling activities that are repeated and for dealing with new tasks that arise. Efficiency of communication and assignment of responsibilities and decision-making authority to individuals and job positions play an important role.

Structural organisational charts show hierarchical decision levels and strategic and operational issues. They provide a first glimpse of how private and public organisations operate. The charts indicate the assignment of issues, functions, responsibilities and tasks to management and staff positions and the way in which groups of job positions are arranged in the various activity areas of an organisation. The hierarchy of information flows and the communication pathways between vertical and horizontal decision and work levels are usually indicated.

Process organisational charts reveal the flows within the internal system of an organisation and the processes by which it communicates with its external economic, social and political environment. The basis for preparing process charts is a comprehensive classification of management and work actions, based on analysis of interlocking strategic management activities, determination of the sequence and timing of operational steps and assessment of internal and external company communication interfaces. To establish an efficient process organisation, the first step is to divide the overall tasks that need to be accomplished into subtasks and consider the sequence in which these are carried out. The individual subtasks are combined to form complexes of tasks and assigned to employees. There are several possible combinations, each of which offers the corresponding design scope.

Functional process diagrams may be used to show internal and external links and the connections between various tasks and subtasks and their assignment to management and working staff. They are usually presented in the form of a matrix, in which the combination of specific subtasks is summed up for the activity areas indicated in a structural organisational chart. Function diagrams are advantageous if a large number of job positions and organisational units are involved in carrying out complex tasks and if decision-making authority is distributed among several management levels. Indications of the communication pathways are an essential component of functional process diagrams, showing which job positions exchange information at what level of intensity. Analysing the communication pathways needed and comparing them with the actual rate of use provides important tips for improving coordination and collaboration in an organisation.

Job descriptions supplement the information provided by structural and functional organisational charts by specifying the tasks and activities that are to be accomplished in the various organisational units. Important elements of job descriptions include details of the task areas involved, authority to give instructions and the range of responsibilities. Job descriptions are an important prerequisite for managing personnel, assessing aptitude, identifying needed training and planning careers.

Different approaches to understanding efficient management and work organisation in business have been taken, with different views of organisational structures and functional processes and their effects on management and working arrangements (Thommen and Achleitner 2006: 791–2). A century ago, for example, Frederick Taylor (1911) introduced a new view of the importance of employees in businesses and companies. He stated that division of labour and specialisation based on engineering science, along with a rigorous application of the principle of performance, would lead to an increase in productivity. 'Taylorism', with its multiple-line, functional organisational system consisting of responsible managers and work teams, was applied to craft work. When Henry Ford adopted these principles for car manufacturing in the United States shortly thereafter, Taylorism became the foundation for industrial production, with important implications for business organisation and personnel management.

Another step in the development of a theory of organisational design was taken by Henri Fayol (1916), who shifted the focus from a production-related view to a general management conception extending to enterprises and companies as a whole; he advanced a comprehensive understanding of the role of organisations and the need for purposeful organising. Comprehensible and clear relationships between the elements of an organisational structure, basically in the form of single-line systems, were a prerequisite for the organisation's effective and efficient functioning. In the 1930s, the 'human relations approach' used by Elton Mayo (1933) and Fritz Roethlisberger and William Dickson (1939) showed that employees' productivity was influenced not just by physical working conditions but by psychological factors, such as attention and interest, and social factors, such as group membership and group standards. This led to the conclusion that not only formal but also informal relationships played a vital role and deserved appropriate attention by management and staff.

During the 1960s and 1970s, research on organisational aspects took a comprehensive view of the complex world in which organisations develop and have to prove their efficiency. The starting point here was the observation that earlier organisational models had taken approaches that were too one-sided. Rather, the specific situation and the sum total of the influencing factors needed to be considered, and that meant that organisations had to be studied and assessed using a contextual model. John Kenneth Galbraith (1977) and W. Richard Scott (1981) formulated the 'situational approach' and 'contingency approach', respectively, asserting that there was no such thing as the 'best' organisational method and that not every method was equally efficient. Instead, the prevailing empirical situation – both internal conditions and the external environment – influences the effectiveness and efficiency of particular organisational structures and processes.

An institutional economics perspective sees organisations as goal-directed systems for action with an interpersonal division of labour. This research approach, which originated with Ronald Coase (1937), was developed during the 1960s and 1970s. The focus of the analysis is the decision-making individual (methodological individualism), on the hypothesis that an organisation is not just an anonymous construct with an established structure but a synergistic system of the individual behavioural patterns of its members (Picot *et al.* 2005: 31–2). The members have more or less defined preferences and interests and attempt to maximise their benefits. As decision-making individuals, they behave rationally, at least to some extent: since no individual, in making complex organisational decisions, can grasp all the possible and necessary information and evaluate it thoroughly, completely rational behaviour is not possible.

A more general view is the understanding of organisational issues within the broad framework of institutional diversity (Ostrom 2005: 3–5). Elinor Ostrom defines institutions as 'the prescriptions that humans use to organize all forms of repetitive and structured interactions including those within families, neighbourhood, markets, firms, sports leagues, churches, private associations, and governments at all scales' (Ostrom 2005: 3). This definition suggests that different kinds of organisations have principles in common but relate to specific groups and circumstances and have developed different individual and collective rules to organise and structure their internal and external interactions. The institutional forms of particular types of organisations need thorough analysis if their functionality and rules are to be understood.

4.3.2 Organisation types

In *functional business organisation*, tasks and responsibilities are often grouped according to major activity areas along the value-creation chain – that is, in departments for purchasing, production, sales, customer service, research and development and finance (see Figure 4.17a). The advantages of this type of organisation are short communication pathways among different functional business areas and a focus on close links between markets, production and procurement. Disadvantages include the risk of pronounced departmental thinking if the various teams do not integrate their approaches. For example, production of large batches leads to lower unit costs in the production department, but these larger inventory stocks create higher handling costs for the sales department. A delivery policy focused on major clients, to the neglect of customers purchasing small quantities, may reduce delivery unit costs and improve the financial results of the sales department, but may also lead to reduced production and diminished returns for the company as a whole.

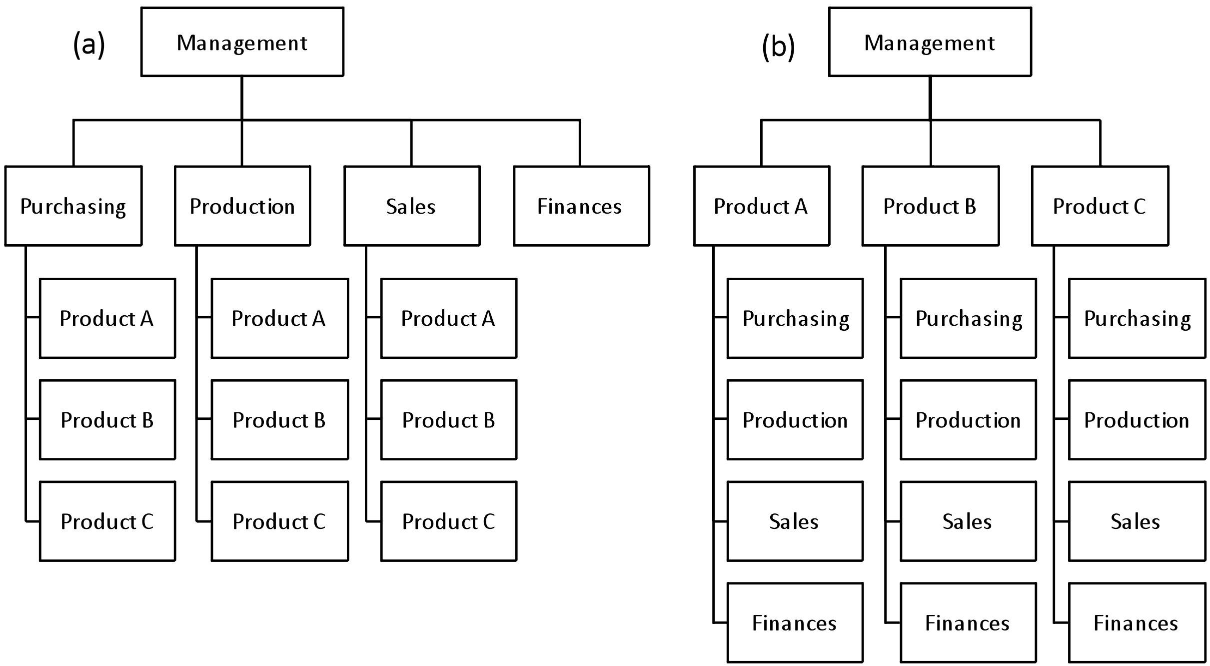

Figure 4.17 (a) functional organisation and (b) divisional organisation

Source: adapted from Schierenbeck 2000: 105

In *divisional organisation*, business is structured according to different objects and services. The classification criteria may involve products, product groups or regions (see Figure 4.17b). In divisional organisations, functional tasks and responsibilities are located below the object-related divisional level. This type of organisation makes it possible to optimise the value-creation chain for major product groups or regions, either within a country or on a worldwide scale. It is particularly useful if market-related requirements differ widely by product or by region, such that specialised departments can be developed. *Profit centres* are a particular form of a divisional business organisation that allows large entrepreneurial autonomy in strategic responsibilities and operational activities. Both in accounting terms and in relation to their business success, they are largely independent units in planning and implementing market-related activities and assuming responsibility for success in their domains. The criterion for structuring the organisation in accordance with product groups, regions or service functions and for setting up profit centres is to what extent the overall financial results contribute to the company's business success and allow penetration into new markets. This depends on the company context.

Figure 4.18 shows an example of an organisational chart for a large multinational company that combines divisional and functional organisation structures. The significant point here is that the four operational divisions, headed by Executive Vice Presidents, report directly to the Chief Executive Officer establishing a direct line of communication and authority between the top management and the operational activity level enabling a low hierarchical organisation structure. The four operations divisions may be organised according to main production and commercial activities addressing market segments with defined

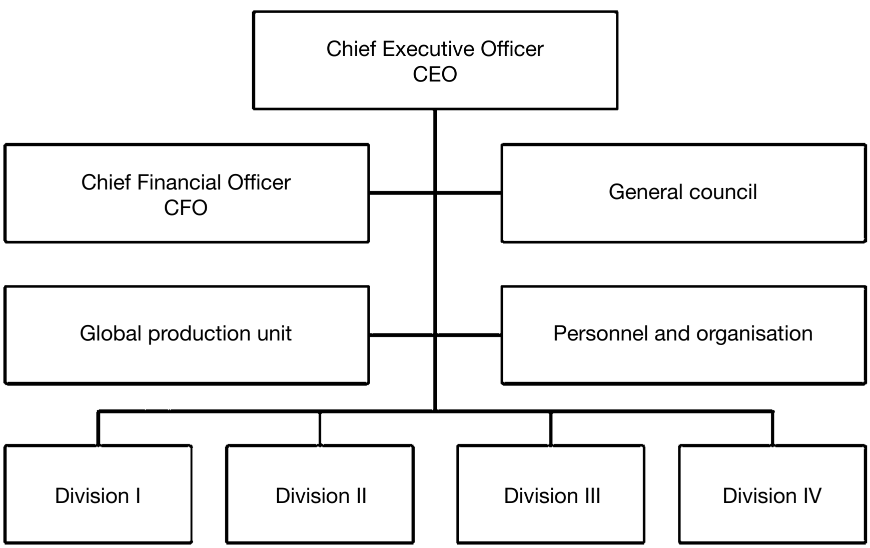

Figure 4.18 Organisational chart of an internationally operating company

customer needs. They may also be organised, for instance, on a regional scale by continents and country groups or by major technologies that drive the business activities of a company.

The functional decision-making management units are located at the intermediate level of the organisational chart and comprise four broad domains that have close links with each other and communicate both to the Chief Executive Officer and to the Executive Vice Presidents. The Chief Financial Officer and the general counsel have responsibilities for financial, policy and legal issues that affect the company as a whole. The global products unit serves customers and deals with product identity, quality and efficient logistics. The personnel and organisation unit is concerned with personnel resources development, production-specific expertise, development of new technologies and research in manufacturing and products utilisation.

In a general perspective, the choice of direction and management relationship determines the structural organisation type (Peters *et al.* 2005: 65–6): line organisations, line and staff organisations, multiple-line organisations and matrix organisations, for example, each have their own decision-making pathways (see Figure 4.19). Differences include centralisation or decentralisation of organisational units and the regulation of management relationships among them.

In a *line organisation*, subordinate levels receive orders and instructions directly from the authorities at a superior level; this type of structure ensures simplicity, clarity and transparency of communication and decision-making processes. In a *staff-line organisation*, the additional staff units support managers in addressing specific issues and problems. This helps management in carrying out tasks that require special expertise. *Multiple-line organisation* leads to a functional division of management practices with networked communications pathways and multiple attributions of tasks and responsibilities to staff at various levels of the organisation. The advantages are extensive specialisation in carrying out tasks and cross-connections in communications pathways based on expert decision making. By contrast, coordinating management functions becomes more complex and may involve substantial costs and efforts.

In a *matrix organisation*, task specialisation is carried out in two different dimensions – that is, relative to management functions such as finance, communication, production and relative to distinct management objectives, such as

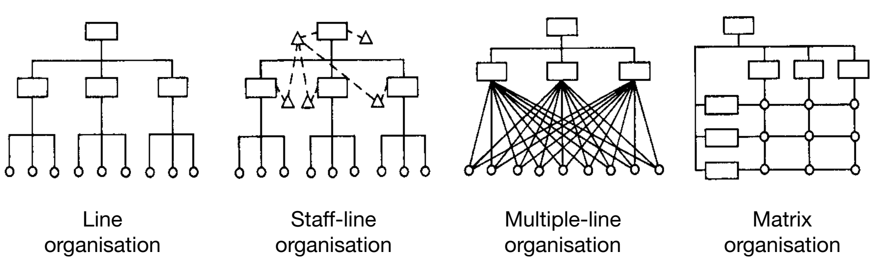

Figure 4.19 Structural types of organisation

products, services, responsibilities and tasks. The advantages are greater flexibility of organisation structures and processes, more opportunities for coordinated management team decisions and more comprehensive, well-circumscribed task areas. Elaborate processes for demarcating areas of responsibility, substantial communication requirements and well-defined job descriptions are a precondition for functioning matrix organisations.

For clearly distinct tasks, (semi-)*independent advisory and working groups* may be established, on either an ad hoc or a regular basis, to complement the existing management structures. The strategic and operational responsibilities for carrying out the assigned tasks lie primarily with the group itself. Within the group, the members act as a team of equals using their own individual specialist competences. They are jointly responsible for organising their work and for the content-related results of their activities. The assignment of the group's work tasks assignment need to provide sufficient autonomy in coming up with new ideas and proposals on the one side as well as sufficient goal orientation and monitoring on the other side.

Larger companies usually feature several structural organisation types – that is, a combination of line, staff and matrix forms to deal with the complexity of entrepreneurial processes. Line organisations are a typical model for organising value-creation processes, particularly if supplemented by staff organisation for supportive processes, such as information technology, purchasing and human resources management. Multiple-line and matrix types of organisation are used when coordination between various divisions and business functions is complex, as in large organisations.

Organisation and the distribution of tasks and responsibilities follow the goals of a company and the functions to be accomplished and not the other way round. The actual organisational chart and formal structuring in divisions, departments and working units thus vary from case to case depending on overall goals and strategies, the economic branch in which the company is engaged, its size and turnover volume and the markets in which it operates. The following example of the Mondi Group, which has a leading market position in uncoated fine paper, corrugated business, bags and coatings, presents the strategic goals and major activities that the company considers vital for ensuring its success. It is against this targeted profile that organisational and performance considerations need to be made.

- *Operational excellence*: Maximise equipment and process efficiencies; focus on quality and productivity; improve cost competitiveness and all operational activities.
- *Customer focus*: Understand market and customer needs; strive for flawless service and on-time delivery; facilitate sustainable partnerships and measure success.
- *Cutting edge products*: Ensure shared product development and success with customers; create competitive advantages with leading high-quality products and brands; leverage expertise and create tailor-made solutions.

- *Sustainable development*: Care about health and safety; reduce environmental impacts and engage in sustainable forestry; put social responsibility into practice.
- *People development*: Inspire and develop people; promote excellence in leadership; shape our culture and embrace diversity.

4.3.3 Formal organisational elements

Standardisation of work processes and division of labour play an important role in assigning tasks and responsibilities to managers and employees in different organisational structures. Formal organisational elements include, for instance, the determination of tasks and activities, the attribution of authority and responsibility, the grading of working positions, repartition of working units (departments and sections) and the establishment of networks of communication and collaboration (Ulrich and Fluri 1995: 173–4). How such formal elements are conceived, determined and used is closely connected with employee motivation and the working environment.

Task: Company policy, goals and strategic and operational planning determine the tasks to be carried out. Tasks represent a target output to be produced by managers and employees in different situations, at different time scales and with varying means and efforts. Depending on the organisational level, tasks are comprehensive and general or defined in a specific, detailed manner. Various tasks are connected with each other and assigned to employees within their area of responsibility. Tasks and areas of responsibilities are basic elements of an effective and implementable organisational structure. Their determination defines an employee's duties and performance.

Activities: Tasks are carried out by undertaking specific activities, such as processing or transport of materials or products. Communication and information processes require such activities as recording, storing and processing or conveying information. In management, activities are primarily related to problem analysis, decision making and problem solving and include preparation for decision making, the decision itself, implementation of the decision and evaluation.

Several features can be used to characterise tasks and activities:

- the functional area in which they are to be carried out;
- the activities associated with completing tasks;
- the problem-solving or decision-making process to which tasks and activities are related;
- the frequency with which specific tasks and activities arise; and
- the conditions in relation to space, time, quality and quantity in which target outputs associated with a specific task and activity have to be produced.

Competences to act and decide (authorisation): They are assigned to employees through a transfer of determined responsibilities, functions and tasks. Authorisation is an institutional legitimisation in a particular working domain or an assignment throughout a company or organisation. Competences for implementing tasks and exercising responsibilities include the right to perform those activities that are required for accomplishing the necessary tasks and use the necessary measures to attain the achievements expected. They can be categorised according to the following criteria:

– dispositional authorisation;
– decision-making authorisation;
– authorisation to share in decision making;
– authorisation to give instructions;
– authorisation to act in a representative capacity; and
– policy-making authorisation.

Responsibility: This term refers to the obligations of employees to accept and exercise the competences that have been transferred to them, and to answer for the results. The transfer of authorisation and personal responsibility for a specific task or management area can motivate employees by giving them professional and personal challenges. Independent and capable fulfilment of entitlements to act should be associated with positive incentives, like premiums or promotion opportunities. Neglect of authorised responsibilities will lead to negative sanctions and, in serious cases, dismissal in accordance with employment law. Fulfilment of tasks and acceptance of responsibility are thus guided by two components – the transfer of authorisation and a determined area of responsibility. Managers at higher hierarchical levels should not intervene in the employee's area of responsibility without a compelling reason.

Positions and departments: The identification of an area of responsibility that is transferred to an employee within a defined organisational unit leads to the creation of a staff position or a permanent or temporary job. It defines the workplace of an employee, the organisational unit to which he or she is assigned and the rights and responsibilities associated with the tasks to be performed. In organisational design, a position is not equivalent to the physical workplace; it is a structural and functional post that is part of a company's personnel planning chart. If several positions are combined, they form part of staffing patterns in work teams, sections, divisions and departments.

Connecting routes: Connecting routes between individual positions are established to organise functional work processes, ensure cooperation and support in teamwork and facilitate the exchange of strategic and operational information. Particularly in complex production and performance systems, optimising connecting routes between organisational units through efficient information technology and logistics is important. Decision-making regulations establish pathways for information exchange and coordination and define how management decisions should be made and implemented. This requires the setting principles for decision making to be based on authorisation, information, consultation, involvement and cooperation.

Organisational development refers to a personnel-oriented approach to developing structures in social systems. (French and Bell 1994: 47–8; Ulrich and Fluri

1995: 205–6). The assumption is that structural and functional changes in an organisation can be effective only if they are compatible with the needs, values and expectations of those who work in it. Organisational development is productive if it leads to a better match between employees' goals and the overall system goals. This approach increases quality in problem solving, promotes creativity and gives everyone a better appreciation of the necessity of ongoing or projected organisational changes.

The focus of human resources management is on the implications for employees when new business structures, new working requirements and new functional links between different management units are introduced. The question to be asked is how an area of responsibility can be redefined in such a way that it matches employees' capabilities and motivational structures and encourages better performance (Berthel and Becker 2007: 17–18, 446). The consequences of new organisational measures on upgrading and downgrading of job profiles need to be assessed. In general, varied and demanding tasks provide motivation and encourage performance better than uninteresting and monotonous activities. New opportunities for career development are a stimulant; conversely, a mismatch between employees' qualifications and the requirements for carrying out new tasks creates a disincentive, since neither underemployed nor overworked individuals are able to carry out their tasks to the full.

Organisational change: When envisaging changes in an organisation, managers should weigh the advantages and disadvantages of alternative ways of structuring work performance and tasks. Change is one of the greatest challenges that face managers, particularly in larger companies. A systematic approach to organisational development that deals with the process of change in a competent fashion includes the following:

- helping everyone involved to understand and appreciate the importance of the interpersonal processes associated with reorganisation processes;
- promoting trust and objective communications by disclosing the reasons for change and designing processes in a transparent way;
- involving employees in the search for new solutions and in assessing possible alternatives;
- avoiding unnecessary losses of status or face during implementation; and
- establishing rational procedural processes for managing conflicts.

The chances of success during implementation increase if employees are informed about the phases in which the change will be undertaken and if they have been able to participate in the preparation process. Frictions are reduced if management levels and divisional units can identify with the organisational change and fully understand its purpose and their contributions. This presupposes that managers responsible for the reorganisation have a clear idea of the target situation they are aiming for, the goals and improvements that need to be achieved, and above all the consequences for everyone involved (Hafen *et al.* 2000).

Organisational analysis: An organisation may need to be reassessed if new entrepreneurial goals have been set and operations must become more efficient. Organisational analysis serves to reveal weaknesses in the existing organisation and prepare for reorganisation (Bühner 2004: 360–1). Organisation structures and especially processes form the starting point for this type of analysis. The core of this approach is thinking about what an organisation would look like if it had to be newly established to carry out the required tasks at the lowest possible cost. It can be applied to entire companies or to individual units and management areas. Zero-base budgeting reveals the advantages, as well as disadvantages, that a competitor entering the business process would have. Reference cases to be considered are companies and organisations that have been created in connection with new industrial estates, new logistic systems and new regional policy incentives for attracting business to specific locations.

Value analysis: The aim of a value analysis is to identify how (and by how much) the costs of producing goods and services can be reduced in distinct segments of the value chain. It starts with a functional analysis of products and services – an assessment of the characteristics they have from the customer's point of view. Solutions are then sought that will identify production technologies, procurement resources and energy requirements of the desired market goods and services. On the basis of that information, new production processes are developed and optimised through organisational improvements. Overheads, often a substantial proportion of total costs, cannot be assigned directly to individual marketable products and services. An overhead value analysis examines company activities in relation to the contribution they make to value creation. Particularly in the administrative area, organisational processes that add only little value or are unproductive need to be identified and eliminated.

The way in which responsibilities and tasks are organised in public administrations is increasingly influenced by new approaches and experiences in business management. 'New public management' and 'efficiency-oriented administrative management' characterise this trend (Hablützel *et al.* 1995; Pollit and Bouckaert 2011; Schedler and Proeller 2006). The aim of reforms is to make public entities more effective and efficient by adopting insights and knowledge from analysis and modern management methods in the private sector. New public management approaches are of particular interest in the public forest sector, since in many European countries a considerable proportion of the forest area is owned and managed by governments, city councils and communal entities. They are relevant, for instance, in institutional and administrative reforms concerning national and subnational forest services as well as local and regional forest management agencies.

New public management and comparable reforms imply a comprehensive understanding of the public sector's role, its functions and responsibilities, the goals and performance level to be reached and the tasks to be accomplished. The factors that determine output performance, such as political decision making and legal and administrative procedures, need to be analysed. Modern management structures and tools can contribute to public outcomes and business output alike.

As the political system adjusts to society's growing needs and changing demands, a user-friendly and efficient administrative system is an important aspect of political reform efforts. An output-oriented approach with verifiable performance achievements is much different from previous governmental and administrative reliance on measuring inputs.

New public management is based on a contract management model in which political and administrative authorities agree, through negotiation, on the outputs to be provided to particular groups or the public in general. They offer to commit an agreed financial volume of public funds to provide the specified goods and services, maintain certain activities in the public interest or make available educational and social activities to the community. The type and extent of agreed public services and the intended target groups and recipients are determined by the political institutions of a country – that is, by parliament and government through laws, regulations and budgetary allocations. The public administration assists in identifying and costing those goods and services to be financed from public funds, such as public infrastructure or delivery of social services.

The instruments and processes used for implementing performance-based attributions of public funds are negotiated budgets, transferred annually to government ministries, departments and offices, which are specified through performance agreements. The producers or suppliers of output – whether governmental entities or private companies and nongovernmental agencies commissioned by the administration – act within the framework of the annually approved performance agreements and budgets. The political authorities require comprehensive information to make decisions regarding the financing of specific product budgets. The public administration has to provide specific product catalogues based on planned costing or norm-cost calculations, as well as on achievable income from sales and access or service charges. In forestry, this includes not only revenue from the sale of timber from public forests but also revenue from services designed to meet protective and recreational demand, as well as expenditure for nature protection and landscape conservation.

A new approach in public management includes cost awareness, orientation towards performance and effectiveness and more attention towards customers and apparent demand. Cost awareness and economic efficiency require the use of modern systems of business accounting. They can be evaluated by comparing actual costs with standard costs. For evaluating cost-effectiveness, public benefits need to be recorded in qualitative and quantitative terms and as far as possible expressed in monetary values. That raises a number of methodological questions, such as when assessing, for example, public safety measures whose benefits are difficult to monetise. A useful tool for testing effectiveness is 'benchmarking', which allows comparing processes, methods and above all quality of output provision among agencies. Qualitative and quantitative surveys of special user groups or the general public are one way to estimate the value attached to goods financed by public funds.

Reforms have been undertaken by public forest administrations in several European countries (Krott 2001: 49–50, 69–70; Stevanov and Krott 2006).

Modernisation in forest services relates to new combinations of forestry management goals, new organisational structures, more effective planning processes at local and regional levels and more integration among forest production and nature conservation goals. New approaches are being tried in information management, financial sources and budgeting tools, and involvement of private forest owners. Organisational reforms affect the responsibilities of forest services and lead to a partial or full separation between supervisory, regulatory functions and public land management responsibilities. Coordination of responsibilities and decision-making procedures among public forest services and other administrative bodies have become a necessity. Changes in public forest administration relate to the use of public information tools, to human resources policies, for instance, regarding salary structures, as well as to job security, layoffs and outsourcing. New standards and profiles in training and professional education have been developed.

4.3.4 Property rights, transaction costs and the principal agent

A more recent trend in the development of organisational considerations and models is the systematic incorporation of institutional aspects such as property rights, economic aspects such transaction costs and behavioural aspects of different actors involved in organisational processes. Called 'institutional economics', this approach increasingly shapes the understanding of the nature of organisations and their role in business administration and public management. Neo-institutional concepts that are of particular interest in this context include property rights theory, transaction costs theory and principal-agent theory.

The *theory of property rights*, developed during the 1960s, is concerned with investigating how predominant structures of ownership and possession arise, with their effects on social and economic development and the framework for economic activities (Woll 2008). The theory was decisively influenced by American economists (Alchian and Demsetz 1973; Buchanan 1975; Buchanan *et al.* 1980; Coase 1960; Olson 1968). The central problem is the relationship between rights to act and rights of disposal, on the one hand, and formal property rights on the other. Core topics are market economy and hierarchical transactions, transaction costs and comparative investigations of effectiveness and efficiency of economic systems and use regimes. Property rights, which arise from the existence and utilisation of goods, determine the distribution of rights to act and rights of disposal (Picot *et al.* 2005: 46–7). Using this approach as an explanatory model is helpful for grasping the relationship between economic agents in general and the relationships that can be implemented through organisational measures in particular.

Transaction costs theory focuses on individual transactions – that is, on exchanges between specialised actors in complex economic systems based on the division of labour (Picot *et al.* 2005: 56–7). Actors are usually individuals, although the word can be used in a general sense for companies, external stakeholders or public institutions. Transaction costs result in connection with the actualisation of a transaction – that is, in the context of preparing, agreeing, arranging, checking and adapting different types of exchange relations. The variables may be expressed in monetary terms, other benefits that are difficult or impossible to monetise and disadvantages and encumbrances that are difficult to quantify. The transaction costs approach can be applied to organisational and behavioural issues, where it is relevant to structuring practical and rational division of labour – for example, in dividing, combining and coordinating different tasks and responsibilities, or in decisions regarding the centralisation or decentralisation of competences. Other ways of using it arise in connection with optimising processes of exchange and coordination, and in defining a company's core tasks and comparing the advantages and disadvantages of outsourcing.

The *principal-agent theory* is concerned with transactions between someone, the *principal*, who mandates another person to act or decide on his or her behalf, the *agent*. The principal and agent have different interests, which may be complementary, neutral or contradictory. The actions and decisions of both depend on a combination of factors, such as legal and organisational dispositions, the distribution of resources between them, their functional and hierarchical positions and assignments of responsibility and authority. Depending on the situation and the responsibilities assigned, managers and employees in an organisational structure may act both as agents, in carrying out tasks, and as principals, in directing the activities of other staff. Several principal-agent relationships may overlap, with one person acting at different times as agent or principal (Picot *et al.* 2005: 72–3). Principal-agent theory provides explanations and organisational options for the division of labour, distribution of tasks and responsibilities, specialisation among entrepreneurial activities, human resources management and evaluation of results and achievements.

Since principal and agent often do not have the same level and quality of information, information asymmetry is a substantial cost factor and a central problem to be addressed in establishing organisational structures and processes. It should be noted that the information deficit–information advantage may lie on either side – the principal or the agent. Costs are associated with information asymmetry: for example, signalling costs for the agent who is trying to reduce the information asymmetry, control costs for the principal seeking to ensure an adequate information flow and tresidual welfare losses from persisting information deficits.

The behavioural assumptions used in the principal-agent approach are essentially the same as in the case of transaction costs theory. Both cases assume a state of limited rationality – that is, limited or incomplete information – and an incentive to maximise benefits and minimise costs. The human tendency to take risks is a further behavioural aspect. This requires considering what structural and organisational risk management measures can be taken to prevent bad decisions. Management risks of this kind may result, for instance, from inadequate information on the part of the agent, failure to note information or misinterpretation on the part of the principal or deliberate misassessment or deceit by one of the parties.

The comparison in Table 4.2 shows that these research theories should be seen in a common context. They are complementary in explaining individual behaviour and organisational design. How property rights are structured and used and how

Table 4.2 Comparison of property rights theory, transaction costs theory and principal-agent theory

	Property rights theory	*Transaction costs theory*	*Principal-agent theory*
Object of study	Distribution of property rights	Transactions	Relationship between principal and agent
Assumed behavior	Limited rationality Maximization of individual benefit	Limited rationality Maximization of individual benefit Opportunism	Limited rationality Maximization of individual benefit Opportunism Tendency of individuals involved to take risks
Efficiency criterion	Sum of transaction costs and welfare losses due to external effects	Transaction costs	– Agency costs – Signaling costs – Control costs – Residual welfare losses
Environmental conditions	– Inseparable production processes – Leverage effects – Surrogates for property	– Uncertainty – Specificity / strategic importance – Frequency – Transaction atmosphere	– Unknown quality – Characteristics – Non-observable efforts – Incomplete contracts
Design recommendation	Arrange property rights to optimize trade-off between welfare losses due to external effects and transaction costs of internalizing them	Arrange transactions with special attention to contractual conditions that minimize associated transaction costs	Achieve compatible incentives between principal and agent, or optimize trade-off between incentives and risk allocation
Action variables	Concentration or dilution of property rights	Choice of contracts with various levels of obligation	Tools for overcoming information asymmetries, balancing interests and allocating risks

Source: Picot *et al.* 2005: 142, © 2005 Schäffer-Poeschel Verlag für Wirtschaft, Steuern, Recht in Stuttgart.

their effects may be explained have direct implications for transaction costs. In turn, transaction costs are an important factor that influences the relationship between the principal and the agent.

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5 Accounting

The core economic information system

5.1 Accounting system

5.1.1 Financial and management accounting

An accounting system presents a *model of the economic transactions* between an enterprise and its economic environment, based on quantitative and usually numerical variables. It focuses on monetary variables of quantity and value (Schierenbeck 2000: 497). Business processes in the company and relationships with its entrepreneurial environment are systematically recorded and represented in monetary terms.

The accounting system provides basic data for making entrepreneurial decisions and controlling effectiveness during a determined period, usually one year. It shows how efficient a company is, both as a whole and in its various parts. It is an effective and powerful instrument that constantly prompts decision makers and managers to optimise production processes in relation to costs, customers and innovation, and to adapt their business activities to changing internal and external conditions. (For a comprehensive treatment of the subject see, for instance, Behr and Leibfried 2010.)

National and international regulations determine specific accounting procedures, which may differ significantly depending on the size and legal form of an enterprise and the scope of its business activities. Internationally accepted standards for accounting are the International Financial Reporting Standards (IFRS) and the US Generally Accepted Accounting Principles (US-GAAP). IFRS, which became national law in the member states of the EU in 2003, provides a consistent framework of bookkeeping for companies across Europe. The standards of US-GAAP, the national accounting code of the United States, have found broad international acceptance because of the size and worldwide importance of the US capital market. Both codes define the principles of accounting to ensure quality, reliability and comparability of the quantitative information:

- *Faithful representation*: The information provided needs to describe the current and true economic reality of a company (true and fair view).

- *Substance over form*: Economic reality, rather than legal and administrative form, drives the content of accounts.
- *Ongoing concern*: Accounting assumes the continuity of operations in an enterprise or company.
- *Accrual principle*: Business transactions must be recorded in the time period of their occurrence, not according to payment dates.
- *Prudence*: Accounts must consider uncertainties through a sensible valuation of balance sheet items.
- *Consistency*: The accounting treatment for business transactions should not be changed within a determined accounting period. Any changes of accounting practices, both within a time period and between time periods, need to be clarified and explained.

Legal standards, targeted generation of performance indicators and special bookkeeping requirements imply that the accounting system is highly formalised. Other aspects, such as staff satisfaction, motivation and attitudes towards work, are not included in the operational accounting system, although they have a major influence on business activities and outputs. They may be explained in complementary reports.

The accounting system provides information to owners and investors, managers and employees, and the state, external stakeholders and the public. Owners, investors, creditors and financial institutions can perceive and evaluate a company's financial results. For tax authorities, company accounts form the basis for raising taxes. Depending on the type of company, quantitatively and qualitatively different data are provided.

Important tasks to be accomplished by the accounting system are the following:

- determining assets and ownership rights;
- monitoring debts and claims;
- quantifying business activities in monetary terms;
- monitoring and controlling profitability;
- providing data for planning and budgeting;
- calculating production costs as basis for pricing;
- providing a basis for payment of taxes; and
- systematically collecting receipts for monetary transactions.

The principal distinction is between information required for external users and that needed for internal management uses (Schellenberg 2000: 21–2).

- *Data for external users*: Financial accounting provides protection for shareholders and creditors, memoranda on numerically quantifiable links with the environment, legal assistance (evidential value of bookkeeping records in cases of dispute), tax basis and public information.
- *Data for internal use*: Managerial accounting provides comprehensible reporting of the company's income, profit and cash flow to managers for decision making and controlling.

Additional management information requirements are met by processing accounting data, particularly with the help of performance indicators, comparative data and in-depth analyses. Primary processing and data collection include accounts for inventories and flow of goods, profit centre accounting and cost controlling. Budgets and planning accounts for movements of goods, investment analysis and pre-calculation for delivering goods and services are other necessary information. Secondary processing and data collection include business operating statistics, analysis of balance sheet and income statement, cost variance analysis, actual versus plan comparisons and comparative benchmarking with competing enterprises.

Financial accounting and management accounting are the two central components of the accounting system.

- Basic elements of financial accounting are the income statement (or profit and loss account), balance sheet and cash flow statement.
- Management accounting comprises cost accounting and analysis of quantitative information for making operational and strategic business decisions.

It is important to distinguish the structures and functions of the two parts and be aware of the specific bookkeeping methods that refer to them. Both components provide companies and their managers with consistent quantitative information for decision making (Jones 2006: 22–37), from costs and revenues and current and prospective business positions to strategic choices for present and future entrepreneurial directions.

The results from financial and management accounting influence company policy and company goals, support human resources management practices and elaborate effective and efficient internal organisational systems and regulations. Long-term decision making requiring capital investment appraisal is another example of the close links between accounting and decision making. For short-term decision making, contribution margin analysis, throughput accounting and break-even analysis are important instruments requiring data from the accounting system. Planning activities and performance evaluation require analysis of financial and manufacturing budgets as well as standard costing and interpretation of cost variances.

5.1.2 Bookkeeping

The figures of financial and managerial accounts are generated by recording business transactions in journals and transferring the result to the ledger. Double-entry bookkeeping is used because it is robust and quickly detects mistakes in accounting processes. This standard practice is the core economic information system in medium-sized and large companies. In small businesses, single-entry bookkeeping with income and expense accounts may be sufficient (see Chapter 2, Section 2.2.4).

Double-entry bookkeeping is based on individual financial transactions for each journal entry and uses different accounts for balance sheet and income statement (charts of accounts). They indicate stock figures (i.e. assets, liabilities and shareholders' equity) and flow figures (i.e. costs and returns). Double-entry bookkeeping records each business transaction twice based on specific rules for recording debits and credits (see Figure 5.1). There are always two accounts that are affected, since in accounting terms a business transaction corresponds to a transfer of value from one account to another. For instance, income of a company is shown first in the profit and loss statement by the comparison of cost and expenses, and second in the balance sheet through the change of owner's equity during an accounting period.

In the course of everyday business, it is not practicable to establish a new balance sheet and income statement after each business transaction is entered. In practice, business transactions are handled using double-entry accounting. Starting from an initial balance sheet, individual balance sheet accounts are opened – that is, the applicable opening value is entered into the accounts. Daily business transactions that are relevant for bookkeeping are initially presented in the form of invoices, sales receipts, bank statements or other records. These are entered chronologically into a journal, with comments (explanatory text) or an accounting record added. In the next step, the journal entry is posted to accounts and the individual accounts are charged with the relevant amounts. When the accounts are closed to prepare financial statements at year's end, the balance sheet and income statement accounts are balanced. The sum of all the accounts on a specific reporting date provides the figures for setting up the final balance sheet and income statement.

The following steps show the process, from recording transactions to preparation of a post-closing balance for an accounting cycle (Warren *et al.* 2009: 156–7).

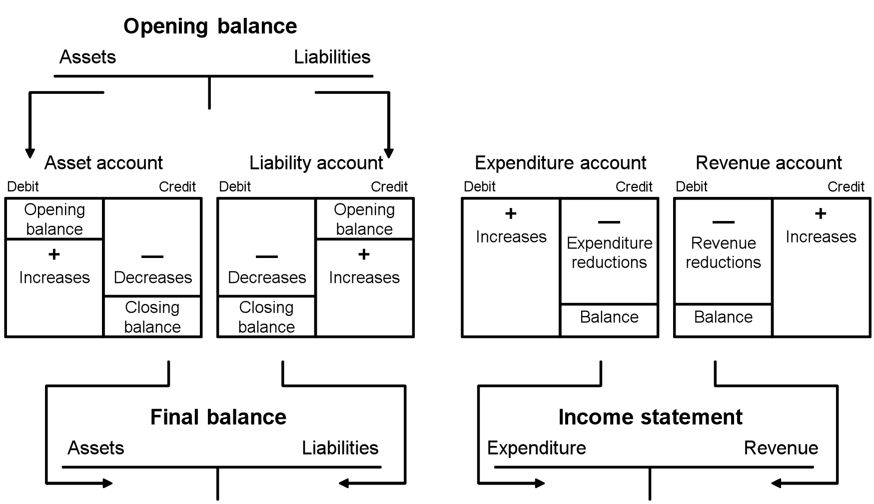


Figure 5.1 Entry rules for balance sheet and income statement

Steps in accounting cycle	*Use of documents*
Analysing and recording of transactions	Journal
Transfer of transactions to accounts	Ledger
Preparation of unadjusted trial balance	Unadjusted trial balance
Preparation of adjustment data	Records, documents
Posting of adjustment data to ledger	Journal, ledger
Preparation of adjusted trial balance	Adjusted trial balance
Preparation of financial statements	Profit and loss statement, balance sheet, cash flow statement, other reports
Preparation of closing entries	Journal, ledger
Preparation of post-closing trial balance	Post-closing trial balance

To present business transactions in an efficient, clear and reliable way, an account is formed for each item in the balance sheet and income statement. This means that changes in specific items do not affect the entire financial accounting system, only specific accounts. Accounts normally have a T shape. The two sides are known as the asset side and the liability and shareholders' equity side. Each business transaction is entered in at least two accounts as either an increase or a decrease (see Figure 5.2). Entries are entered in one account on the debit side and

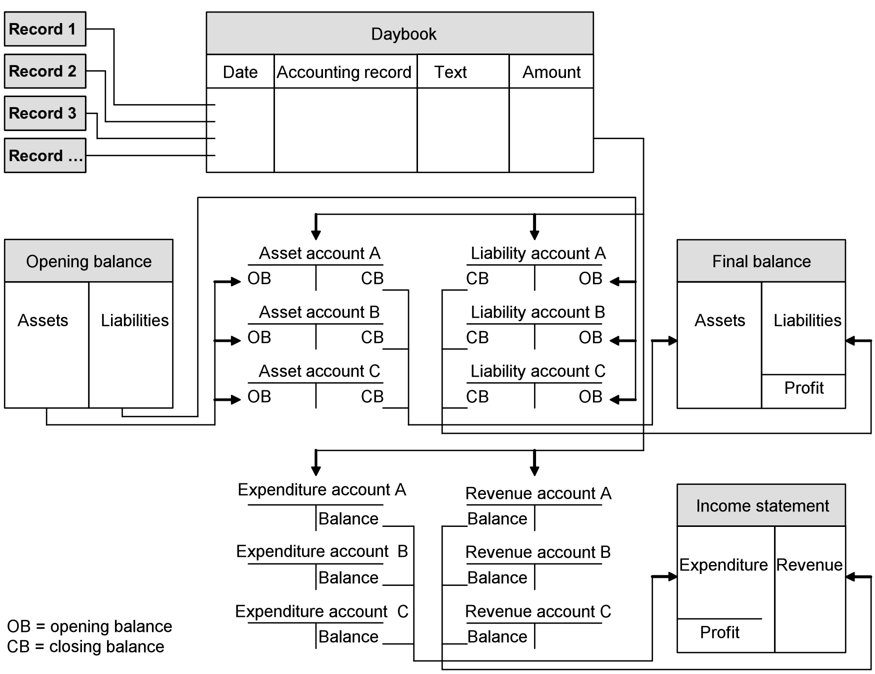


Figure 5.2 Links and accounting process in double-entry bookkeeping

in another account on the credit side. This means that opposite entry rules apply to asset and liability and shareholders' equity accounts.

A considerable number of accounts are needed, which have to be arranged according to determined criteria. A system of accounts that is clear and specific to a company is known as a chart of accounts. Because charts of accounts in similar types of companies have similar structures, a sector-specific standard chart of accounts is used. Companies use these standards as the basis for their own versions (Meyer 2002: 8–9; Schellenberg 2000: 83–4).

The chart of accounts developed by Karl Käfer (1976) has become standard. In its schematic structure, a typical example features the following classes of accounts:

– *Classes 1, 2*. Stock accounts, which serve as the basis for preparing the balance sheet.
– *Classes 3, 4*. Expense and income accounts, which are the basis for preparing the income statement.
– *Classes 5, 6*. Investments.
– *Classes 7, 8*. Open, available for internal company offsetting or bookkeeping.
– *Class 9*. The final accounts.

The system of accounts may be further developed, particularly for sector-specific groups and professional associations. Accounting systems used for public budgets involve specific budgeting codes and entry regulations that correspond to the requirements of public administration. Increasingly, they include elements similar to those used in business accounting and provide information about expenses, services and investment projects. Modern charts of accounts are software based. Their comprehensive lists of accounts provide a variety of options for individual companies.

5.2 Financial accounting

Purpose and tasks: The purpose of financial accounting is to provide structured and coherent information about a defined business period. The bookkeeping units are enterprises and companies, autonomously acting legal entities for which balance sheets and income statements are prepared. Major tasks for financial accounting include the following:

– chronologically and systematically recording current business transactions, using journals and accounts;
– calculating obligation and debt conditions at a specific date and presenting them in a balance sheet;
– making statements about earnings and risks regarding future outflows of cash, goods and services; and
– providing evidence of income and profit over a determined period and presenting this information in an income statement.

There are three main outputs of the financial accounting system:

- *Balance sheet*: It shows at a single point of time the asset and debt status of a company (formal interpretation) and allows estimating expected future business opportunities and risks (material interpretation).
- *Profit and loss statement*: It shows the economic results of business activities during a determined period.
- *Cash flow statement*: It provides detailed information on the source of cash income and use of cash over a determined period.

5.2.1 Balance sheet

The balance sheet presents the state of a company's assets and liabilities and shareholders' equity. It shows their type, amount and composition on a specific reporting date. It indicates by type, extent and due date the company's fixed assets and other noncurrent investments; its current assets in the form of cash, cash equivalents and short-term investments; its equity; and its noncurrent and current debts. There are minimum requirements for the form and content of a balance sheet (Lechner *et al.* 2010: 593–624; Meyer 2002: 15–16; Schellenberg 2000: 54).

Balance sheet items may be arranged from the point of view of liquidity. German commercial law, for instance, arranges items upwards, starting with low turnover (fixed assets, equity) and ending with the items having a high turnover (cash and short-term debt). Since this is done with assets and liabilities, the adequacy of financing for long- and short-term assets becomes visible. There are other ways to present balance sheet information. Tabular form, for example, facilitates the comparison of a company's balance sheets from different years.

International regulations address the information requirements of investors on international capital markets, whereas the focus in many national commercial laws is on protecting creditors and preserving capital. For this reason, larger companies tend to present their annual accounts in accordance with both national commercial law and international accounting regulations, to allow valid comparison of their results with companies listed in the stock market. The reporting regulations defined in the US-GAAP are widely used internationally. In Switzerland, listed companies (with the exception of banks) have been obligated since January 2005 to list their financial statements in accordance with either the IFRS or the US-GAAP principles (IASB 2008).

Companies that have securities listed on the stock markets in one of the EU member states are required to present their financial reports in accordance with the IFRS. These standards apply to limited companies and certain forms of partnerships and consist of regulations regarding the structure and content of annual financial statements and the methods to be used. On the asset side, fixed assets must be listed before current assets, and on the liabilities and shareholders' equity side, equity must be listed before long- and short-term debt (see Table 5.1).

Table 5.1 Balance sheet scheme according to IFRS

Assets		*Liabilities and shareholders' equity*	
Fixed assets	Plant, equipment	Equity	
	Financial assets	Liabilities	Noncurrent
Current assets			Current

Table 5.2 shows an IFRS balance sheet for a privately financed company in the forest industry with land holdings producing timber, fibre and wood products, and recreational services. Fixed assets and other noncurrent investments include standing timber, forestland and other fixed assets, such as buildings. Current assets include inventory, accounts receivable, cash and cash equivalents. Liabilities and shareholders' equity include share capital, shareholders' and bank loans and current liabilities, arranged by operative liabilities, tax liabilities, current debt and other current liabilities. Information provided in this structure is enhanced by three considerations: figures from the previous year are listed alongside the figures of the current year; the 'gross principle' is applied in dealing with individual asset positions; and operating and nonoperating asset components are shown separately.

Balance sheet items can also be sorted downwards, starting with those of the highest liquidity (see Table 5.3, US-GAAP). Companies may use different levels of detail in their balance sheets.

An important point in understanding the significance of a balance sheet is the concept of assets on the one side and liabilities and shareholders' equity on the other side (Warren *et al.* 2009: 52–3).

Assets are resources owned by a company that serve to create benefits for business purposes. They can be physical items like cash, supplies and property, or intangibles that have value, such as patent rights, copyrights and trademarks. Other assets include accounts receivable, prepaid expenses, buildings, equipment and land. Assets may be fixed or current.

Fixed assets are not used up at all (in the case of property) or only gradually (in the case of buildings, machines and patents) during operations. They are included in output indirectly – that is, in the resulting products or services provided. Wear and tear on fixed assets is treated as depreciation in bookkeeping terms. Fixed assets consist of goods that undergo constant or repeated use in the company. Whether an item is considered a fixed asset depends on the purpose for which it is used by the company. For example, property and real estate usually belong under fixed assets. However, if the company is in the business of selling properties, then land and real estate (with the exception of the company's own office building) are treated as current assets.

Table 5.2 IFRS balance sheet example (in thousands of Euros)

	2012	*2011*
Fixed assets and other noncurrent investments		
Timberland and forestland	794,867	830,232
Fixed assets	269,143	240,947
Other assets	161,520	146,505
Total fixed assets and other noncurrent investments	1,225,530	1,217,684
Current assets		
Prepaid and other current assets	31,653	34,862
Tax and other credit receivables	15,182	134,521
Inventories	76,861	61,822
Accounts receivables	57,726	72,464
Cash and cash equivalents	244,107	52,364
Total current assets	425,529	356,033
Total assets	1,651,059	1,573,717
Owners of parent company	421,125	392,542
Noncontrolling interests	453,130	408,106
Total equity	874,255	800,648
Noncurrent liabilities		
Post-employment benefit provision	46,336	77,998
Noncurrent debt	471,573	485,470
Other noncurrent liabilities	87,793	87,282
Total noncurrent liabilities	605,702	650,750
Current liabilities		
Operative liabilities	58,292	57,522
Tax liabilities	7,221	8,378
Current debt	65,002	3,248
Other liabilities	40,587	53,171
Total current liabilities	171,102	122,319
Total equity and liabilities	1,651,059	1,573,717

Fixed assets may be divided into tangible (or material) fixed assets, financial fixed assets and immaterial fixed assets. Material fixed assets are physically tangible. Financial fixed assets are available in the form of bonds, securities or shares. Intangible assets cover rights, such as patents, concessions and licences. Examples of each follow.

Material fixed assets:

- *Real estate*: Land, immovable tangible assets, property.
- *Machinery and equipment*: Movables, such as technical equipment, machines, tools, means of transport and business furnishings.
- *Real rights*: Building rights and easements, mining rights, joint ownership of property.

Table 5.3 US-GAAP balance sheet example (in thousands of Euros)

	2012	*2011*
Current assets		
Cash and cash equivalents	244,107	52,364
Accounts receivable	57,726	72,464
Inventory	76,861	61,822
Income tax and alternative fuel mixture credit receivable	15,182	134,521
Prepaid and other current assets	31,653	34,862
Total current assets	425,529	356,032
Timberland and forestland	794,867	830,233
Property, plant and equipment		
Other land	17,290	17,316
Buildings	91,576	88,323
Machinery and equipment	943,569	891,280
Total property, plant and equipment	1,052,435	996,919
Less accumulated depreciation	–783,292	–755,972
Total property, plant and equipment less accumulated depreciation	269,143	240,947
Other assets	161,520	146,505
Total assets	1,651,059	1,573,717
Current liabilities		
Accounts payable	40,504	40,922
Bank loans and current maturities	65,002	3,248
Accrued taxes	7,221	8,378
Accrued payroll and benefits	17,789	16,600
Accrued interest	4,335	4,549
Other current liabilities	36,251	48,622
Total current liabilities	171,102	122,319
Long-term debt	471,573	485,470
Pension and other benefits	46,336	77,998
Other noncurrent liabilities	87,793	87,282
Shareholders' equity		
Common shares	421,125	392,542
Retained earnings	453,130	408,106
Total shareholders' equity	874,255	800,648
	1,651,059	1,573,717

Financial fixed assets:

- *Bonds and securities*: Debt provided to other entities (companies, states) that will generate interest and be repaid after a defined period of time.
- *Shares*: Shares in the owner's equity of other companies that are held for long-term interests and may provide decisive influence on those companies.

Immaterial fixed assets:

- Exclusive rights, either purchased or obtained through the company's own research and development, to produce and sell goods with unique features.
- Concessions, licences, publishing rights, trademarks, copyrights, manufacturing procedures, product-related research and development costs, computer software.
- Expenses for incorporation, capital increases and organisation that serve to establish, expand or change business activities.

Current assets are goods procured and produced for the purpose of sale for which the monetary benefit inflow is expected within one year, such as raw materials, auxiliary materials and operating supplies, or semi-finished and finished products. Current assets comprise such items as the following:

- cash and cash equivalents, bank balance, bills of exchange and cheques, securities from monetary transactions that belong to the company's property;
- current receivables (claims against customers from selling goods and services), such as legally valid claims against third parties based on supplies and services that have been provided and invoiced;
- inventories of raw materials, auxiliary materials, operating supplies, semi-finished products, finished products, commissions being carried out; and
- down payments to suppliers shown in the balance sheet as current assets in the amount deposited.

Other components of current assets include accruals and deferrals. These involve entries for period-adjusted accrued and deferred items of future income for determined services:

- payments in the previous year that represent, from a business point of view, expenses for the current year; and
- accruals of payments or services expected in the current year that represent, from a business point of view, earnings from the previous year.

An example of a deferred item would be a premium paid on 1 January 201X for a company's liability insurance for a three-year period (see Table 5.4). Two-thirds of the amount paid can be shown on the asset side in the annual accounts in 201X and included in the balance sheet. In the following year, this amount represents the prepaid insurance payment.

Liabilities are the counterpart to assets. They represent the financial means available for a company to finance its operations.

Current liabilities are the amounts an enterprise owes to creditors as fixed legal obligations that must be repaid within the current year. The following components can be distinguished:

Table 5.4 Example of accruals and deferrals

Category	*Year 201X*	*Year 201X + 1*	*Year 201X + 2*
Cash	Deposit €6,000 in cash for 3-year insurance		
Expense	€2,000 = expenses in year 201X (income statement)	€2,000 = expenses in year 201X + 1 (income statement)	€2,000 = expenses in year 201X + 2 (income statement)
Accrual/ deferral	€4,000 = deferred item (balance sheet)	€2,000 = deferred item (balance sheet)	Closure of deferred item (balance sheet)

– accounts payable as current liabilities from received supplies and services;
– down payments from customers for goods and services to be delivered within the current year;
– bank debts that need to be repaid in the current year;
– bills of exchange, which are commercial papers that include a promise to pay on the part of the issuer (usually a bank or financial institution); and
– other short-term debt.

Accrued expenses and deferred income (i.e. entries for period-adjusted accounting) belong to debt. These consist of payments received during the previous year representing profits for the following year in economic terms; or goods and services received in the previous year that lead to payments in the following year but economically represent expenses for the current year.

For example, say a forest enterprise rents space in a building for €10,000 for 1 October 201X to 31 March 201X + 1, and the payment is due on 31 March 201X + 1 (see Table 5.5). This is an expense for 201X that would not be recorded without period adjustment. For the annual bill for 201X, €5,000 therefore is charged as an expense. At the same time, the rental payment due in the following year has to be shown in the balance sheet as an accrual.

Table 5.5 Example of adjustment entries

1 Oct 201X	*31 Dec 201X*	*1 Jan 201X + 1*	*31 Mar 201X + 1*
Start of tenancy	Entry of €5,000 as expense for year 201X (income statement)		Due date for rental from 1 Oct 201X to 31 Mar 201X + 1 totalling €10,000
	€5,000 accrual (balance sheet)		Entry of €5,000 as expenses for year 201X + 1 (income statement)
			Closure of accrual

Debt as part of *noncurrent liabilities* may have several other components:

- *Provisions*: Long-term obligations towards third parties if it is uncertain when they will arise, what the amount will be and to which individuals, companies or institutions they are to be paid. Provisions are shown in the balance sheet at the expected or estimated amount. This applies, for instance, to expected but not yet realised losses, forthcoming tax payments and guarantee and insurance provisions.
- *Loans*: Bond loans, convertible bonds and optional bonds raised on the capital market that need to be repaid after the current year are shown on the balance sheet as amounts repayable.
- Mortgages.

Shareholders' equity: The economic result of a year's business activities (profit or loss) is added to or withdrawn from shareholder equity. Components of equity are the owners' capital, representing proprietorship in the company; accumulated and not distributed profits, which are shown on the balance sheet as reserves; profits from the previous year that have been neither distributed nor assigned to the company's reserves and are therefore available; and net profit available for distribution after retransfer of statutory reserves.

A company's assets are financed with equity and from debts owed to third parties – that is, with long- and short-term loan capital. The connection between origin and use of financial resources gives rise to the equation Σ assets = Σ liabilities + shareholders' equity. The principle of the balance sheet, that the amount of assets corresponds to the amount of liabilities and shareholders' equity, is used to calculate the company's equity. For this purpose, existing asset entries are valued individually and added up to determine the assets. All claims against the company from third parties are then listed and assessed. The resulting shareholders' equity is the sum of all assets minus the sum of all liabilities.

Changes in the balance sheet: The principle is that if an asset entry changes because of a business transaction, then either another asset entry has to change by the same amount in the opposite direction, or a liability and shareholders' equity account has to change by the same amount in the same direction. This principle applies equally to business transactions affecting liabilities. Thus every business transaction involves two equal changes, the effects of which are opposite. Four possible types of change in the balance sheet are possible (Meyer 2002: 21–2):

Asset swap:

Balance sheet

Cash	–	
Goods	+	

Example:
purchase of goods in cash

Increase in total assets:

Balance sheet			
Goods	−	Accounts payable	+

Example:
purchase of goods on
credit from supplier

Swap in liabilities and shareholders' equity:

Balance sheet			
		Loan	−
		Equity	+

Example:
conversation of loan
into equity

Reduction in total assets:

Balance sheet			
Cash	−	Accounts payable	−

Example:
purchase of debt owed
to supplier

5.2.2 Income statement (profit and loss account)

Business transactions that affect asset accounts have an effect on shareholders' equity. This is relevant in the case of a reduction of assets (e.g. cash, inventory) for generating revenue or increasing liabilities without any effect on assets (e.g. by building up provisions), or a company may experience an increase in assets from generating revenue or a decrease in liabilities without any effect on assets. The difference between expense and income explains the change in equity during a defined business period resulting from the production and distribution of goods and services.

These transactions are recorded in the *income statement*, also referred to as a *profit and loss account*. Because income and expenses lead to changes in assets and liabilities, it follows that income from business activities appears in the balance sheet as a change in shareholders' equity and in the income statement at the same time and to the same extent. Figure 5.3 shows how the balance sheet and the income statement indicate income simultaneously and in the same amounts over an accounting period of one year.

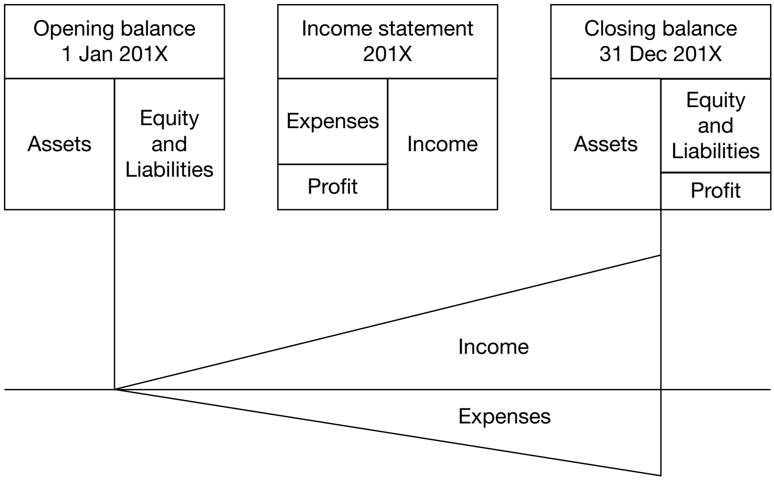


Figure 5.3 Double profit calculation with balance sheet and income statement

Table 5.6 shows the steps and links between the balance sheet and the income statement using entries for specific business transactions.

(1) Deposit of capital (€1,000) by owners in the company's bank account (current asset). The shareholders' equity increases by the same amount. The balance sheet is growing.
(2) Cash sale of a product: (a) The product is sold at a price of €50. Therefore the cash account in the balance sheet increases by this amount. (b) The product has a book value of €35. The inventory account decreases by this amount. In total, the balance sheet increases by €15 (€50 cash – €35 book value = €15). (c) The product sold generates a revenue of €50 in the income statement. (d) At the same time the book value of the product is recorded as an expense of €35. Thus an income of €15 is recorded (€50 revenue – €35 cost of goods sold = €15). For the sake of simplicity VAT is not taken into account in this example. Note the corresponding entries in the balance sheet and income statements as a result of double-entry bookkeeping.
(3) Depreciation of a machine (€30) as a reduction in value of a specific asset. This consumption of assets on the balance sheet is reflected in the income statement as an expense.
(4) Formation of a provision (€6) for guarantee services. This is a presumed payment obligation to third parties, outside the company. A reserve has to be assigned to debt (liability and shareholders' equity), which increases. The counterentry is made as an expense in the income statement.
(5) Repayment of a loan (€80). This reduction in total assets leads to liability entries for debt, and the bank account balance (asset) declines.
(6) Liquidation of provisions (€25) no longer required. If, for example, presumed claims from third parties do not have to be met, debt (liability and share-

Table 5.6 Connection between balance sheet and income statement

	Change in balance sheet over period		*Income statement*	
Process	*Assets €*	*Liabilities and shareholders' equity €*	*Expenses €*	*Income €*
(1)	+ 1,000	+ 1,000		
(2)	+ 15			+ 15
(3)	– 30		+ 30	
(4)		+ 6	+ 6	
(5)	– 80	– 80		
(6)		– 25		+ 25
Profit		+ 4	+ 4	
Total	905	905	40	40

holders' equity) declines. This results in corresponding income in the income statement and an increase in shareholders' equity.

The resulting profit from these transactions can be calculated from the difference of changes in assets and liabilities and from the difference between income and expenses.

Overall, the table format for an income statement provides comprehensive information, is easy to read and presents intermediate results. It shows in detail a graduated listing of overall business income, the operating results before interest and tax, the overall annual results and the annual earnings or annual losses.

Accounting regulations of IFRS, US-GAAP and national commercial laws contain detailed provisions regarding the content, structure and definition categories to be shown in a profit and loss statement. Defined categories are as follows:

– *Operating expense and income*: This category is specific to the type of company and comprises recurrent expenses and income that derive from customary business activities: costs for materials, goods, staff, interest payments on loans, depreciation and other operating costs. The category also includes the returns from goods and financial operations, and from other types of operating return.
– *Nonoperating (external) expense and income*: These items are recurrent but not specific to a company's activities – for example, use of noncompany assets and sales of fixed assets.
– *Extraordinary expense and income*: These are not recurrent. Examples include income from the liquidation of reserves that are no longer required, unusually high losses from debtors and the sale of fixed assets.

Two methods are commonly used to structure income statements. Both start with revenues but diverge in the way costs are allocated and in the grouping of the costs. The resulting net profit of both methods is identical.

The *nature-of-expense method* displays all costs incurred for operations in a period (see Table 5.7). Since production and sales do not have to occur in the same period, adjustments for changes in inventory and for goods and services used on own accounts are necessary to calculate net profit. The method displays cost types in the income statement.

The *cost-of-sales method* displays costs that are connected with revenue accumulated in a specific year (see Table 5.8). No adjustments for changes in inventory or use of goods or services on own accounts are required. The costs incurred are grouped not by cost type but by function. The advantage of the cost-of-sales format is that it shows an accurate and valid operating result. The income statement presents both the gross margin, in the form of the difference between turnover and the manufacturing costs of turnover, and the costs of other functions in the company. The disadvantage is that the structure of different types of costs (materials, staff, depreciation) is not shown.

IFRS allows both methods for presenting income statements. In Europe, income statements are often presented in the nature-of-expense accounting format. US-GAAP requires the cost-of-sales method for income statements.

For an income statement to be accurate and valid, income during the given period has to be reliably established. This means to proceed according to these rules:

– Profit can be shown only if it has been realised. An order from a customer might be cancelled or altered, for example, so it is only at the time of delivery

Table 5.7 Income statement using nature-of-expense method according to IFRS (in thousands of Euros, except per share data)

	2012	*2011*
Sales	918,717	816,267
Other operating income	17,385	153,761
Net change in inventory	15,040	– 5,841
Materials and services	– 517,589	– 447,702
Freight and sales commissions	– 64,106	– 57,877
Personnel expenses	– 71,648	– 60,691
Other operating expenses	– 678	– 1,242
Depreciation	– 100,173	– 110,625
Operating profit or loss	196,948	286,050
Net financial items	– 34,330	– 35,367
Profit or loss before tax	162,618	250,683
Income tax	– 10,630	– 32,367
Net profit or loss for period	151,988	218,316
Earnings per common share		
Basic earnings per share	1.89	2.76
Diluted earnings per share	1.87	2.73

Table 5.8 Income statement using cost-of-sales method according to US-GAAP (in thousands of Euros, except per share data)

	2012	*2011*
Sales	918,717	816,267
Costs and expenses		
Cost of sales	– 691,604	– 638,987
Selling and general expenses	– 46,872	– 43,750
Other operating income (net)	16,707	152,520
Operating income	196,948	286,050
Interest expense	– 35,249	– 36,631
Interest and miscellaneous income (net)	919	1,264
Income before income taxes	162,618	250,683
Income tax expense	– 10,630	– 32,367
Net income	151,988	218,316
Earnings per common share		
Basic earnings per share	1.89	2.76
Diluted earnings per share	1.87	2.73

and invoicing, when the transaction has become certain, that the revenue can be accurately and legally assessed.

– Profit has to be correctly defined in relation to time periods. Manufacturing a product or providing a service requires time. The value of a specific product or service may be realised in a business period later than the one in which it was produced. The time periods are recognised using accruals and deferrals.
– Comparability can be ensured only if income in different years is calculated using the same principles. If some items are entered in a different way, the change needs to be mentioned during reporting.

5.2.3 Cash flow statement

Cash flow statements document financing processes for owners, managers and external parties. This format of accounting report is just as important as the balance sheet and the income statement (Schellenberg 2000: 179–80). Whereas the balance sheet captures the company's capital structure on a specific reference date, a cash flow statement provides information about the origin and use of funds flowing through the company during a financial year or other period of time. It shows the reasons for observable changes in cash pools. Both IFRS and US-GAAP require cash flow statements; national laws do not necessarily call for this accounting instrument.

The operating free cash flow provides information about how much money a company has generated above the cash required for supplies, wages, investments and so forth. These surplus funds are available for further entrepreneurial activities or can be distributed to owners. The evaluation of companies by profit-oriented investors on today's capital markets is essentially based on operating cash flow (Betsch *et al.* 2000: 211–12), in recognition that companies' long-term success depends on their ability to sustainably finance their liabilities and investment needs using cash from their business activities. From this point of view, cash flow is a strategic performance indicator for company management. It can be calculated on the basis of income and expenses that affect liquidity with the direct calculation method; or with the indirect method on the basis of liquidity-neutral items and changes in the net working capital of the income statement (see Table 5.9).

Table 5.9 Direct and indirect calculation of cash flow

	Cash flow statement	*Examples*
Direct method	Revenue – costs affecting liquidity = Cash flow	Wages, procured raw materials, external services rendered
Indirect method	Profit – change in net working capital + costs neutral for liquidity = Cash flow	Depreciation, build up of reserves and provisions, change in book value of assets

Items to be added to income include depreciation from use of tangible assets over time, deferred payments and amortisation from loss of intangible asset value over time. It also includes gains or losses from the sale of noncurrent assets that are not part of the operating activities of the company. In addition, the change in working capital has significant influence on cash flow. The selection of cash pools examined and the structure of a cash flow statement depend on the specific information requirements.

Typical cash flow statements are divided into three parts (see Table 5.10):

– Cash flow resulting from *operating activities* includes receipts from the sale of goods and services, dividends received on equity securities, interest received on loans, payments to suppliers for goods and services, payments to employees or on behalf of employees and interest payments.
– Cash flow resulting from *investing activities* includes the purchase or sale of fixed assets (e.g. land, buildings and equipment), loans made to suppliers or received from customers and payments related to mergers and acquisitions.
– Cash flow from *financing activities* includes inflow of cash from investors (e.g. shareholders) or from debt financing through banks and outflows of cash to shareholders as dividends from income the company has generated. Other activities that affect the long-term liabilities and equity of the company may also be listed under financing activities.

Table 5.10 Example of cash flow statement according to US-GAAP (in thousands of Euros)

	2012	*2011*
Operating activities		
Net income	151,988	218,316
Adjustments to reconcile net income to cash		
Depreciation, depletion and amortisation	100,172	110,625
Noncash cost of real estate sold	4,674	5,333
Stock-based incentive compensation expense	10,634	11,004
Amortisation of convertible debt discount	5,700	4,552
Deferred income taxes	10,433	–4,373
Other	–3,945	5,840
Changes in operating assets and liabilities		
Receivables	14,511	–18,764
Inventories	–19,344	6,428
Accounts payable	–3,217	–8,768
Income tax and alternative fuel mixture credit	119,339	–133,204
Other current assets	1,797	–2,649
Accrued liabilities	–8,945	19,780
Other assets	–1,301	993
Other noncurrent liabilities	–36,456	–459
Cash provided by operating activities	346,040	214,654
Investing activities		
Capital expenditures	–96,709	–64,031
Purchase of forestland	–3,744	0
Purchase of real estate	0	0
Change in restricted cash	–5,750	977
Other	6,555	–1,730
Cash used for investing activities	–99,648	–64,784
Financing activities		
Issuance of debt	109,668	186,854
Repayment of debt	–67,512	–214,895
Dividends paid	–114,329	–110,518
Proceeds from issuance of common shares	22,161	18,400
Repurchase of common shares	–4,603	–20,625
Cash used for financing activities	–54,615	–140,784
Effect of exchange rate changes on cash	–34	189
Cash and cash equivalents		
Increase (decrease) in cash equivalents	191,743	9,276
Balance, beginning of year	52,364	43,088
Balance, end of year	244,107	52,364

Cash flow statements reveal information on past developments and future opportunities:

- How much was the inflow of financial resources based on actual business activities? What are the factors determining the level of cash flow?
- What was the source of resources from which business activities were financed during the previous period? What other financial sources, apart from the company's own resources, were drawn on, and to what extent?
- How much investment was carried out and what was the source of the resources used to finance it?
- How is the company's financial situation likely to develop during the coming year? What financial reserves are available to allow the company to respond to unforeseen events?

5.2.4 Valuation issues

Since financial statements are intended to represent the true economic condition of a company, the methods for determining the value of items are subject to accounting practices and regulations. Valuation issues arise in connection with drawing up asset registers, which are precise lists of all property assets and debts by quantity and value. The need for valuation arises for almost every asset entry – for foreign currency from export earnings, for estimating the probability of receiving payment from debtors or in calculating the warehouse value of semi-finished or finished goods. When machinery, investments and intangible goods are valued, the future expected inflow needs to be assessed. This is difficult if the assets have an indirect benefit for operating purposes – as is the case, for instance, for furnishings, new technologies and licences and patents.

Valuation of current assets: Current assets comprise inventories of raw materials, operating supplies, work in process and finished goods, accounts receivables, cash and cash equivalents. The basis for inventory is the purchasing cost for raw materials and operating supplies. For work in process and finished goods, the manufacturing cost is the basis for valuation. By their very nature, most inventories turn over several times in an accounting period. Especially in merchandising, businesses inventory turnover tends to be high. Valuation issues relate to a large extent to inventories of current assets (Warren *et al*. 2009: 311–51).

In some kinds of operations, similar materials may be purchased multiple times during a year to avoid high stocks, and purchases may be made at different prices. Replacement of stock often takes place before the old material is fully used up. Consequently, company inventories contain similar items that most likely have different purchasing values. This creates a problem for accounting: for every item produced or sold, the correct costs must be recorded so that gross margins can be correctly calculated. If similar stock items have different values, it is not intuitively clear which value should be used for a specific business transaction. To overcome this problem, accounting systems use 'inventory cost flow assumptions', which provide rules and methods to unambiguously define the correct value of consumed stock items.

Three methods may be used:

1. *First in, first out (FIFO) inventory cost flow*. The first units purchased are assumed to be used or sold first. The total value of the inventory is built up with the most recent incoming stock and its value.
2. *Last in, first out (LIFO) inventory cost flow*. The last units purchased are assumed to be used or sold first. The total value of the inventory is built up with the first incoming stock and its value.
3. *Average inventory cost flow*. Every unit of a stock item has the same value for the purpose of recording business transactions. As new stock arrives, the average value of the inventory is recalculated.

For the same business transaction, the three methods lead to different results with regard to cost of goods sold, gross profit, net income and inventory value on the balance sheet at the end of the business period. In general, the LIFO method generates lower gross profits and higher inventory values in times of increasing purchase prices, compared with the other two methods. In times of decreasing purchasing prices, the FIFO method generates lower gross profits and higher inventory values. To ensure consistent financial statements, the valuation method for inventories may not be changed in the course of a business period (usually a year). If a company decides to change the method for valuation of inventories, it provides in the financial statements a *pro forma* calculation that shows the results of the old method in comparison with the new one.

Market prices are the standard basis for recording inventory value. When a company's raw materials are undergoing price declines, the costs of replacing inventory are lower than the recorded purchase cost. In this case inventory value needs to be written down to the new cost base. The same applies if stock items must be sold on the market at a lower price than the recorded value. This may happen if the items are out-of-date or damaged or if market prices plunge, as would be the case after heavy storms and a subsequent excess supply of wood on the market.

Depreciation of fixed assets: The value of fixed assets on a balance sheet represents the value of long-term resources for business transactions (Warren *et al.* 2009: 441–55). The fixed assets are purchased on a specific date, which makes them subject to accounting and valuation (purchasing value). As a result of wear and tear and different lifetimes of property, plant and equipment, the asset value needs to be gradually adjusted and converted into an expense. This procedure is called depreciation. The value of a fixed asset and the extent to which it should be depreciated are measured relative to the benefit that it continues to deliver in the future.

From the management point of view, the tasks involved in depreciation accounting are as follows:

– valuing the assets on a specific reporting date (the static aspect);
– calculating the production costs, including depreciation of products and services produced over a set period (the dynamic aspect); and

– ensuring sufficient financing to replace a fixed asset to the value of the accumulated depreciation (the financial or asset maintenance aspect).

The following factors should be noted when setting depreciation values (Schellenberg 2000: 277–8):

- reduced value due to use
  - technical wear and tear, asset reduction
  - use-related catastrophic wear (total loss)
- reduced value due to time
  - natural wear and tear (static wear)
  - loss of usability due to price collapse
  - shift in demand on the sales market
  - expiry of patents, licenses, building rights, rental and lease contracts
  - legal regulations
  - profit declaration intentions
- amount of depreciation
  - estimated use period of the asset
  - expected terminal value at the end of the estimated use period
  - depreciation procedure that regulates the assignment of depreciation amounts to individual reporting periods

To assess the use period, empirical values are available that can be used as estimates in the accounting system. The expected liquidation proceeds are estimated on the second-hand market (bargains) or via exchange offers.

The criteria for time-related declines in value are important for the depreciation methods used in the wood industry. Technical innovations, such as chipping technology, for example, can limit the usability of gang saws. Alternatively, the reduced demand for preservative-impregnated railway sleepers means that impregnating plants have to apply faster depreciation than was originally planned. Emissions thresholds for noise or maximum permissible amounts of pollutants can be met through technological innovations or by shortening the depreciation periods for existing equipment. In forestry, empirical values from management studies or technical criteria can be used in determining standard depreciation periods. Small equipment like chainsaws may be included in fixed asset inventories, or it can be charged at full purchasing value to the expense account for machinery and tools in the accounts for the current period. Just like current assets, fixed asset valuations must be adjusted if the recorded book value is higher than the expected economic contribution over the lifetime of the asset. This may happen if market conditions change dramatically and the expected returns from operations are not sufficient to recover the cost of production, including depreciation. In this case the asset is partially or fully written off (impairment).

Several *depreciation methods* have been developed to take into account varying types of use and progressive value reduction in fixed assets over the period of their use. However, it is not always possible to determine in advance whether the expected value reduction will be greater in the initial or final years of the estimated working life. Use in later years is often more intensive, with a consequent increase in wear. There are four current depreciation methods:

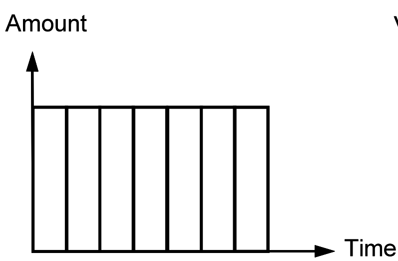
- straight-line depreciation;
- declining-balance depreciation;
- progressive depreciation; and
- depreciation based on effective production output.

Straight-line depreciation or time-proportional depreciation: The level of use wear is the same in all periods. This results in stable annual depreciation amounts. If the performance of the item per time unit is constant, this procedure corresponds to performance-proportional depreciation. Straight-line, or time-proportional, depreciation is calculated using the following formula:

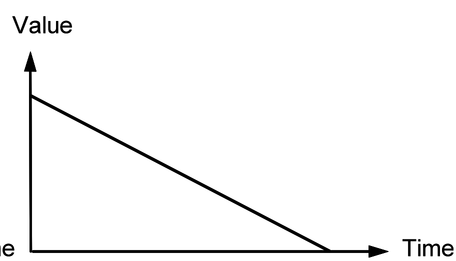
$$D_t = \frac{V - R}{n}$$

D_t = depreciation amount in period t;
V = value at the time of procurement;
R = terminal value, liquidation value at the end of the useful life; and
n = use period (estimated).

Linear and time-proportional depreciation:



Linear depreciation



Time-proportional depreciation

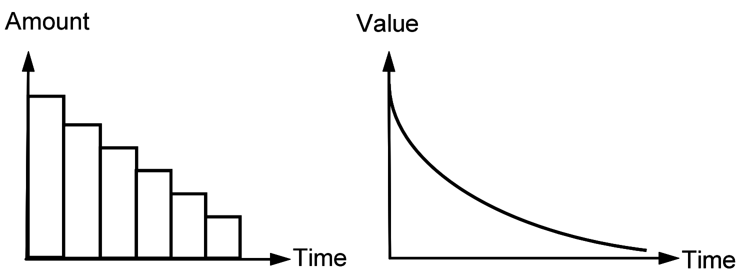
Declining-balance depreciation: Greater depreciation is expected to take place during the initial years, after which usage declines. The declining wear in successive periods leads to annually declining depreciation amounts. This method is mainly used in financial accounting and tax-oriented depreciation policies. Frequently the geometric declining-balance method is used. A determined interest rate (e.g. 10 per cent) is written off the applicable book value, which remains constant during the whole depreciation period.

The variables used in the calculation are

$D_t = V \cdot (1 - i)^{t-1} \cdot i$
$B_t = V \cdot (1 - i)^t$
$R = V \cdot (1 - i)^n$

i = discounting rate p/100;
t = time index for the current year ($t = 1, 2, \ldots n$);
n = use period (estimated);
D_t = depreciation amount in period t;
V = value at the time of procurement;
B_t = book value at the end of period t; and
R = terminal value, liquidation value at the end of the useful life.

Declining-balance depreciation:

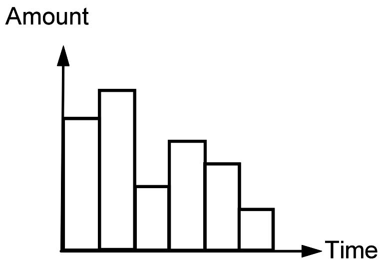


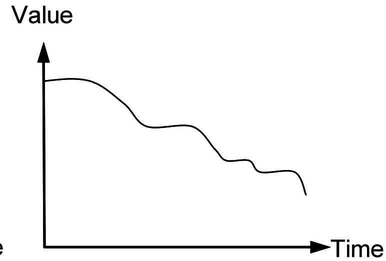
Depreciation based on effective production output: The value reduction is measured by the effective utilisation of fixed assets with variable depreciation charges. Depreciation relative to use is appropriate when the effective use is easy to measure and wear and tear can be estimated on the basis of production. This is the case, for example, with yearly usage hours for machines or kilometres driven by car. Depreciation of the asset value according to units produced is calculated using the following equation:

$$D_t = (V - R) \cdot \frac{P_t}{\sum_{i=1}^{n} P_i}$$

D_t = depreciation amount in period t;
V = value at the time of procurement;
n = use period (estimated);
P_t = production in period t;
ΣP_i = total for all units produced by the asset; and
R = terminal value, liquidation value at the end of the useful life.

Depreciation based on use of assets:





If production P_t is constant over all periods, this procedure is equivalent to straight-line, time-proportional depreciation.

Recording depreciation: When fixed assets that have been acquired are put into use, all costs arising along with their procurement and commissioning are recorded in addition to the actual purchase cost. Such costs may include planning, installation and adjustments. Maintenance and repair work, including costs for upkeep of the fixed asset, are usually entered in the relevant expense account. In practice, however, a clear distinction between maintenance and value-increasing improvement work on fixed assets is difficult. In the case of large industrial machinery units, replacing entire machine parts is often both the purpose of maintenance and a depreciation-relevant increase in value as a result of modernisation.

In *direct depreciation*, the value of the item is reduced in the balance sheet account for the asset and charged as an expense to the income statement. The original value thus no longer appears on the balance sheet from the second year onward.

In *indirect depreciation*, the initial asset value remains in the account. The cumulative depreciation charge is held in a special valuation adjustment account, which in terms of its purpose is a ‘contra asset’ account. To emphasise its content, it is directly listed on the balance sheet after the main account and subtracted from it. This approach makes the acquisition costs, cumulative depreciation and book value of the assets visible on the balance sheet. Linear, time-proportional depreciation is used mostly for financial accounting purposes. Declining-balance depreciation is often applicable for determining tax burdens for a company. The difference in tax liabilities compared with time-proportional depreciation is then displayed in the balance sheet as ‘deferred taxes’.

Depreciation should be carried out by the same method over time so that results from different periods can be compared and manufacturing costs can be calculated as precisely as possible. Nevertheless, the depreciation amounts charged may be influenced by financial considerations. In successful business years, companies tend to charge more depreciation to reduce profits, for tax reasons. In a poor business year an effort is usually made to show lower depreciation amounts. The difference between the two objectives is handled in practice by using two depreciation variables: depreciation charges according to financial considerations, and imputed (calculated) charges that allow an economic valuation for managerial purposes.

Figure 5.4 shows the accounting procedures and interconnections between two frame saw units. The depreciation charges for the two units amount to €450,000 and €300,000, respectively. These amounts are broken down in an accrual account. The effective or imputed value reduction amounts to €600,000. However, for tax reasons, €750,000 is reported. This reduces the net profit reported externally and to the fiscal authority to €40,000. In the internal income statement, however, the effective depreciation charge is shown with a correspondingly higher net profit.

Uncollectable accounts: Sometimes, customers cannot meet their liabilities. For the creditor this means a loss, since sales or other commitments are recognised in accounts receivable as not being paid. Insolvent debtors have to be removed from the list of active debts. Debts that cannot be realised are transferred to the expense account for bad debt losses. For reasons of accounting caution, another valuation adjustment has to be made for uncollectable receivables. It is a flat-rate adjustment within a range customary in a given industry. It should immediately be listed in the accounts receivable and subtracted as a presumed future reduction in cash inflow.

Contingent liabilities: These are presumed liabilities to third parties, but it is not possible to say in advance whether they will have to be paid, or if so, to whom, when and how much. To be recorded in the balance sheet, they need to be probable and at least estimated. As potential obligations to pay, they are assigned to debt in the balance sheet. Examples are contingent liabilities for guarantee services, potential court actions, damages to property, major unanticipated repairs and maintenance, unforeseen tax demands and possible losses from pending business.

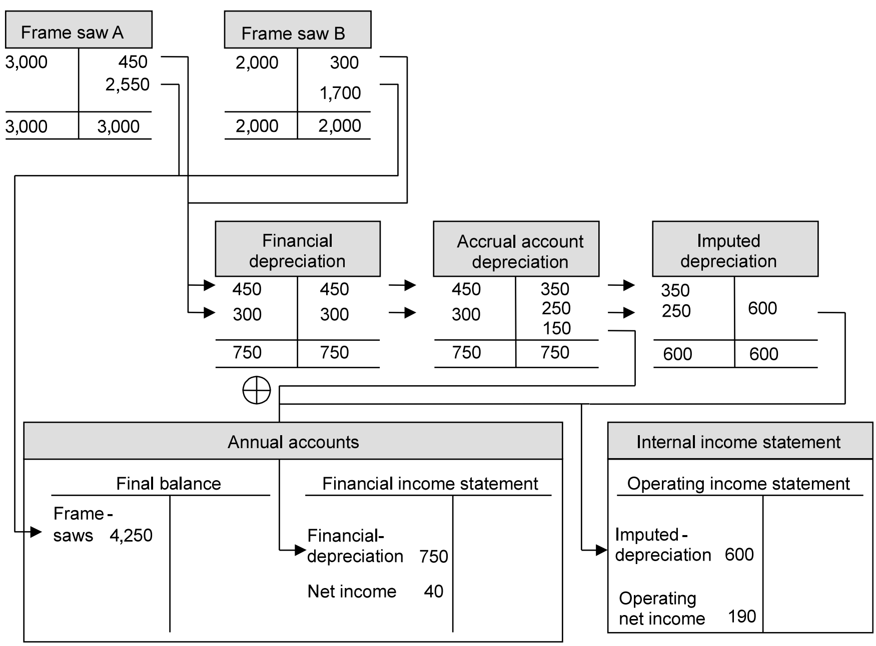


Figure 5.4 Financial and imputed depreciation (thousands of Euros)

Contingent liabilities are charged to the income items under which expenses or reduced income would be indicated.

Hidden reserves: Hidden reserves are equity that is not apparent to an external reader of the balance sheet. They arise when assets are undervalued or debt is overvalued. In such a case, the company's equity appears smaller than it actually is. For example, if financial depreciation charges are higher than the imputed depreciation, the asset value on the balance sheet will decline faster than necessary from a business point of view. Undervaluation in fixed assets may occur because of value-increasing repair work that is fully expensed in annual accounts, or as a result of lower prices for replacement. Hidden reserves are thus the result of valuation differences in balance sheet items. They arise from several causes:

- undervaluation of fixed assets
  - excessive depreciation charges, from a business point of view
- omission of assets
  - depreciation to zero (*pro memoria* items)
  - failure to activate assets
  - not showing accruals or deferrals in the balance sheet
  - not activating specific expenses (e.g. for buildings under construction)
- overvaluation of debt
  - formation of contingencies that are excessive, from a business point of view
  - nonliquidation of contingencies that are no longer required
  - application of excessively high exchange rates for foreign currency debts

5.2.5 Financial analysis

Regular and reasoned analysis of the financial results of a company is one of the most important purposes of the accounting system. Essentially, the financial analysis aims at answering questions about the financial stability of a company and its ability to generate profit (Coenenberg 2000: 875). Balance sheet analysis, income statement analysis and cash flow analysis are the three closely linked sources providing the necessary information for drawing an accurate picture of the financial situation and profitability of a company. Together, they form the basis for an assessment of past and present business activities. This in return allows owners, shareholders and managers to take forward-looking entrepreneurial decisions to benefit from new business opportunities and deal with possible business threats.

Adjustment of annual accounts: The more precisely the accounting data represent true operating values, the more informative the analysis of the balance sheet and income statement will be. Annual accounts produced mainly on the basis of commercial law requirements may need to be adjusted to remove unusual, below-the-line and external values so that the effective assets and income level can be assessed. Tasks that may be required for this kind of adjustment include the following:

- on the balance sheet
  - liquidation of hidden reserves (inventory, supplies)
  - offsetting of valuation adjustments with the basic accounts
  - classification of certain items
  - rounding up of figures
- in the income statement
  - liquidation of hidden reserves (affecting income)
  - classification of certain items
  - rounding up of figures

Specific groups of accounts have to be related to each other and interpreted with the help of performance indicators. Benchmark figures customary in a given sector have an indicative value and are of limited relevance. Ultimately, each business unit or company has to be assessed individually. The following groups of performance indicators can be used in financial analysis (Schellenberg 2000: 143):

- indicators for analysing asset structure;
- indicators for analysing debt structure and reserve ratio;
- indicators for analysing liquidity;
- indicators for analysing the profit situation; and
- integrated indicator systems.

Balance sheet analysis: Figure 5.5 indicates elements of balance sheet analysis and their interconnections.

The *current to fixed assets ratio* varies within economic branches and from sector to sector. The *intensity of investments* is the ratio between fixed assets and

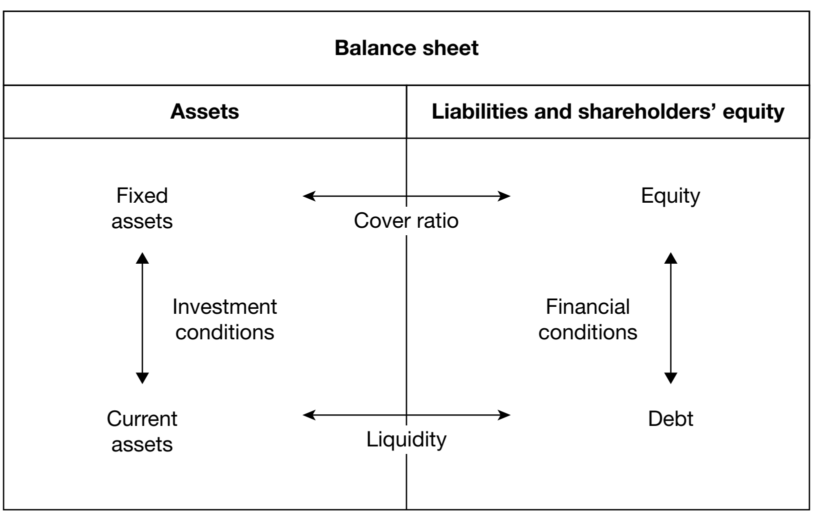


Figure 5.5 Analysis of the balance sheet

total assets. Both ratios depend on the nature of the business. Companies that produce goods usually show a significantly higher intensity of investments than merchandising companies. Their determination is useful for analysing time series (change of ratio over time) and indicating the structure and level of financial requirements. Companies with high investment intensity tend to have a higher demand for long-term financing.

$$\textit{Current to fixed assets ratio} = \frac{\textit{Current assets}}{\textit{Fixed assets}} \quad \left\{\frac{\textit{Proportion of current assets (\%)}}{\textit{Proportion of fixed assets (\%)}}\right\}$$

$$\textit{Intensity of investments} = \frac{\textit{Fixed assets} \bullet 100\ [\%]}{\textit{Total assets}}$$

The *debt to equity ratio* indicates the relation between liabilities and equity. This ratio provides important information to lenders by indicating how the financing risk of a company is distributed between creditors and shareholders.

$$\textit{Debt to equity ratio} = \frac{\textit{Debt}}{\textit{Equity}}$$

$$\textit{Debt ratio (equity gearing)} = \frac{\textit{Debt} \bullet 100\ [\%]}{\textit{Total liabilities and shareholders' equity}}$$

$$\textit{Equity ratio} = \frac{\textit{Equity} \bullet 100\ [\%]}{\textit{Total liabilities and shareholders' equity}}$$

Liquidity means capacity to pay. Performance indicators for liquidity show whether sufficient cash or cash equivalents are available to meet current liabilities. Three methods of what is known as the liquidity ratio compare the available means of payment with short-term debts.

Liquidity ratio I (cash ratio) is liquid funds as a percentage of current liabilities.

$$\textit{Liquidity ratio I} = \frac{\textit{Liquid funds} \bullet 100\ [\%]}{\textit{Current liabilities}}$$

Liquidity ratio II (quick ratio) is liquid funds plus accounts receivable as a percentage of current liabilities.

$$\textit{Liquidity ratio II} = \frac{\textit{(Liquid funds + accounts receivable)} \bullet 100\ [\%]}{\textit{Current liabilities}}$$

Liquidity ratio III (current ratio) is current assets as a percentage of current liabilities.

$$Liquidity\ ratio\ III = \frac{Current\ assets \bullet\ 100\ [\%]}{Current\ liabilities}$$

Liquidity ratios provide information to short-term creditors of a company (banks, suppliers) and indicate how much of the credit is covered by assets that can be converted into cash. Ratio I refers to cash only; ratio II includes additional receivable funds; ratio III includes inventories of raw materials, work in progress and finished goods, assuming that these items have a market value. The three ratios express different levels of certainty and place obligations to creditors with regard to repayment of invoices due.

Asset cover ratio: Fixed assets contain higher levels of risk than current assets. Investments are expensive, and it is not always certain that they will generate future profits. The requirement to match maturity dates in financing means that fixed assets should be financed with capital that is available in the longer term – that is, with equity and long-term debt. *Fixed asset cover ratios* represent the relationship between long-term tied assets and long-term available financing. The cover ratios compare the two sides of the balance sheet and provide information about how the fixed assets are financed.

Fixed asset cover ratio I is equity as a percentage of fixed assets.

$$Asset\ cover\ ratio\ I = \frac{Equity \bullet\ 100\ [\%]}{Fixed\ assets}$$

Fixed asset cover ratio II is equity plus long-term liabilities expressed as a percentage of fixed assets.

$$Asset\ cover\ ratio\ II = \frac{(Equity + long\text{-}term\ liabilities) \bullet\ 100\ [\%]}{Fixed\ assets}$$

Performance indicators vary by economic sector and branch, size of a company, ownership and economic performance. Balance sheet performance indicators are especially important for debt financing through banks. A high proportion of equity and a good asset cover ratio indicate lower risks for the creditor and thus usually lead to lower interest rates for the borrower.

A central question in financing relates to the appropriate share of equity in the balance sheet of a company. There is no general answer, however, since this depends on the nature of the enterprise and the shareholders. In smaller businesses without access to capital markets, a solid level of equity may be an advantage because it gives banks a higher level of confidence in the ability to pay back debt and allows lower interest rates. A high level of equity financing gives shareholders independence from capital markets and institutional players, which can be an important motivation, especially for family-owned businesses. For larger entities, especially when institutional investors represent the majority of the shareholders, the situation is different. Equity is the class of capital with the highest risk in a company, since it is reduced through company losses and paid back with lowest priority in case of bankruptcy. Institutional shareholders therefore expect a higher return on their investment than banks. Financially, a higher level of debt is more advantageous, as long as interest costs for the debt are lower than the costs of equity (financial leverage).

Income statement analysis: Analysis of an income statement refers to income, expenditure and cost-effectiveness (see Figure 5.6). Cash flow gives an indication of the inflow of funds from operations. The analysis of income requires careful structuring of individual income items according to the criteria customarily used in a given sector or specific to the company. In wood production, the timber yield is important. It is subdivided into individual saleable roundwood assortments, annual growth of available forest stands, combination of tree species and forest soil potential for natural regeneration and replanting.

The *sum of income from the sale of business outputs* for a given period is an important indicator and commonly used variable. It is the basis for several composite indicator figures, such as those determining asset turnover and average unit price. In the same way, expenditure items have to be classified and critically compared. Alongside the absolute figures, percentages make it easier to see the relationships.

$$Asset\ turnover = \frac{Revenue}{Total\ assets}$$

$$Average\ unit\ price = \frac{Revenue}{Units}$$

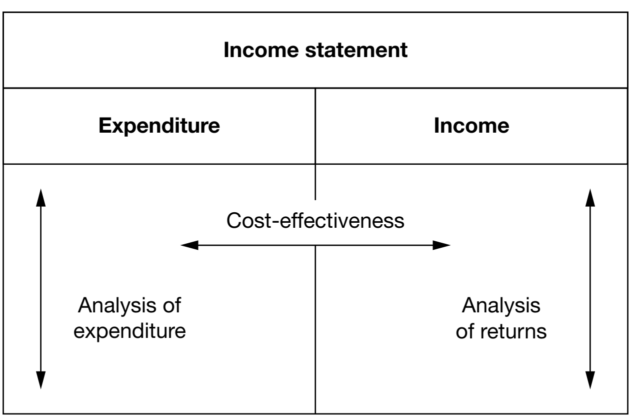


Figure 5.6 Analysis of the income statement

Profit and loss can be expressed either in absolute terms, as the difference between costs and revenues, or in relative terms, as the ratio between profit and the capital used to generate the profit. In the latter case, it is called profitability.

$$\textit{Return on equity (ROE)} = \frac{\textit{Profit} \bullet \textit{100 [\%]}}{\textit{Shareholder equity}}$$

Profitability analysis, also called *return on investment* (ROI) analysis, is an important performance indicator used in examining balance sheets and income statements. It shows how economically the production of goods and services is taking place. It is useful to break down profitability (ROI) into return on sales and asset turnover.

$$\rightarrow \textit{Return on sales (ROS)} = \frac{\textit{Profit} \bullet \textit{100 [\%]}}{\textit{Sales}}$$

$$\textit{Return on investment (ROI)} = \frac{\textit{Profit} \bullet \textit{100 [\%]}}{\textit{Total assets}}$$

$$\rightarrow \textit{Asset turnover} = \frac{\textit{Sales}}{\textit{Assets}}$$

Integrated systems for performance indicators reveal the whole financial system with the mutual relationships between the balance sheet and the income statement. The Du Pont profitability scheme (see Figure 5.7) is an indicator system of this type, which has substantial advantages over isolated indicators. It is useful for analysing the actual profitability of business activities and levers for further improvements in production processes. The double leverage of measures aimed at efficient capital turnover is usually greater than a selective search for possible reductions from individual cost items. However, the implications cannot be understood in a purely mechanical way.

Calculating the influencing factors in the ROI setting reveals how the components of the balance sheet and income statement interact:

- The upper branch of the diagram shows factors that influence the return on sales. Reduced costs or increased sales lead to a higher sales profit rate and thus to a higher ROI.
- The lower branch shows factors that determine asset turnover. If the total capital can be reduced while profit remains the same, ROI can be improved.

In contrast to a purely cost-related view, this creates a dual effect:

- Efficient management of accounts receivable and optimisation of logistics (e.g. through outsourcing and just-in-time production) reduce the amount of

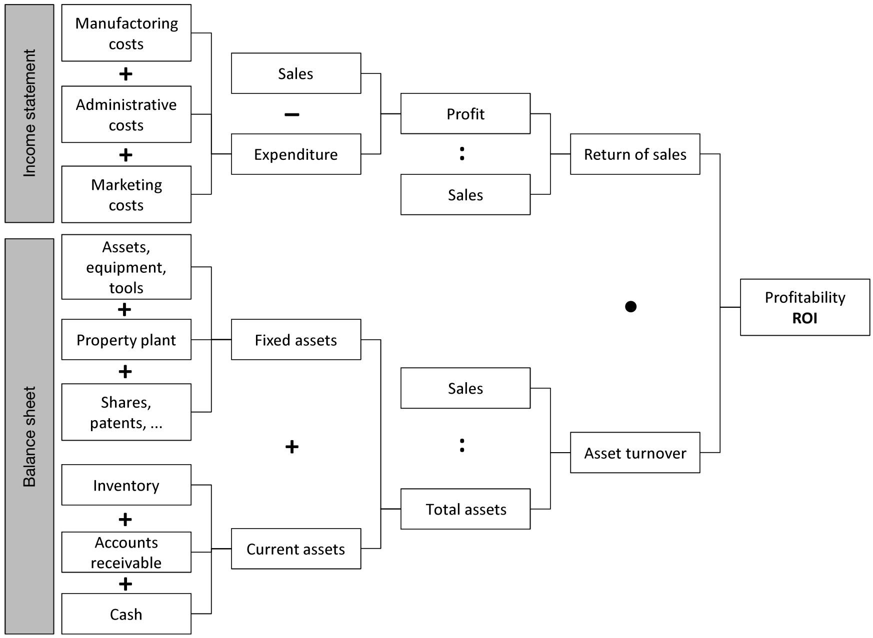


Figure 5.7 Du Pont scheme for profitability assessment

capital used. Managers can see whether nonoperating capital items among the fixed assets might be redeployed or sold off (stripping, asset redeployment). The aim is to use lean production by increasing capital turnover and creating a capital structure that is economically more efficient.

– Implementing efficient capital use through lean production leads at the same time to substantial cost effects, such as a reduction in interest costs for the capital invested, reduction in storage costs and lower administrative expenses, by reducing assets that are unnecessary from an operational point of view.

Comprehensive information on the financial situation of a company is thus obtained through combined analyses of the cash flow statement, balance sheet and income statement. Strategic planning and the development of scenarios are complementary measures for undertaking entrepreneurial decisions. They are based to a large degree on information provided by the accounting system. Entrepreneurial decision making requires the consideration of additional performance indicators (e.g. the ratio of investment and depreciation, net present value, economic value added) to determine whether the development of an enterprise is in line with its goals and strategies.

5.3 Management accounting

The purpose of management accounting is to achieve a quantitative representation of the company's internal processes as a basis for strategic and operational decisions. It focuses on calculating costs and returns caused by the consumption of raw materials, labour and expertise and the production, marketing and sales of goods and services.

Managerial accounting has several tasks and outputs:

- assignment of costs to individual products and services as a basis for planning production and achieving economic results;
- comparison of revenues and costs by activity, business unit and area of responsibility so that activities in the company's organisational units can be optimised through performance assessment;
- preparation of budgets based on planned performance and assigned responsibilities, either yearly or for other time periods;
- economic assessment of investments in material property, plant and equipment or in financial assets; and
- provision of quantitative data about prospective costs and returns for fact-based decision making, if new products and services are to be included in production programmes.

The form and content of managerial accounting are largely at the company's discretion. This is because it addresses primarily internal structures, problems, business units and management staff, which vary considerably from company to company. Monitoring and controlling production processes and business activities demand a flexible, modular structure that can be adjusted to changing information needs. Such a structure makes communication among everyone involved easier and more cost-effective – important because managerial accounting must be fast in drawing attention to new opportunities or emerging problems.

Two interesting publications specifically address managerial economics and accounting as they relate to the evolving paradigm of sustainable natural resources management: Austrian Journal of Forest Science (2009) and Jöbstl and Roder (2009). Both documents deal, in particular, with the economic and financial aspects of multifunctional forest production. They address the integration of marketable goods and services with external payments for nonmarketable, or not-yet-marketable, environmental and social benefits in business accounting, national accounting and public reporting.

5.3.1 Cost accounting

Cost accounting consists of three central elements that are functionally related:

- In cost type accounting all costs – personnel, energy, materials – that arise during a determined period for the company's output provisions are recorded and categorised. Adjustments to financial accounting are made and imputed costs are shown.

- In cost centre accounting the recorded costs are allocated to objects and activities from which they originate. Cost centres are internal functional and organisational units of a company that have clearly delineated business functions and to which calculated or standard costs per production unit can be assigned. In sustainable wood production, for example, costs can be structured according to planting and natural regeneration, tending of young stands, pre-commercial thinning, harvesting of mature timber stands, skidding and transport of harvested trees and sales of different wood assortments. In sawmills this type of classification may involve roundwood storage, debarking units, sawing aggregates, sawnwood drying and storage, use of collateral products and purchasing and sales units.
- In cost unit accounting the costs are assigned to business outputs – that is, the products and services that have been produced and delivered during a given period. In forestry, for example, costs can be calculated per hectare of young stands tended, per cubic metre of roundwood produced or per metre of forest road maintained. In the wood industry, the units of cost apportionment are individual saleable products or product groups.

Cost type accounting, cost centre accounting and cost unit accounting need to be systematically integrated in the internal accounting system of a company or a particular business unit (see Figure 5.8).

It is important to clearly distinguish the meaning of the paired terms costs and outputs in managerial accounting from the meaning of expenditure and income in financial accounting. In managerial accounting, the focus is on actual business activities and on accounting for individual output items – that is, calculating the costs for producing and marketing specific products and services. This makes it possible to analyse and assess internal economic and business relationships and provide strategic and operational management information.

Operating expenditure and operating income serve the company's actual business purposes. Expenditure and income that do not serve the company's operating purposes are described as neutral. The difference between financial and managerial accounting is made clear when the operating results are calculated. In this case, the gross results (i.e. the company's total results) are adjusted by subtracting neutral expenditure and neutral income to show the actual result of operations. This provides information about whether an economic entity is working in an efficient and effective manner in its core business.

The calculation of operating performance focuses on the causal connection between consumption of goods and services for operations and the financial output resulting from selling marketed products and services. Costs that do not appear as expenditures in the financial accounting system are shown as additional costs in managerial accounting. Examples of additional costs include imputed interest charges, imputed depreciation and costs of equity.

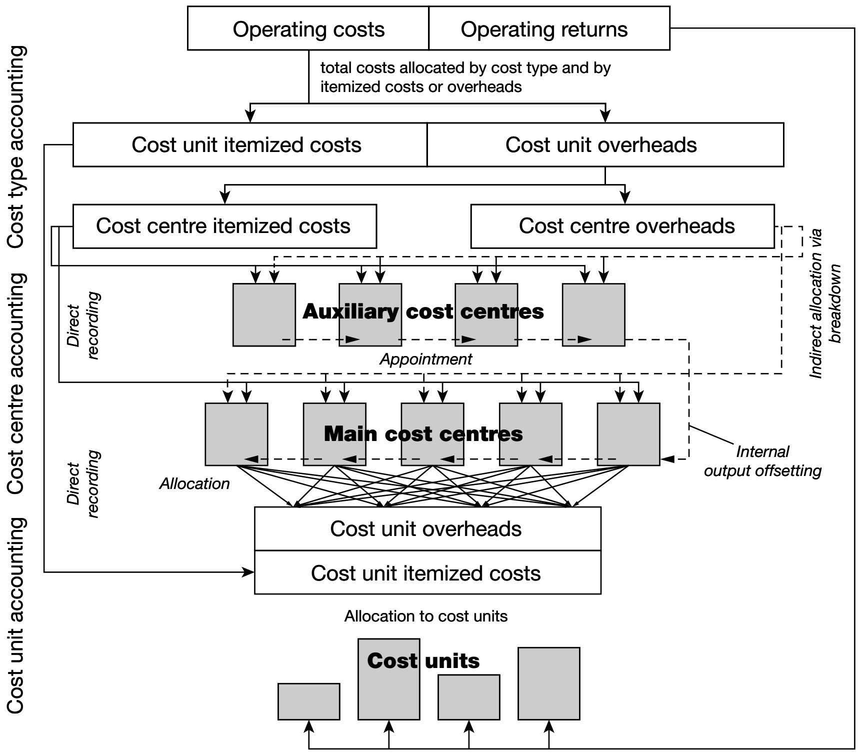


Figure 5.8 Structure of a managerial accounting system

Source: Schellenberg 2000: 268, modified

The *concept of cost* includes two aspects (Jöbstl 2002: 32; Thommen and Achleitner 2006: 414–15). First, it involves consumption of operating material goods and services. Outflows include outflows of cash, as well as labour used within the company itself. Second, the term is related to specific objects, and it is useful to speak of costs only if it is clear to which objects they belong. They may belong, for instance, to a specific product or service that has been provided, to the selling process of commercial goods, to an advertising campaign or to a company's research and development project. The value-related conception of costs is commonly used. In addition, there is a cash-related concept of cost, which involves payments associated with objects.

Costs may be operational or imputed (see Table 5.11). The central element from which costs arise is operating expenditure, whereas neutral expenditure does not create costs. The right side of the table shows the additional costs that cannot be calculated from expenditure for business purposes. This applies, for example, to internal operating costs, imputed interest charges and imputed risk adjustments. Cost components of this type are known as imputed (calculated) costs.

Table 5.11 Expenditure and costs

Expenditure					
Neutral expenditure		*Operating expenditure*			
Nonoperating expenditure	Extraordinary expenditure	Expenditure = costs	Expenditure > costs	Expenditure < costs	
E.g. real estate costs, interest, bond expenditure	E.g. extraordinary losses from sales of fixed assets	E.g. wages, energy, rental	Formation of hidden reserves, accrual	Liquidation of hidden reserves, accrual	
		Costs = expenditure	Costs < expenditure	Costs > expenditure	E.g. internal operating costs, imputed interest on invested equity, imputed risk costs
		Basic costs			*Imputed costs*
		Costs			

Source: Schellenberg 2000: 264, modified

Managerial accounting needs to provide decision information in such a way that every business activity undertaken shows all costs, explicit and implicit, accruing from its implementation. This includes the costs of capital employed for producing goods and services. In managerial accounting, an appropriate interest rate needs to be assumed for equity and debt; it is included as an imputed cost. Information on capital costs provided by the managerial accounting system is required for assessing the value generated to the shareholders. In practice, the weighted average cost of capital is calculated and used to determine costs of equity and debt that should be attributed to a business activity or the company's operations as a whole.

The meaning of costs refers to the outflow of goods and services during a business period. That is, outflows unconnected with producing the company's output represent costs. These neutral costs may include the following:

- extraordinary losses in accounts receivables beyond what is usual in the sector or company;
- extraordinary outflows of goods due to an unusual event (e.g. a fire); and
- costs that are not related to production of goods and services in a business (e.g. for a rented-out residential building that is not used by the company and for which the associated rental income represents neutral income).

Outputs are the values of the goods and services produced by business activities. Outputs have several important characteristics:

- Only output that serves the actual purposes of the company is taken into account.
- Income not derived from business activities, income not occurring in the relevant period and extraordinary income are not considered for output calculation.
- Only output to which a monetary value may be assigned is recognised in calculating output.

The central element for determining output is operating income (see Table 5.12). Calculation of output is carried out in the same way that operating expenditure is calculated for costs. Imputed or additional output arises in addition to the reported operating income and involves products and services allocated internally. Neutral income has no effect on output.

5.3.2 Cost type accounting

Cost type accounting means recording the arising costs in a systematic way and assigning them to existing cost objects – cost centres, cost units or other cost objects like internal orders. Cost type accounting is carried out in four steps:

- recording costs while eliminating neutral expenditure;
- calculating costs from operating expenditure (basic costs) and identifying imputed or additional costs;

Table 5.12 Income and performance

<table>
<tr><td colspan="5">Income</td><td></td></tr>
<tr><td colspan="2">Neutral income</td><td colspan="3">Operating income</td><td></td></tr>
<tr><td>Nonoperating income</td><td>Extraordinary income</td><td>Income
=
output</td><td>Income
>
output</td><td>Income
<
output</td><td></td></tr>
<tr><td>E.g. real estate income, interest received, bond returns</td><td>E.g. extraordinary profits from sales of fixed assets</td><td>E.g. sales</td><td>Liquidation of hidden reserves, accrual</td><td>Formation of hidden reserves, accrual</td><td></td></tr>
<tr><td></td><td></td><td>Output
=
income</td><td>Output
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income</td><td>Output
>
income</td><td>E.g. output provided internally</td></tr>
<tr><td></td><td></td><td colspan="3">Basic output</td><td>Imputed output</td></tr>
<tr><td></td><td></td><td colspan="4">Output</td></tr>
</table>

Source: Schellenberg 2000: 266

- summing up costs using standard entries; and
- allocating costs to particular cost objects.

Direct (or primary) costs can be directly assigned to the individual cost objects. In forestry, for example, these are costs for seeds used in the nursery, tree planting, wood harvesting and forest road maintenance. In technical production processes in the wood industry, a comparatively high proportion of costs can be directly assigned to operative cost units. Corresponding values can be measured and recorded, such as the number of work hours to operate a machine or the amount of energy required for the functioning of a particular production unit, measured using a counter. *Indirect (or secondary) costs* cannot be directly assigned to a specific cost object. These may be caused, for example, by a group of different products, a higher-level cost centre, a group of cost centres, specific business activities or commercial activities serving the enterprise as a whole.

Table 5.13 shows a classification according to cost types that can be recorded using data from the financial accounting system. A system of records adapted to specific cost types is necessary for formalising and standardising cost records. Companies use detailed numerical codes to separate cost types for the purpose of analysis and transparency. Typical invoices for recording important cost types include payroll accounting, investment accounting and stock accounting.

Labour and personnel costs comprise wages (i.e. remuneration for skilled and unskilled labourers) and salaries (i.e. remuneration for technical, professional and managerial staff, or 'white-collar workers'). In both cases all social and general employment costs to be paid by the employer have to be taken into account. Labour and personnel costs are recorded in the payroll accounts. This includes the salary paid to the owner, who works for the company, as either salary paid out, if a contract is in place, or imputed remuneration, if not.

Payments for time work, piece work and bonus payments may involve direct or indirect labour costs. *Piecework wages* can be assigned to individual products (piece rate = pay rate per unit • quantity produced) and belong to direct costs. *Time wages*, in the form of monthly salaries for permanent employees and staff, usually cannot be assigned to individual products and services and are therefore considered indirect costs. On the other hand, when tasks are accomplished according to job orders, hourly work per job order can be reported as direct costs in a product or

Table 5.13 Cost types

Goods or services	*Cost type*
Workers	Labour or personnel costs
Property, plant, equipment	Depreciation costs, maintenance costs
Materials	Materials costs
External services, employer's services	External costs, employer's costs, service costs
Funds	Interest costs
Public services	Taxes
Entrepreneurial risk	Insurance premiums

activity. In some service professions, 'billable hours' may be used for direct cost distribution.

Depreciation costs for property, plant and equipment result from a reduction in value during a specified period, when machinery and equipment or buildings and real estate are used. In managerial accounting, the actual reduction in value is calculated as either a direct cost (e.g. for use of a vehicle or a group of machines) or an imputed depreciation cost (e.g. for use of office space). The choice of depreciation methods depends on the causes of depreciation and the type of decline in value of the cost item.

When there are many items to be depreciated, a supplementary listing may be used to provide the details for each:

- purchasing price and date;
- planned (estimated) use period;
- depreciation methods for financial and managerial accounting;
- expected terminal value;
- cost centre to be charged; and
- measures that increase value, such as major repairs or general overhauls.

Materials costs include the entire chain of production-related use of materials, of which there are three types. *Raw materials* are the primary materials used for a product and incorporated into it (e.g. gravel from a company-owned gravel pit for building forest roads, roundwood for making wooden boxes charged to an internal company account, roundwood used in sawmilling or wood fibre or cellulose used for producing paper and paperboard). *Auxiliary materials* are incorporated into the product but do not form a basic component of it (e.g. paint for protecting and decorating a wooden building, glue for producing laminated beams or producing particle board or nails and screws for producing wooden shipping crates or pallets). *Operating supply* comprises items not incorporated into the product but used in producing it (e.g. electric power, heat, petrol and diesel or lubricants for chainsaws).

External costs result from using services provided by other companies and business units. Appropriate recording of these costs requires consistent records, such as delivery notices, copies of invoices and confirmations. The costs of contract work for wood skidding and transport, payments to consultants and other external services are usually transferred to cost centres. Transferring such information from financial accounts to managerial accounts is easier if the records include details for each cost unit and cost centre using the service.

Interest costs arise from capital invested in operating assets and may be treated in different ways. For managerial accounting the operating capital has to be determined initially. Imputed interest charges are offset for equity and interest-bearing debt. The assets marked in the balance sheet may be used to obtain this information. Equity holdings outside the sector, long-term loans and mortgages provided by the company, residential buildings for employees, reserved development sites (fixed assets), bonds and emergency inventory (current assets) are usually not counted as invested capital for operations.

Taxes and other public payments are raised by legally entitled public entities, such as the state, cities and local communities, and reflect the valuation for providing infrastructure and social services to the public and specified groups. Special taxes and payments may be stipulated for certain business activities in which a company is involved. Taxes are either indirect or overhead costs. Whereas general business taxes are considered overheads, public payments linked to distinct production activities – for instance, a fuel or energy tax – are imputed production costs in managerial accounting. The financial accounting system provides the necessary information for calculating the corresponding costs.

Venture costs or *risk costs* that occur during the production process and lead to losses could include acts of God (*force majeure*), fluctuations in general economic conditions or human error. In forestry, particular risks arise from natural disasters. The extent to which forest fires or storm damage should be treated as risk costs is a matter of controversy and needs detailed analysis. In some cases insurance may cover extensive damage from forest fires.

5.3.3 Cost centre accounting

Cost centres represent a company's products and services, organisational units or important activities with determined management responsibilities. Sector- and branch-specific cost centres take into account the diversified cost structures typical for production activities and allow analysis of the potential for rationalisation in introducing new, less costly production technologies. The greater the detail with which cost centres are classified, the easier it is to obtain a nuanced view of the factors giving rise to costs and then decide on possible cost reductions. However, organisational and administrative costs involved in recording, offsetting and checking increase as the number of cost centres rises.

In cost centre accounting, again two categories of costs can be distinguished. *Direct (primary) costs* are generated directly, such as the costs of wages, materials and energy that can be attributed directly to a particular cost centre. *Indirect (secondary) costs* are not directly influenced by the cost centre but are allocated from managerial bookkeeping for other areas and activities of the company. Cost centre accounting is an important tool because it allows the transfer of indirect or overhead costs to the units that incur them – information that provides transparency, motivation and willingness to accept responsibility among a company's employees.

Tasks in cost centre accounting include the following:

- localising costs, which means identifying the location or source where direct and indirect production costs arise;
- controlling costs and monitoring cost-effectiveness in the company's organisational units;
- allocating and recording costs in a way that enables nuanced and appropriate transfer of overhead costs to distinct business areas; and
- determining operating areas, technical and managerial competences and staff responsibilities.

For practicality, it is useful to structure cost centres in a meaningful way. The first step is to distinguish between primary and subsidiary cost centres. Primary cost centres are those for which the costs can be assigned directly to particular cost units. Subsidiary cost centres show output for other cost centres. They can be assigned to cost units only indirectly.

The distinction between primary and subsidiary cost centres usually has to be made specifically for each company, or at best for each economic branch. Some primary cost centres may produce output for other primary cost centres and need to be accounted for in internal transfer of products and services. Examples are the sale from a roundwood production unit to a subsidiary business unit producing wooden articles to end users, the sale of plants from a forest nursery as a subsidiary activity to a reforestation or afforestation project unit or the setting of sales or transfer prices for wood chips used in an internal power plant for generating electricity and heat for processing energy.

Assigning indirect costs to users or recipients requires a differentiated method of allocating subsidiary cost centres and a coherent and precise internal cost transfer system. In industry, the relationships between the cost types and the cost centres, as well as the relationships among cost centres, are established using order numbers, goods coupons, machine operating hours, amounts of energy effectively consumed and other quantitative criteria. Labour inputs based on hourly records equivalent to cost centres should be kept for staff and large machinery. Tools and small machines are usually treated as overheads and allocated to the primary cost centres in proportion to hours worked. In forestry, output provisions are decentralised, and measurable quantities (e.g. from silvicultural interventions) can often be obtained only with considerable time and measurement effort, after results from a management plan have become available.

In modern forest enterprises with multifunctional management activities, distinct cost centres – wood production, management of recreational forests, landscape and nature protection activities, silvicultural treatment of protective forest cover – are necessary. The rising costs of providing a range of ecosystem and environmental services must be calculated and analysed in context. It is no longer sufficient to assign the costs of multifunctional forestry practices as overhead to the cost centre of wood production, as was done in the past.

The many combinations of outputs – all the various private and public forest products and services – thus need to be reflected in managerial bookkeeping. An appropriate structural classification of a cost distribution scheme, taking account of the multifunctional nature of the forestry operations, may involve reporting of the following groups of cost units:

- sustainable wood production;
- production of other forest products;
- protective services;
- recreational services;
- services for nature protection and landscape conservation;
- other services and tasks; and
- investments and reserves.

Typical wood production cost centres are harvesting and transport operations, construction and maintenance of forest roads, improvement of forest stands, natural regeneration of replanting of forest sites and establishment of new forest plantations. In larger production units, silvicultural activities, such as tending and pre-commercial thinning, measures to exclude deer or felling, skidding and wood transport may be treated as supplementary cost centres so that wood production costs can be analysed in a detailed and comprehensive manner.

It is useful to record, assign and analyse the costs of wood production and multifunctional forest management according to the following criteria:

- By production area:
  - wood production and silviculture
  - management of protection forests
  - management of recreational forests
  - consultancies and maintenance services
  - other services and activities
- By working area:
  - seedling production and replanting
  - tending and thinning of tree stands
  - wood harvesting and timber transport
  - access roads and other engineering works
  - forest protection measures
  - forestry infrastructure services
  - management and planning activities
- By landscape unit:
  - individual stands or geographic units
  - special forest management planning units
- By area of responsibility and organisational unit:
  - forest district
  - work groups and management teams
  - forest owner units (in case of joint management arrangements).

5.3.4 Cost unit accounting (costing)

With cost unit accounting, also referred to as costing, the total costs of marketable products and services can be assigned to specific cost units and compared with the returns obtained or expected from these units. Cost unit accounting enables the manager to assess the efficiency of output processes and reflects the economic business result of the goods and services being sold.

Cost unit accounting has several purposes:

- valuing the stocks of semi-finished and finished products of manufacturing companies and establishing the basis for pricing decisions (calculating short-term minimum prices);
- monitoring the efficiency and effectiveness of business production processes and assessing alternative working procedures; and

– making strategic and operational changes to production programmes and providing a reasoned basis for management decisions, such as for make-or-buy decisions.

Planned cost unit accounting: The expected costs of production are calculated on the basis of anticipated and estimated values (*ex ante costing*). The method is based on predicted cost and output values, known as budgeted costs. If budgeted costs are related to an assumed or predetermined actual utilisation, they are known as *target costs*.

Standard cost unit accounting: Operational planning figures, from either the company itself or outside experience, indicate efficient production in accordance with the best current standards. Standard costs are used as performance targets. The production experience of company managers is the basis for reference values for current production control. Normal costs are used in particular for internal company offsetting. Because they are derived from previous experience, however, their validity for efficiency assessment is limited.

Cost unit control: The actual production costs are calculated on the basis of costs that occur (or have occurred) during ongoing (or recently completed) production processes (*ex post costing*). The results are used to value the stock of finished products and record economic success per individual production unit. Intermediate costing control is undertaken for specific sub-products or production phases of ongoing output provision. It is required for cost units with production times covering more than one bookkeeping period and for evaluating stocks of semi-finished products.

Cost unit period accounting: This statement provides short-term business results for a determined period and differs from the income statement in financial accounting in the following respects. It is set for periods shorter than a year, often only one or several months, and adjusted for nonoperating, extraordinary and nonperiod expenses and revenues. With appropriate sub-classification, it reveals the origin of profits or losses related to specific goals or groups of products and services being produced or marketed.

Various costing methods are used to compute the total of the effective costs from the available accounting sources. Divisional costing and surcharge costing may be distinguished (see Figure 5.9).

Process costing: The company's total costs, without further distinction between itemised costs and overheads, are divided by the number of items or service units measured – for instance, by the time input used for production and sales (Warren *et al.* 2009: 896–900). This calculation procedure, used mostly by companies with uniform mass production and cost centres with uniform outputs, provides average costs of individual cost units. In single-step process costing, changes in inventory stocks are not taken into account. In two-step and multiple-step process costing, changes in inventory stocks are accounted for. Manufacturing costs are separated from sales and administration costs, and products held in inventory are charged only with manufacturing costs. If several varieties of the same product are manufactured using different amounts of labour time and operating resources, the cost relationships can be expressed by weighting the figures.

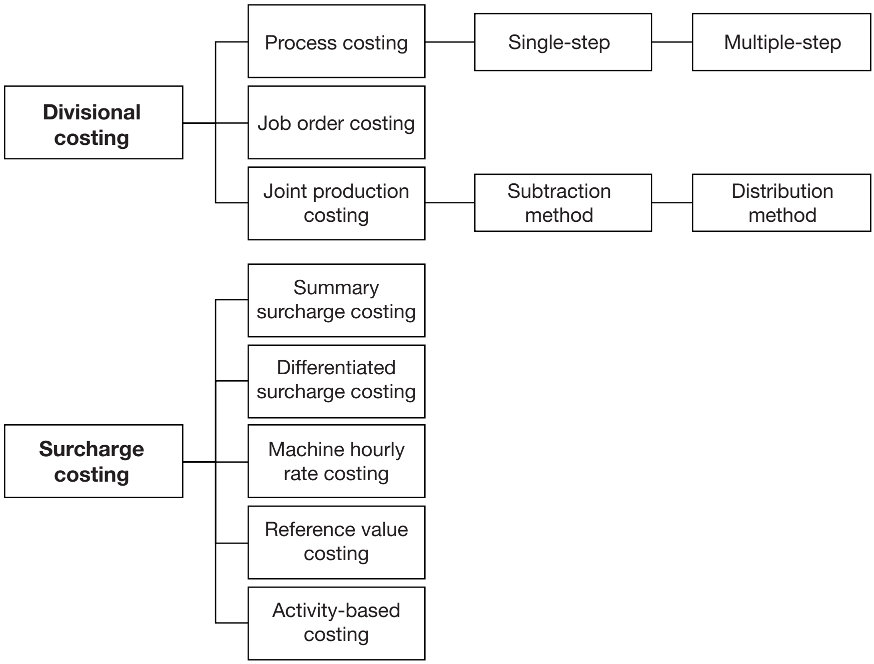

Figure 5.9 Overview of costing methods

Job order costing: This method is widely used in manufacturing operations (Warren *et al.* 2009: 856–68). Actual costs are assigned to and collected through single production or job orders that have defined outcomes. This requires the measurement of materials, operating supplies, machine usage and labour time. Job order costing supports the separation of raw materials, work in progress and finished products. Raw material becomes work in progress, with the consumption attributable to a job order. Upon completion of the job order, the material becomes a finished product. Therefore, in a job order accounting system, inventory accounts and subsidiary ledgers are maintained for materials, work in progress and finished goods. Job order costing allows constant comparisons of manufacturing performance against standard or planned manufacturing costs.

Joint production costing: The costs are assigned according to the load-bearing capacity of products and services produced. It is assumed that products and services that achieve a higher price on the market are capable of bearing a higher proportion of production costs than lower-priced products and services. The method is useful for costing production, in which the same process and raw materials are used to manufacture different products with different market prices (Schmidhauser 1994: 12–13). Joint production costing is used, for instance, in gas production from coal, which also produces tar, ammonia and benzol, and in crude oil refining, which produces heavy oil, heating oil, petrol, kerosene and other fractions of the raw material (Schierenbeck 2000: 676–7; Wöhe and Döring 2008: 973–4). Another example is roundwood, which is the raw material for sawnwood, pulp chips and wood energy.

Two approaches are used in joint production costing:

- If a main product and one or more by-products are manufactured, the subtraction method is used. The returns from by-products are subtracted from the total costs – that is, the income is regarded as reducing the cost of the main product. If a by-product is not sold or achieves a lower return than the main product, the residual costs of the main product increase.
- If it is not possible to identify a main product, the distribution method can be used: each product has the same relationship between value or price per unit and costs per unit. This means that total costs are passed on to the various products, taking cost-bearing and proportional quantities into account. The method involves a rather simplified approach to cost and price relationships and approximates production-related costs.

Surcharge costing: Itemised costs, such as payments for labour and raw materials, are assigned directly to every production unit, but overheads are assigned via extra charges (Schellenberg 2000: 339–40). In *summary surcharge costing*, the company's total overheads are offset by a single charge. The itemised costs for raw materials and labour (or the total itemised costs) are used as the coding basis. In *differentiated surcharge costing*, the cost unit overhead is split into components and assigned to the cost units according to specific rates. Components include overheads for materials, manufacturing, administration and sales. This method enables overheads to be allocated to cost sources.

Machine hourly rate costing: Production areas and production processes are classified in detail, right down to the level of machines and workplaces. Systematic records are kept – usually based on automated electronic registration – of the amounts of energy and materials used, preferably including prices as well as operating times per set of machines and workplace. This approach makes it possible to pass production overheads to the cost units in accordance with the effective workload and other inputs involved.

Reference value costing: In this generalised method of machine hourly rate costing, quantitative allocation rates are used for the relevant types of overhead. It includes measures that approximate internal costs for nonprofit products in appropriate units for internal company purposes. Reference value costing may be suitable for specific costing procedures in multifunctional forest management practices. For management of protection forests, for instance, this could involve costs for performing silvicultural and engineering work to lower the risk of avalanches, protecting access roads from rockfall or protecting alpine residential areas from mudflow and inundation.

Activity-based costing: This method takes a different approach to overhead assignment; it defines the main influencing factors for costs arising in the overhead area during standardised working processes. Figure 5.10 shows how activities can be subdivided via the production area of services to third parties until a stan-

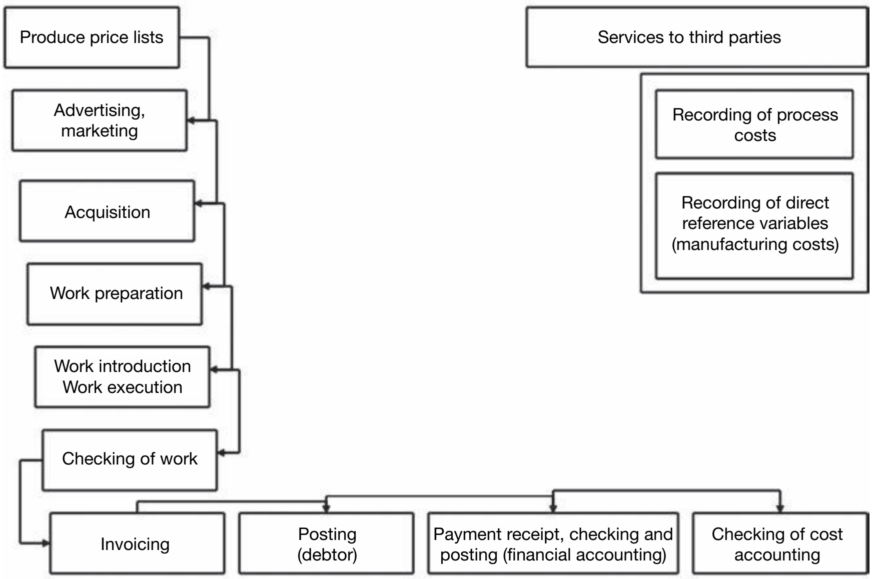

Figure 5.10 Activity-based costing: Partial processes from an activity analysis

Source: Werder 2000: 88

dardised pattern emerges. The aim is to calculate these costs, known as cost drivers, by using a unique processing procedure and charging the cost units appropriately with the costs of the entire process (Schauer and Andessner 2003). This approach leads to good costing results, especially when the managerial accounting system is not optimally designed.

In a more detailed analysis, each activity is broken down into sub-processes. The cost of each recurrent, standardised sub-process is then assessed, and targets to be achieved or undercut are established. Nonstandardised sub-processes – usually involving manufacturing costs – have to be recorded separately. The number of sub-processes, rated with their prices, yields the cost drivers determining a particular production output. The costs of individual services have to be calculated separately for individual contracts. Once the cost drivers have been identified, they are available for planned costing (e.g. in the context of tenders for contracts). Only the varying manufacturing costs still have to be ascertained.

5.3.5 Cost distribution sheet

Cost distribution sheets show the integrated approach between cost type accounting, cost centre accounting and cost unit accounting. Provided they are structured on a consistent basis and adjusted periodically, they are a practical tool for distributing overheads to the cost centres, transferring internal output between cost centres and transferring data to the cost units (see Figure 5.11). The commonly used computerised aids follow the same scheme. For a full representation of cost

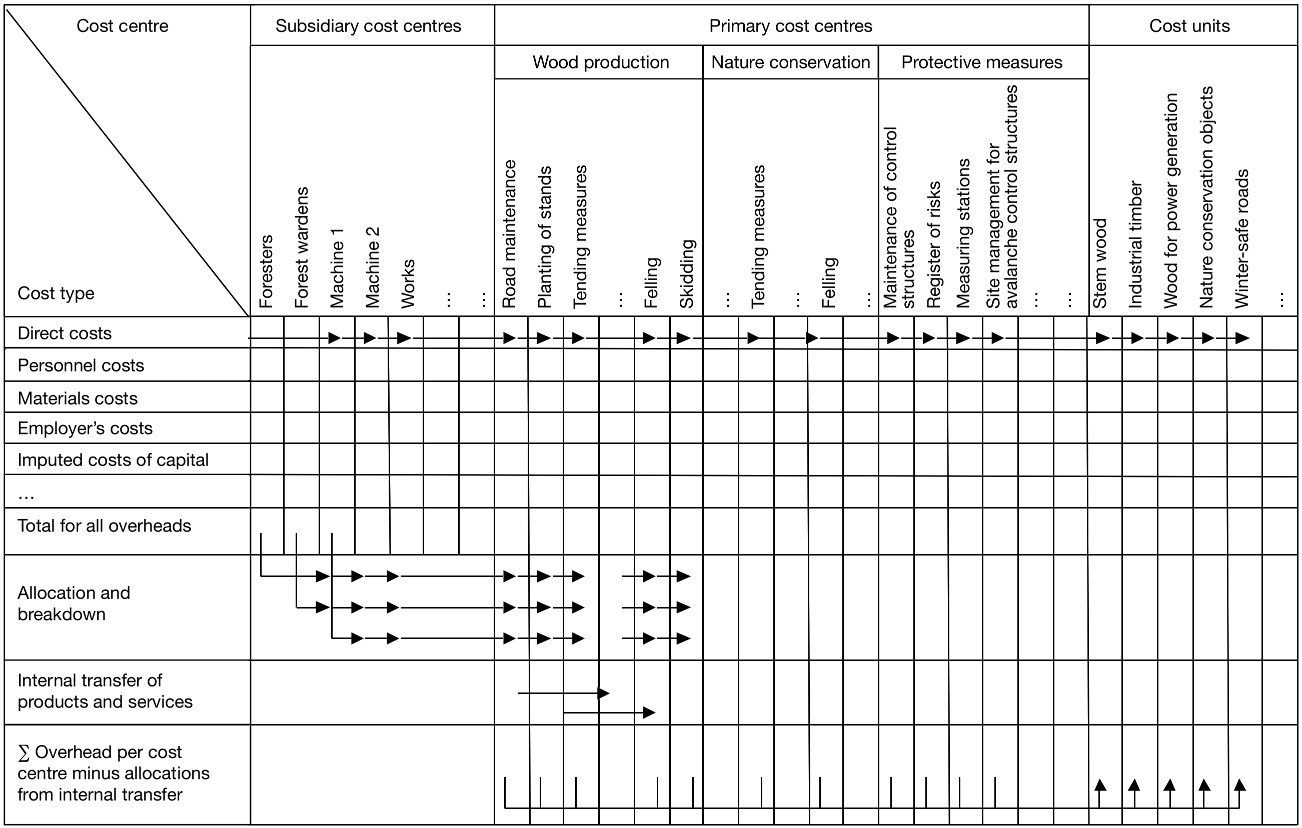

Figure 5.11 Cost distribution sheet

unit accounts (profit centre accounting), supplementary information about the corresponding revenues from each cost unit is needed.

At the example of the primary cost centre for wood production the steps for processing a cost distribution sheet are as follows. Direct costs are entered for primary cost centres or cost units. Indirect costs, such as personnel, machinery and administrative costs, are booked in subsidiary cost centres. They are then distributed to the primary cost centres using personnel and machine hour reports, percentage keys or other coding criteria. With a complete distribution and assignment to primary cost centres, the subsidiary cost ends up with an account balance of zero. This means that all overheads have been transferred to primary cost centres. In a further step, internal deliveries and outputs are transferred to the relevant primary cost centres so that they can be charged their entire cost at the point where they originate. In a final step, the costs of the fully charged primary cost centres are transferred to the relevant cost units (jobs).

5.3.6 Examples of costing

Example 1 – Costing in harvesting operations: The following example illustrates the use of the subtraction and distribution methods in joint production costing, based on an 80-year-old coniferous forest stand in Central Europe that produces primarily sawlogs; pulpwood and wood for energy use (biomass) represent lower-value products. As a result of extensive storm damage, the output ratio between the main product (sawlogs) and co-products (pulpwood and biomass) was considerably lower than usual (50 per cent instead of 75 per cent). All damaged wood was recovered in an integrated harvesting operation and skidded to a central worksite. The initial values were as follows:

	Quantity (m^3)	*Proceeds(€)*	*Proceeds€/m^3*
Sawlogs	5,500	660,000	120.00
Pulpwood	3,000	90,000	30.00
Biomass	2,500	100,000	40.00
Total of damaged wood	11,000	850,000	77.27

Calculation using the subtraction method: The total quantity of recovered wood amounts to 11,000 m^3, with total costs of €800,000. The average profit for the total wood volume of 11,000 m^3 is €50,000, or €4.55 per m^3. If the subtraction method for joint products is used to calculate separately the profit for sawlogs as the main product, per item profit rises to €9.09/m^3 for sawlogs.

	Total costs of wood harvesting	€800,000
–	Returns from pulpwood and biomass	€190,000
=	Residual costs of sawlogs	€610,000
	Returns from sawlogs	€660,000
–	Residual costs of sawlogs	€610,000
=	Profit on sawlogs	€50,000
=	Profit per m^3 sawlogs	€9.09

Calculation using the distribution method: If the proportions are 5,500 m^3 each for sawlogs and the combined volume of pulpwood and biomass, it would be difficult, at least in terms of volume, to speak of a main product. The calculation leads to a higher proportion of costs assigned to sawlogs, with a sawlog profit amounting to €7.06/m^3. A comparison of the three assortments shows that the production of sawlogs is consistently advantageous. However, pulpwood and biomass can be produced alternatively. Because the profit of pulpwood amounts to €1.76/m^3 compared with €2.35/m^3 for biomass, the latter assortment is more advantageous, according to this particular calculation.

	Unit	*Sawlogs*	*Pulpwood*	*Biomass*
Quantity (Q)	m^3	5,500	3,000	2,500
Sale price	€/m^3	120	30	40
Weighting figure W = returns ÷ 100 m^3/€		1.2	0.3	0.4
Calculation Factor CF (= Q • W)	$m^{3(CF)}$	6,600	900	1,000
Total CF	$m^{3(CF)}$	8,500		
Costs (C) per B: Total costs	€	800,000		
÷ total of CF	$m^{3(CF)}$	8,500		
= C	€/m^3	94.12		
Total costs (TC) per product (= CF • C)	€	621,176	84,708	94,118
Cost per unit = TC ÷ Q	€/m^3	112.94	28.24	37.65
Profit per unit	/m^3	7.06	1.76	2.35
(Profit per unit ÷ cost per unit) • 100%	%	6.25	6.25	6.25

Example 2 – Target sales price costing based on costs: In sawmills, primary products such as boards, beams and mouldings are produced from sawlogs as primary products. Secondary products are bark, side boards, slabs, splinters and sawdust, and in the case of profiling technology, primarily chips. The following calculations illustrate practical costing of target sales prices for a sawmilling unit working with chipper canter technology.

Table 5.14 shows a forward calculation that assumes a predetermined price for the raw material (in this case, sawlogs without bark from the forest track). The minimum sales price per m^3 of main product from chipper canter work is calculated as a return on sales of 3 per cent. Costs for transport, incidental costs, manufacturing costs and operating costs are calculated on the basis of accounting results. In this example, individual cost components have been ascertained using the surcharge costing methods. Value-added tax (VAT) is not included in the costing result and has to be invoiced to the purchaser.

Table 5.15 shows the opposite route, involving reverse costing – that is, assuming a possible or intended yield per m^3 of the main product. The result is the maximum price at which roundwood without bark from the forest site can be purchased.

Table 5.14 Roundwood sale calculation to sawmilling unit

	Roundwood price without bark, from forest		€80.00/m^3
–	Discount	– 2%	€1.60/m^3
=	Roundwood price without bark, net		€78.40/m^3
+	Transport costs, extra costs		€9.50/m^3
=	Materials costs		€87.90/m^3
+	Manufacturing costs		€56.58 /m^3
=	Production costs		€144.48/m^3
+	Administrative and marketing costs		€10.52/m^3
=	Prime costs		€155.00/m^3
+	Profit and risk (as % of prime costs)	3%	€4.65/m^3
=	Cash sales price (= costed net return for 1 m^3 joint product)		€159.65/m^3
+	Discount	2%	€3.20/m^3
=	Target sales price (= costed gross return for 1 m^3 joint product)		€162.85/m^3
–	Cost-reducing returns for by-products		€40.10/m^3
=	Target sales price (= costed return for 0.45 m^3 main product)		€122.75/m^3
	With a yield of	45%	
=	Target sales price (= costed return for 1 m^3 main product before VAT)		€272.80/m^3

Table 5.15 Roundwood purchasing calculation for sawmilling unit

=	Sales price (= targeted sales price for 1 m^3 main product before VAT)		€290.00/m^3
	With a yield of	45%	
=	Returns (= targeted returns for 0.45 m^3 main product)		€130.50/m^3
+	Cost-reducing returns from by-products		€40.10/m^3
=	Gross returns (targeted gross returns for 1 m^3 joint product)		€170.60/m^3
–	Discount	– 2%	€3.40/m^3
=	Net returns (= targeted net returns for 1 m^3 joint product)		€167.20/m^3
–	Profit and risk (as % of net returns)	3%	€5.00/m^3
=	Prime costs		€162.20/m^3
–	Administrative and marketing costs		€10.52/m^3
=	Production costs		€151.68/m^3
–	Manufacturing costs		€56.58/m^3
=	Materials costs		€95.10/m^3
–	Transport costs, extra costs		€9.50/m^3
=	Roundwood price without bark, net		€85.60/m^3
+	Discount	2%	€1.70/m^3
	Roundwood price without bark, from forest		€87.30/m^3

5.4 Further reading

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6 Investment and financing

6.1 Investment

6.1.1 Investment decisions

Investment is the conversion of funds into goods and services that are required for business outputs and sales, expansion of production capacities and establishment and maintenance of management capabilities. Investment objects are goods and services to be obtained for such purposes for periods usually longer than one year. In the immediate sense, investment means converting available funds into material goods. Funds used to procure objects serving a company's business activities represent material investment. The conversion of funds for other investments, such as the purchase of shares in other companies, is known as financial investment. In a broader sense, the term investment refers to all the assets that a company has invested in: current and fixed assets, information systems and knowhow, capacity for business research and development and the rights and skills of its employees.

Companies in the wood-based sector may invest in new pulp mills or paper machinery, improved logistic platforms for the distribution of products, forestland purchase and management, construction of new forest roads and transport systems or high-efficiency wood harvesters and skidders. Many of these investments, such as machinery in the pulp and paper industry, are very capital intensive, and others, such as replanting and silvicultural activities, have long payback periods. For companies in the wood-based industry, an important reason for investment is ensuring the security of the raw material supply by managing their own forest holdings and acquiring wood utilisation and management rights. Whatever the purpose, investment or financing decisions in wood processing can be compared with those in other industrial branches on the basis of anticipated profit opportunities and risk assessments.

An investment has several general characteristics:

– Funds are tied up in the investment object for a long term.
– Investments may tie up large amounts of funds.
– Investment decisions affect other business areas, leading to a strong interdependence between production, marketing and financial processes.

- Investments have implications for the current and future profitability of a company.
- Start-up or primary investment is required when decisions are taken to set up a new business activity or expand into new business areas.
- Follow-up investments are necessary when there are additional opportunities for expansion in established activities and for maintaining the production capacity of an established enterprise. This may specifically involve replacement investments, rationalisation investments and expansion investments into new products and markets.

The various types of investment must be distinguished to allow correct record keeping in the investment catalogue, establish depreciation methods and make a realistic assignment of investment costs to the relevant cost units. A single investment may relate to several business areas and consist of different investment types.

In wood production, standing trees and forest stands are a company's capital but at the time of harvest they become the product for making a profit. Because of wind throw, landslides, fire and other natural calamities, wood production and forest management may carry considerable risk and make the discount rate difficult to determine. Complex decisions have to be made for a variety of situations. Buying land to establish forest plantations with fast-growing species – perhaps under a rotation of ten years – requires different economic considerations from plantation schemes with species that need several decades to reach maturity for harvesting. Financing a sustainable forest management regime with long-rotation hardwood species such as oak and beech for sawnwood production needs different considerations from the production of small-dimension softwood assortments for chipping and wood-based panel production. Forestland owners must select the financing regime for managing their holdings. Capital owners and shareholders must decide whether to invest in developing a forestry business for the future or take money out in the form of dividends. In all cases, the answer depends on their personal situation, preferences and confidence.

Investment decisions are important tasks to be made by owners and management because they affect a company's future capabilities, output capacity and productivity – usually over a period of several years. At the same time, they tie up funds to a substantial extent and may represent a major proportion of the company's financial capacity. Investment plans have to be assessed in a comprehensive, well-founded and integrated way. The basis for appraising a possible investment is an assessment of its potential financial effects, determined through careful analysis. There should also be a conscious decision that the investment is a better choice than, say, distributing profits to shareholders or buying shares in another, presumably more profitable, company or enterprise.

Investments are made to achieve the following goals (*investment goals*):

- Maintaining or increasing profit or expected profits;
- Managing entrepreneurial risks;
- Ensuring adaptability and flexibility in a changing external environment; and
- Improving the competitive position in a particular market.

Problem-solving process: The general problem-solving process in management can be applied to investment decision making. The main steps in this process are as follows (Thommen and Achleitner 2006: 43–4, 873–4):

- Assessing the starting position
  - Checking the company's goals and strategies
  - Noting changes in customers' requirements
  - Analysing the available technology
- Setting the investment goals
  - Profitability, risk profile, flexibility, strategic positioning, competition
  - Assessment of technical, economic and social factors
- Defining the investment measures needed
  - Replacement or expansion investments
  - Rationalisation investments
  - Investments aimed at adapting to changed market conditions
  - Investments aimed at increasing work safety
  - Investments in improving environmental protection
- Defining the investment resources
  - Calculating the investment resources required
  - Procuring the necessary financial resources
  - Preparing an investment budget
- Deciding and implementing the envisaged investment
  - Choosing the financing method, employee training, marketing measures for new products
- Defining and checking the results
  - Checking the effectiveness and economic efficiency of the investment

During every phase of the problem-solving process, the controlling functions of planning, decision making, instruction and checking are necessary – although to differing extents and with different emphases. The accounting system provides an important basis for deciding on investment measures and calculating the investment resources required.

Strategic investment appraisal: It is not sufficient to evaluate investments purely from the point of view of their financial profitability. Investment appraisal above all involves taking the following strategic factors into account:

- Investments have to be consistent with the strategy – that is, they have to harmonise with the company's goals and future development options in its current business environment. If this is not the case, then perhaps the chosen strategy cannot be pursued, or the investment project ought to be modified or dropped.
- The strategic benefit of an investment needs to be evaluated. An investment may be unprofitable in the short term but open up valuable options for the company in the future. Promising investments are therefore aimed at exploiting options, not just avoiding risks or eliminating operating bottlenecks.

– Qualitative factors may, in some circumstances, play an important role in investment appraisals. Often, factors involving qualitative elements – safety in the workplace, quality standards, avoidance of environmental and safety risks, enhancement of the company's image – are decisive for choosing a specific investment variant. Qualitative factors can be incorporated into investment appraisals using utility analyses or descriptive procedures. In some cases, investment may be mandatory – for instance, to meet new pollution regulations or work safety standards.

Investment control: Controlling investment projects involves substantial effort. Investment costing procedures are usually not incorporated into standard business accounting, and it is not possible to perform them routinely. It is therefore best to use specific investment accounts only for particularly important investments. Decision-making criteria for the type and extent of control measures may include the investment's strategic significance – that is, its complexity and implications – and the expected risks. Targeted and nuanced investment controls that focus on strategically important points can provide directors and managers with extremely valuable results and findings:

– Regular assessment of progress towards the investment goal leads to improvements in implementation.
– Early corrective measures can be carried out if the expected results no longer appear realistic because of changes in the business environment or other reasons.
– Mistakes in the investment appraisal can be identified and the experience thus gained can be beneficial when assessing future investment activities.

6.1.2 Investment projects

It is often assumed that the profitability of a particular investment project can be analysed independently of other functions in the company. In many cases, however, several related activities need to be considered. This is particularly the case with projects that affect other business activities and necessarily lead to subsequent investments. Careful delimitation of the scope of the project is needed, with an eye to the consequences for other business areas. It is important to give careful thought to the prerequisites for investments and their effects on business activities and to use appropriate calculation methods correctly. Important aspects include the following considerations (Seiler 2003: 453–4).

Choice of an alternative: This involves the starting position – the situation with which the investments that are to be analysed are being compared. A variant often chosen is the zero option – that is, the business situation without investment. Even a zero option, however, is subject to change. For example, the current situation may require further investment if machines already in use have to be replaced or production processes have to be altered to comply with new environmental regulations. In some circumstances, it may be possible to improve the basic alternative through organisational measures, without new investment. In this case, the situation after the improvements have been carried out has to be analysed in the investment appraisal. The success of the improvements made would otherwise be attributed to the envisaged investment project.

Relevant costs: Investment considerations are always directed to the future. The decisive elements in an investment decision are the future income and expenses that are a direct consequence of the planned investment. Income and expenses resulting from decisions made in the past are irrelevant. The same applies to income and expenses connected with the investment but earned or paid in the past; such expenses are known as sunk costs. An example is the investment in constructing a factory built a decade ago.

Book values are not usually appropriate as variables for assessment in the context of investment analysis. They provide only the current values of installations and equipment; the intervening depreciation is not taken into account in the balance. Book values for machines and plant buildings, for example, may diverge substantially from the real values that are relevant for investment considerations. Using earlier acquisition values would lead to false conclusions because they do not correspond to current procurement prices. Existing fixed costs, for example, in connection with usable buildings and facilities that already exist, should not be included in calculations for a new investment project. Proportional costs for operating management or bookkeeping may be taken into account to the extent that they are genuinely connected with the additional expenses involved.

Choice of assumptions: The validity of an investment proposal depends foremost on the quality of realistic assumptions that are used. Investment appraisals may be based on overly optimistic assumptions if those promoting a new investment project or those responsible for taking the decision have a favourable inclination or personal interest in its implementation. Critical points here include the following:

- The dynamics of change in an entrepreneurial environment, not sufficiently taken into account, affect the anticipated profitability of the planned investment. The same might be true if future expenses are underestimated because the assessment base with which the project is compared is too low.
- The projections are often based on a simple extrapolation of trends from the past. Because investments often have effects that persist for several years, this approach can easily prove unreliable.
- The lifetime of an investment may be longer than anticipated, or the residual value of the investment may be incorrectly assessed. Particularly at low discount rates, this can lead to major assessment errors.
- The effects of the timing of the investment are not sufficiently taken into account. This can cause errors in the expected financial returns if, for instance, the sales of products and services fluctuate seasonally or cannot be realised at the projected time scale.

Change in net current assets: Net current assets are the difference between current assets and short-term liabilities. The balance sheet refers to them as assets and liabilities from operating activities. They include changes in production capacity due to investment or disinvestment, which in turn leads to changes in stock positions. Changes in turnover may be associated with increases in outstanding debts. Additional funds needed to finance changes in net current assets have to be taken into account. This can be done in either of two ways, but all investment projects must be treated consistently.

– Capital needed for additional net current assets is treated like additional capital for a production plant.
– It is assumed that additional net current assets are to be financed with short-term debt and the interest cost is taken into account. This is the only case in which interest charges are included in investment analysis calculations.

Depreciation: Since only cash flows are considered, depreciation is not taken into account in investment assessments. Declines in the value of machines and plant equipment are evaluated by entering the residual value as income at the end of the use period. The expenses required for the investment are thus already charged in full at each due date. Including depreciation in an investment analysis would lead to double-counting the declines in the value of machines and plant.

Risk assessment: Investment decisions always carry a certain amount of risk, since it is not possible to assess future developments with absolute certainty. Because risk increases over time, this is especially important for the very long-term investments often taken in forestry. Catastrophic events can be expected over a 100-year rotation.

The financial risk of a project is taken into account using the discount interest rate. The rate is determined by the anticipated risk associated with the envisaged investment. Calculating the discount interest rate in a methodologically flawless way is an elaborate process. Companies therefore usually set a standard discount rate that is applied to all investment analyses. The rate often corresponds to the weighted capital costs for the company, which are directly connected to the company's risk level. Assumptions regarding future sales, income or expenditure should not include any further safety margins but should be assessed realistically to avoid underestimating the profitability of the investment.

6.1.3 Investment analysis

Analysis of a potential investment is based on mathematical procedures for quantitative appraisal. The aim is to calculate the economic benefits of an investment project in comparison with the base case – that is, a scenario in which the investment is not made. Also tested are alternative investments that might promise greater economic benefits than the planned project. The assessment criteria consist of economic variables that can be measured and compared in quantitative terms, such as production outputs, deliveries and sales, as well as in financial terms, such as costs, profits and profitability, and capital values. Effects of an investment that are not capable of being evaluated in quantitative and monetary terms are considered imponderables that cannot be considered in investment analysis (Thommen and Achleitner 2006: 189–90, 613–15; Thommen and Achleitner 2007: 135–6). These qualitative benefits, which might include external effects on the company's brand or reputation or internal effects like staff motivation and commitment, are normally not included in quantitative analysis, since defining them in monetary terms is difficult and time consuming. However, they are part of a qualitative investment evaluation.

Investment analyses allow an objective assessment of entrepreneurial decisions in accordance with the prevailing economic factors and business opportunities. Investment analysis is used in both private companies and business entities run by public bodies. The evaluation methods developed in entrepreneurial practice can be classified as static or dynamic procedures or as operations research approaches (see Figure 6.1).

Static evaluation methods are used mainly for an initial, low-cost assessment or if there is a short time horizon; they do not account for temporal differences in the

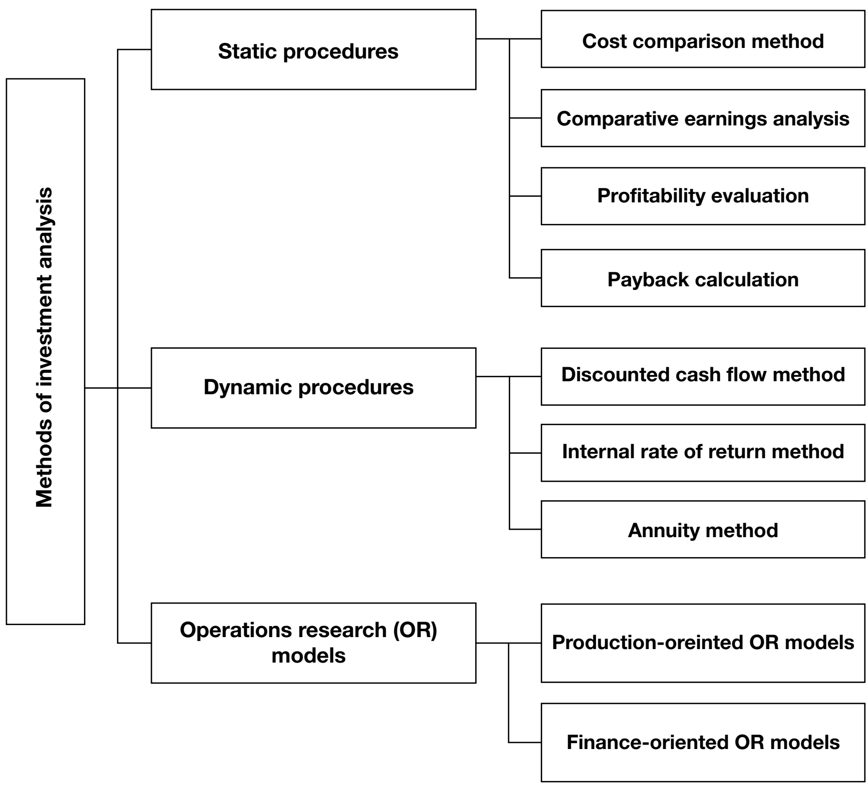

Figure 6.1 Overview of investment analysis procedures

occurrence of costs and benefits of the investment. They are usually calculated on the basis of average values for the first use period, which are then transferred to subsequent time periods. The information required is obtained either directly from the accounting system or from other available data, such as specialist publications or manufacturers' documentation.

Static procedures are widely used in practice because they are simple and clear. However, there are no substantial differences over time with regard to payment flows between different investment options. Static procedures are therefore useful and expedient only if the use period of the investment is limited to the short or medium term or if the investment represents only a small proportion of the total volume of the company's investments.

Decisions on implementing complex investments are carried out on the basis of *dynamic investment analysis methods*. The discounted cash flow (DCF) method and internal rate of return (IRR) method are established standards here. Dynamic evaluation methods require more calculations but have several advantages that yield a more accurate financial evaluation:

- The dynamics of business development – discrepancies in time horizons between cost inputs and earnings from expected outputs – are reflected in the investment calculation.
- Changes in cost structures, such as replacing manual labour with new technologies or restructuring production costs because of changes in sales organisation, can be taken into account.
- Relationships between ongoing investment projects or future projects can be established.
- The economic effects of an investment can be evaluated for several periods, and the timing of cash flows and risk can be factored into the calculation.

Operations research procedures model complex relationships between different parts of a company, such as production, sales, financing and investment (Daenzer and Huber 1999: 512–13). Such methods are used mainly by large integrated companies that have the expertise and specialised staff for making this type of analysis. However, practicable applications are generally too costly for small and medium-sized companies.

The biggest issue in investment appraisal is not conducting the various procedures and calculations but rather procuring and preparing the quantitative information. The data are usually not provided by the business bookkeeping system in the required form, necessitating additional adjustments, interpolations and assumptions. Investment decisions are based on assumptions about future sales, costs and profits – assumptions that must be supported by additional evidence from the business environment.

6.1.4 Static methods of investment calculation

Relevant methods discussed in this section are the cost comparison method, the profit comparison method, the profitability analysis and the payback calculation.

The *cost comparison method* examines the costs of two or more investments, without taking into account the financial returns. The investment with the lowest cost is the one that should be selected.

Costs for judging investment options may be calculated on the basis of costs per accounting period or costs per output unit. Using output units as the variable for comparison is advantageous if the alternatives being investigated involve different production capacities and annual production outputs. Only costs that are directly associated with an investment option are compared. Costs common to all alternatives are left out of consideration.

The cost comparison method thus includes the following cost items:

– variable operating costs VC, such as costs for wages, materials, maintenance, energy and tools; and
– fixed capital costs, which are divided into: (1) depreciation costs per time period, C_d, and (2) interest costs on the average capital tied up, C_i.

Assuming that annual use remains constant, such that there is linear depreciation, the total costs $C = VC + C_d + C_i$ are calculated as follows:

$$C_d = \frac{(I - TV)}{n}$$

$$C_d = \left[TV + \frac{(I - TV)}{2} \right] \cdot \frac{IR}{100}$$

$$= \left[\frac{(2TV + I - TV)}{2} \right] \cdot \frac{IR}{100} = \frac{(I + TV)}{100} \cdot \frac{IR}{100}$$

I = investment amount (capital commitment)
TV = terminal value at end of use
n = number of periods, in years
IR = interest rate (%)

To obtain the cost per output unit C for manufactured quantity x, C is divided by x. The variable operating costs VC are obtained from the accounting system.

The cost comparison method leads to good results if the investment alternatives lead to the same revenues or have no effect on revenues at all. Otherwise the results will most likely lead to wrong investment decisions.

The *profit comparison method* takes into account differences in expected yields from an investment. Of several potential investments, the alternative selected is the one that promises the largest returns. The procedure used for this type of comparative analysis is similar to that for cost comparison analysis. The expected profit can be calculated per period or per output unit – for instance, profit per total hours needed for production or per tonnes of product.

The method is useful when assessing simple replacement and expansion investments. In the sustainable forest management, for example, expansion investments may influence alternative output programmes, production systems or production intensities in such a way that yields are changed. In roundwood production, this applies in particular to the following:

- output programmes for roundwood assortments to be delivered to different wood-processing units;
- logging and transport processes in either a continuous or an interrupted processing chain;
- silvicultural production intensities – that is, the intensity of wood harvesting in determined forest stands; and
- combinations of various elements in using forest resources.

The *profitability analysis* assesses the relationship between profit that can be obtained from the investment and the necessary capital commitment. The contribution margin after harvesting costs is usually used as a comparative value for investments in roundwood production. For instance, in an analysis of two logging and skidding systems, the contribution margin after harvesting and skidding costs for the two systems are compared and the capital costs of the aggregates are considered.

$$\textit{Profitability} = \frac{\textit{Profit per period}}{\textit{Average capital employed}} \bullet 100$$

$$= \frac{\textit{Profit per period}}{\left[\dfrac{\textit{Investment} + \textit{terminal value}}{2}\right]} \bullet 100$$

In the case of a rationalisation investment, the profitability evaluation can be modified by using the expected cost savings per period instead of profits. The cost savings can be estimated using a detailed calculation of the cost centres for woodcutting and skidding. If necessary, additional cost centres can be taken into account.

$$\text{Profitability} = \frac{\text{Cost savings per period}}{\text{Average capital employed}} \cdot 100$$

$$= \frac{\text{Cost savings per period}}{\left[\dfrac{\text{Investment + terminal value}}{2}\right]} \cdot 100$$

A more detailed profitability analysis is possible if one includes turnover in the calculation. In order to obtain the return on investment (ROI) one has to multiply the return on sales rate with the asset turnover rate (see Chapter 5, Section 5.2.5). Nothing changes in the calculation of the final result, but the individual factors provide specifics about how profitability is achieved.

The *payback calculation* determines the time until the expected income equals the investment amount. The chosen investment alternative has the shortest payback time compared with the anticipated use period. The faster the amount invested is repaid, the lower the risk of the investment. Conversely, for investments whose benefits will appear in the longer term, higher requirements for profitability have to be set.

For the cost comparison or profitability analysis, monetary flows – that is, surplus revenue – may be calculated as follows:

- expansion investment, based on profit per period + depreciation and interest; or
- rationalisation investment, based on cost savings per period + depreciation and interest.

The return period PBT, known as *payback time*, can be calculated in two ways:

- Accumulation calculation: Surplus cash-flow for each period are added up until the sum total of the accumulated values corresponds to the original amount invested. This procedure is appropriate when cash flows per period are not constant and linear amortisation is not used.
- Average method: This method can be used when cash flows are assumed constant. The amount invested is divided by regularly occurring returns, which remain at a constant level. The formula for the PBT is as follows:

$$\text{PBT} = \frac{\text{Capital invested}}{\text{Profit + depreciation}} \qquad \text{or PBT} = \frac{\text{Capital invested}}{\text{Cost savings + depreciation}}$$

Overall, the payback calculation is preferable to the procedures mentioned so far, for two reasons:

- The procedure is based on liquidity-oriented considerations.
- The risk of longer return periods is taken into account.

The PBT does not in itself allow any conclusions to be drawn regarding the profitability of an investment. In practice, the payback calculation is often used only as a rough estimate of the risk of the investment, not for comprehensive investment appraisal. Dynamic methods of investment calculation, described below, are more useful for determining profitability.

6.1.5 Principles of dynamic investment calculation

The time factor: Dynamic methods for investment appraisal are used to model payment flows occurring at various times throughout the entire use period of an investment. Cash inflow and outflow are used instead of revenue and cost data. The difference is significant. For instance, revenue is generated when an invoice to the customer is issued; cash is generated when the invoice is paid. A time gap of 30 to 180 days is not unusual in business transactions. Costs that do not affect liquidity are not taken into account (e.g. depreciation, provisions for guarantees). When assessing investments in which resources will be tied up for more than a year, it is advantageous to use dynamic procedures for investment analysis. Disregarding the time-related value of money would lead to massive miscalculations in an investment appraisal.

Comparability among cash-flows occurring at different times is achieved by discounting them to a specific time point. For the dynamic methods used, this means that all data have to be recorded over the entire use period. Time differences for the values are taken into account through compound interest.

Dynamic methods are not capable of overcoming all problems in making an investment appraisal. There are several points to consider:

- *Uncertainty of information* is inherent for future developments. The risks of miscalculation can be reduced by choosing a higher discounting rate, reducing income flows and increasing the expenditure flows and shortening the use period of the investment.
- *Uncertainties about allocation* of income and expenditure to individual investments exist.
- *Uncertainties regarding the reinvestment option* occur, since it is assumed that surplus revenue is reinvested at the set discount rate using the discounted cash flow (DCF) method or at the calculated internal rate of interest. This assumption needs to be checked in each investment case.

The effects of potential uncertainties in an investment appraisal can be assessed using a sensitivity analysis, which shows how the results differ with changes in sales amounts, investment funds, discounting rate and assumed use period – or any other assumption made in the analysis.

Discounting in investment appraisal is used to reflect uncertainties related to investments. Figures used are normally based on actual payments and assumptions regarding their development in the future. These assumptions bear different levels of uncertainty, which increase with the following:

- the limits to knowledge regarding the foreseeable profitability of investment and its effect on operational performance (revenues, costs, outputs);
- the increasing time horizon for which assumptions have to be made; and
- the general volatility of markets and business opportunities.

To reflect this, cash flows and profits in the future are considered to have a lower value than cash flows and profits in the present. When assessing investments in which resources will be tied up for more than a year, the values used for investment analysis must be discounted. Discounting calculates a present value PV from the amount of a future accumulated value FV_t, time period t and interest rate IR. The discounting factor v required for the calculation is shown in the following equation:

$$v = \frac{1}{(1+i)^t} \qquad i = \frac{IR}{100} \quad \text{(discount rate in per cent)}$$

$$t = \text{ year in which payment is due } (t = 1, 2, 3, [.]\ n)$$

This gives:

$$PV = FV_t \bullet v_t = FV_t \bullet \frac{1}{(1+i)^t}$$

FV_t = Value of cash flow at time t

At an interest rate of 8 per cent, what is the net present value PV of the future payment FV_t of €100,000 that is due in ten years' time? Instead of payments, future expected income can be calculated in the same way.

$$PV = FV_t \bullet \frac{1}{(1+i)^t} = €100{,}000 \bullet \frac{1}{(1+0.08)^{10}} = €100{,}000 \bullet \frac{1}{2.16}$$

$$= €100{,}000 \bullet 0.46 = €46{,}000$$

FV_t = €100,000
IR = 8 per cent
i = 0.08
t = 10 years

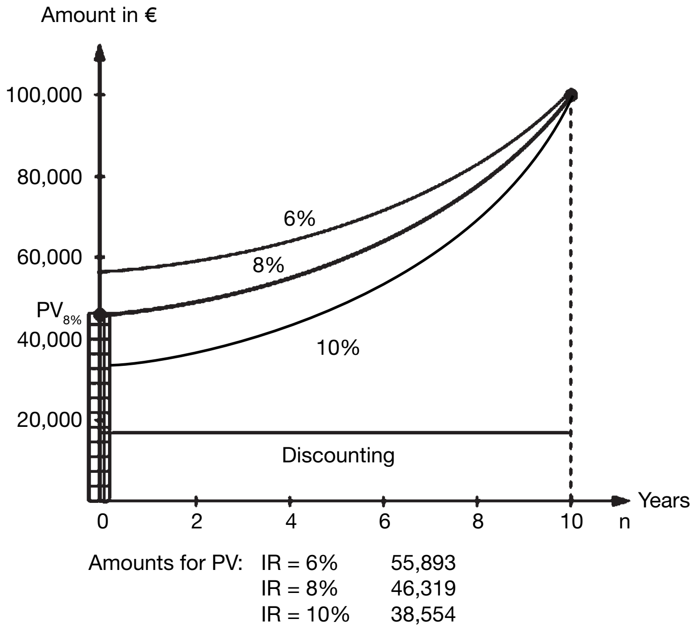

Figure 6.2 Discounting

Figure 6.2 shows discounting at an 8 per cent interest rate and with two alternatives, 6 per cent and 10 per cent.

The opposite of discounting is *compounding*, which is useful for identifying the future value with a known interest rate after a period of time. Compounding calculates the future value FV_t (capital at time point t) for a single payment, which earns a fixed interest rate IR for a specified period t. The compound interest formula is as follows:

$$FV_t = P \cdot (1 + i)^t \qquad i = \frac{IR}{100}$$

t = number of periods (years)
i = interest rate used for discounting (= IR/100);
P = principal amount (initial investment)

Example of compounding: What is the accumulated value to which a capital amount of €10,000 will grow in ten years at an interest rate of 8 per cent?

$$FV_{10} = P \cdot (1 + 0.08)^{10}$$
$$= €10{,}000 \cdot (1.08)^{10} = €10{,}000 \cdot 2.159 = €21{,}589.25$$

P = €10,000
t = 10
IR = 8 per cent
I = 0.08

Figure 6.3 shows compounding at an 8 per cent interest rate and with two alternative interest rates, 6 per cent and 10 per cent.

The discount factor can be taken from discount tables (see Table 6.1), which are usually rounded up to three decimal places. This may lead to minor divergences from computed results. To obtain the present value, a future payment must be multiplied by the appropriate present value interest factor for the year and interest rate. For example, a payment of €100,000 that is received in three years has a present value of €79,400 at an interest rate of 8 per cent (discount factor: 0.794). The same payment has a present value of €71,200 if the interest rate is 12 per cent (discount factor: 0.712). If discount factors for a specific interest rate are not shown in the table (e.g. for 7.5 per cent), linear interpolation between adjacent values is required. With the availability of spreadsheet programs, discount

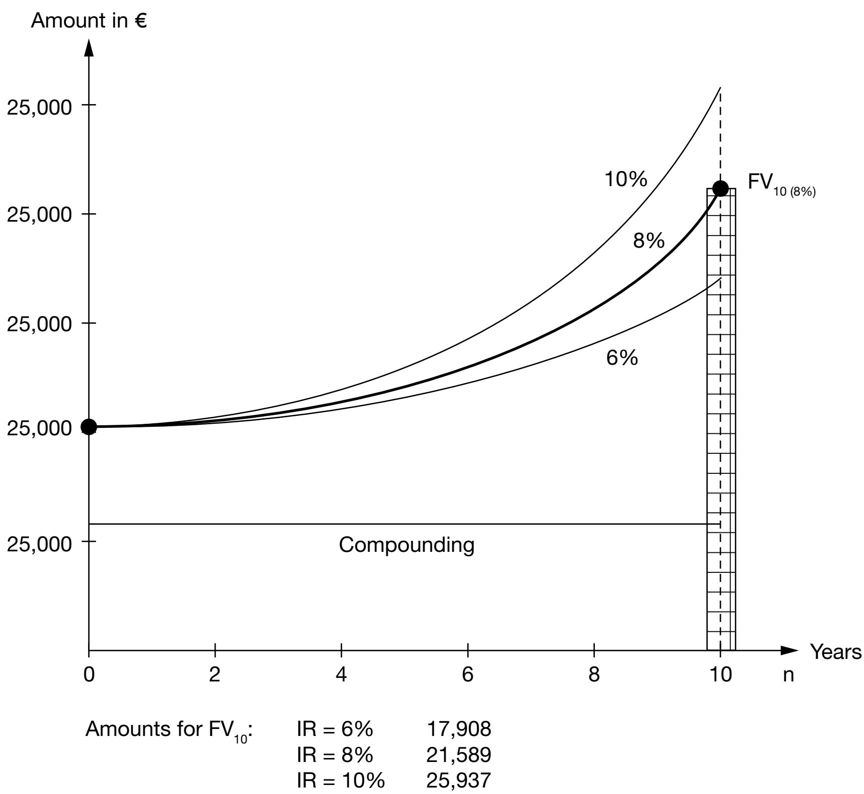

Figure 6.3 Compounding

tables have lost some importance. The use of discounting in investment evaluation is detailed in Section 6.1.6.

Annuity and annuity factor: The term 'annuity' is used when calculating a present value PV of regular payments over a defined period of time at an interest rate IR. A classic example of this would be a calculation of the capital necessary to secure a constant annual pension payment (as annuity in arrears). PV is calculated by adding the discounted annual payments:

$$i = \frac{IR}{100} \qquad PV = \frac{CF}{(1+i)^1} + \frac{CF}{(1+i)^2} + \frac{CF}{(1+i)^3} + \cdots\cdots + \frac{CF}{(1+i)^n}$$

$$= CFv_1 + CFv_2 + CFv_3 + [.][.]\, CFv_n \text{ because } v = \frac{1}{(1+i)^n}$$

v = discount factor in number of periods
IR = interest rate
PV = present value
CF = cash flow
v = discount factor

As the quotient of each two consecutive items remains constant in the equation, this represents a geometric series. The annuity factor a_n, which is needed to calculate the present value PV, corresponds to the formula for a geometric series. PV is the product of the annuity factors a_n and the annually constant payment CF:

The annuity factor a_n can be taken from Table 6.2.

$$a_n = \sum_{t=1}^{n} v_t = \frac{(1+i)^n - 1}{i(1+i)^n} \qquad PV = a_n \bullet CF = CF \bullet \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$$

Example of annuity: Payments amounting to €10,000 have to be made at the end of each year for a period of ten years. What present value PV does this correspond to at an interest rate of 8 per cent? Or, to put the question differently: what present value PV has to be invested at the beginning of the year at an interest rate of 8 per cent in order to allow a payment of €10,000 to be made at the end of the year every year for ten years?

6.1.6 Methods of dynamic investment calculation

The *discounted cash flow (DCF) method* is a standard procedure for investment analysis used to evaluate the economic benefit of an investment project. Using the DCF method is more complex and time consuming than the other methods described. But it leads to more accurate calculation results, because cash flows are

Table 6.1 Discount factor v

Years	Interest rate (%)																			
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.893	0.877	0.862	0.847	0.833	0.820	0.806	0.794	0.781	0.769
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826	0.797	0.769	0.743	0.718	0.694	0.672	0.650	0.630	0.610	0.592
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751	0.712	0.675	0.641	0.609	0.579	0.551	0.524	0.500	0.477	0.455
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683	0.636	0.592	0.552	0.516	0.482	0.451	0.423	0.397	0.373	0.350
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621	0.567	0.519	0.476	0.437	0.402	0.370	0.341	0.315	0.291	0.269
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564	0.507	0.456	0.410	0.370	0.335	0.303	0.275	0.250	0.227	0.207
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513	0.452	0.400	0.354	0.314	0.279	0.249	0.222	0.198	0.178	0.159
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467	0.404	0.351	0.305	0.266	0.233	0.204	0.179	0.157	0.139	0.123
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424	0.361	0.308	0.263	0.225	0.194	0.167	0.144	0.125	0.108	0.094
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386	0.322	0.270	0.227	0.191	0.162	0.137	0.116	0.099	0.085	0.073
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350	0.287	0.237	0.195	0.162	0.135	0.112	0.094	0.079	0.066	0.056
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319	0.257	0.208	0.168	0.137	0.112	0.092	0.076	0.062	0.052	0.043
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290	0.229	0.182	0.145	0.116	0.093	0.075	0.061	0.050	0.040	0.033
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263	0.205	0.160	0.125	0.099	0.078	0.062	0.049	0.039	0.032	0.025
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239	0.183	0.140	0.108	0.084	0.065	0.051	0.040	0.031	0.025	0.020

Discount factor $v = \frac{1}{(1+i)^t} = (1+i)^{-t}$

Table 6.2 Annuity factor a_n

Years	Interest rate (%) 1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.893	0.877	0.862	0.847	0.833	0.820	0.806	0.794	0.781	0.769
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.690	1.647	1.605	1.566	1.528	1.492	1.457	1.424	1.392	1.361
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.402	2.322	2.246	2.174	2.106	2.042	1.981	1.923	1.868	1.816
4	3.902	3.809	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.037	2.914	2.799	2.690	2.589	2.494	2.404	2.320	2.241	2.166
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.605	3.433	3.274	3.127	2.991	2.864	2.745	2.635	2.532	2.436
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.111	3.889	3.685	3.498	3.326	3.167	3.020	2.885	2.759	2.643
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.564	4.288	4.039	3.812	3.605	3.416	3.242	3.083	2.937	2.802
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	4.968	4.639	4.344	4.078	3.837	3.619	3.421	3.241	3.076	2.925
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.328	4.946	4.607	4.303	4.031	3.786	3.566	3.366	3.184	3.019
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.650	5.216	4.833	4.494	4.192	3.923	3.682	3.465	3.269	3.092
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	5.938	5.453	5.029	4.656	4.327	4.035	3.776	3.543	3.335	3.147
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.194	5.660	5.197	4.793	4.439	4.127	3.851	3.606	3.387	3.190
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.424	5.842	5.342	4.910	4.533	4.203	3.912	3.656	3.427	3.223
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.628	6.002	5.468	5.038	4.611	4.265	3.962	3.695	3.459	3.249
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	6.811	6.142	5.575	5.092	4.675	4.315	4.001	3.726	3.483	3.268

$$\text{Annuity factor } a_n = \sum_{t=1}^{n} V_t = \sum_{t=1}^{n} \frac{1}{(1+i)^t} = \frac{(1+i)^n - 1}{i\,(1+i)^n}$$

accounted for according to their occurrence over time. The method forces detailed and thorough thinking through of the investment project. It is essential to build up a quantitative planning model of the investment project comprising the year by year cash flows and documenting the amount of cash inflows and outflows expected from the project. The future cash flows of an investment are then discounted for each year at an interest rate IR to their present value. The net present value (NPV) corresponds to the difference between the total of discounted cash inflows and the total discounted cash outflows. The method assumes that all cash flows occur at the end of the planning year. An investment is beneficial when the NPV is positive. This shows that a surplus is being generated above the minimum profitability requirement, expressed as interest rate IR. The DCF method is also the basis for the internal rate of return (IRR) method and for calculating annuities.

When using DCF to compare several investment projects, the aim is to find the project that shows the largest positive NPV. However, direct comparability between two projects is possible only with the same investment, since a specific capital value can be achieved with either a large or a small investment amount. The following variables are needed to calculate NPV:

- t time index for the current year, with $t = 1, 2, 3, [.]\ n$;
- n number of periods (in years);
- i interest rate used for discounting (discount rate = IR/100);
- I procurement costs for the investment, such as purchasing price and installation;
- C/O_t current cash outflow for year t, such as replacement parts, supplies and repairs;
- C/I_t current cash inflow for year t, which includes mainly the returns from sales of the output produced;
- CF_t $= C/I_t - C/O_t$, the difference between cash inflow and cash outflow per time period t;
- TV terminal value at the end of the use period.

NPV is derived from the difference between all discounted cash inflow C/I_0 and cash outflow C/O_0:

$$NPV = C/I_0 - C/O_0$$

$$C/I_0 = \frac{c/i_1}{(1+i)^1} + \frac{c/i_2}{(1+i)^2} + \cdots + \frac{c/i_t}{(1+i)^t} + \frac{TV}{(1+i)^n} = \sum_{t=1}^{n} + \frac{c/i_t}{(1+i)^t} + \frac{TV}{(1+i)^n}$$

$$C/O_0 = \frac{c/o_1}{(1+i)^1} + \frac{c/o_2}{(1+i)^2} + \cdots + \frac{c/o_t}{(1+i)^t} + I = \sum_{t=1}^{n} + \frac{c/o_t}{(1+i)^t} + I$$

$$NPV = \frac{c/i_1 - c/o_1}{(1+i)^1} + \frac{c/i_2 - c/o_2}{(1+i)^2} + \cdots + \frac{c/i_t - c/o_t}{(1+i)^t} + \frac{TV}{(1+i)^n} - I$$

$$= \sum_{t=1}^{n} + \frac{c/i_t - c/o_t}{(1+i)^t} + \frac{TV}{(1+i)^n} - I \quad \textit{and}$$

$$NPV = \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \cdots + \frac{CF_t}{(1+i)^t} + \frac{TV}{(1+i)^n} - I_0$$

$$= \sum_{t=1}^{n} + \frac{CF_t}{(1+i)^t} + \frac{TV}{(1+i)^n} - I$$

NPV is determined by the amount and time distribution of annual cash flows and by the assumed discount rate i. There are different ways of determining the interest rate IR:

- The IR used for discounting must be at least equivalent to the costs of capital tied to a business. This is the standard procedure in many companies. It uses the weighted average costs of capital, with specific costs for the different types of debt and for equity.
- The IR is based on alternative investment options.
- A target IR can be set by the owners and managers of a company.

Table 6.3 provides an example of a DCF calculation, summarising all line items used in investment planning. It shows cash outflow for an investment in new production installations at the beginning, which generates cash inflow from the sale of goods and requires regular additional cash outflows for operations and maintenance (raw materials, personnel costs, spare parts, energy). The production installations are sold after five years, providing additional cash inflow of €1,500,000 in the last year of the investment.

The example illustrates that, despite increasing net cash flows over time through continuous improvement of production, the discounted value of cash flows is

Table 6.3 Discounted cash flow method

Year	*0*	*1*	*2*	*3*	*4*	*5*
Cash inflow		5,900	5,930	5,955	5,960	7,460
Cash outflow	–9,800	–3,200	–3,150	–3,080	–2,950	–2,950
Net cash flow	–9,800	2,700	2,780	2,875	3,010	4,510
Discount factor v (IR = 12 %)	$(1+i)^{-0}$ 1.000	$(1+i)^{-1}$ 0.893	$(1+i)^{-2}$ 0.797	$(1+i)^{-3}$ 0.712	$(1+i)^{-4}$ 0.635	$(1+i)^{-5}$ 0.567
Discounted cash flow (DCF, t = 0)	–9,800	2,411	2,216	2,046	1,913	2,559
Net present value (Σ DCF, t = 0)	345					
Payback time	3.5 years					

decreasing at an interest rate of 12 per cent. This rate can be considered typical for a company producing goods. The investment is beneficial for the company because it provides a positive NPV. The payback time is 3.5 years, which appears reasonable for an investment with a lifetime of five years. This draws attention to the assumptions used for estimating cash flows at the end of the investment, which is to include proceeds from selling the installed equipment.

The investment can be further challenged using sensitivity analysis. If the proceeds from selling the production equipment are set to zero, the NPV is still positive (NPV = €494,000). If the cash inflow from selling goods is reduced by 10 per cent (sales price), the NPV becomes negative (NPV = – €795,000). The payback time increases to 4.5 years; remember that payback calculation is a static method and therefore based on net cash flows, not on DCFs. The investment is robust with regard to the terminal value of the machinery but sensitive with regard to sales price.

If the cash flow CF remains constant over the entire use period, another possibility to calculate the NPV is using the *annuity calculation* representing a simplification of the DCF method. The NPV of the investment in this case is the sum of the investment amount I, the annuity of the yearly net cash flows and the discounted terminal value.

$$NPV = -I + CF_t \cdot a_n + \frac{TV}{(1+i)^n}, \text{ where } a_n = \sum_{t=1}^{n} V_t = \frac{(1+i)^n - 1}{i\,(1+i)^n}$$

The annuity calculation is much simpler than the DCF method.

- It allows a fast estimation of NPVs without detailed analysis of yearly cash inflows and outflows and allocation to different periods. Investments that result in a positive present value using the annuity method should be further assessed using the DCF method.
- It can be used in appraising smaller investments with limited risks, provided that cash flows are homogeneous over time (e.g. replacing a technical device in a machine to reduce costs).

Long-term investments affect a company's profitability for many years, and it may be difficult to derive valid assumptions for the distribution of net cash flows. In this case it may be useful to assess the first five to ten years of the investment period using the DCF method with detailed assumptions on the yearly distribution of net cash flows. For the remaining periods, cash flows are often assumed being equal to the last period that was assessed in detail. For these net cash flows again the annuity method can be used for calculation of present values. This reduces the calculation effort. The derived value of the annuity has to be discounted to the present. In some investment projects it may be appropriate to assume an infinite return from the investment. In this case the terminal value TV of the investment is calculated using the perpetuity formula. The value CF_{t+1} is normally extrapolated from the net cash flow of last period assessed in detail. Again the calculated terminal value TV must be discounted to the present.

$$\text{Terminal Value}_t = \frac{CF_{t+1}}{i}$$

The *internal rate of return (IRR) method* is derived from the DCF method. It is the average interest earned from the invested capital over the assumed lifetime of the investment project. At a net present value of zero (NPV = 0), the IRR equals the discount rate used in the DCF method. This means that at the determined interest rate of i = IR/100, the invested capital I plus the interest on capital I are returned. An investment is advantageous if the IRR is higher than the required minimum IR. When several alternatives are compared, the one with the highest IRR is best from a financial point of view.

On the basis of the DCF method, the following equation applies when NPV = 0:

$$NPV = \sum_{t=1}^{n} \frac{c/i_t - c/o_t}{(1+i)^t} + \frac{TV_n}{(1+i)^n} - I;\ NPV = 0$$

$$I = \frac{c/i_1 - c/o_1}{(1+i)^1} + \frac{c/i_2 - c/o_2}{(1+i)^2} + \cdots + \frac{c/i_t - c/o_t}{(1+i)^t} + \frac{TV_n}{(1+i)^n}$$

$$= \sum_{t=1}^{n} \frac{c/i_t - c/o_t}{(1+i)^t} + \frac{TV_n}{(1+i)^n}$$

To calculate the IRR, the equation needs to be solved for i. This results in a polynomial to the n^{th} power in (1 + i), which for n is ≥ 3 (i.e. a polynomial for a use period of an investment lasting more than two years that can be solved graphically). To do this, two discounting rates are selected at which the NPVs are close to zero, but with one positive and the other negative. These two points are then diagrammed, with NPV on the ordinate and the IRR on the abscissa and connected with a straight line. The intersection of this line with the abscissa marks the IRR of the investment project. An IRR of 4.7 per cent appears in the example in Figure 6.4.

The IRR method is a direct profitability criterion suitable for ranking various investment options. However, the method has its weaknesses. It assumes that cash can be reinvested at the IRR, which may not always be the case, especially if the IRR is high. The method also favours projects in which high income is expected at the beginning of the period. This implies that future risks may be overemphasised. Finally, the method conceals the fact that because of their volume, investment projects that require large amounts of resources despite a low IRR can make a larger total contribution to the economic development of a company than smaller investments with a higher IRR.

The DCF and IRR methods are used to assess large and complex investments. But they are not capable of overcoming all the challenges in making an investment analysis, as these points illustrate:

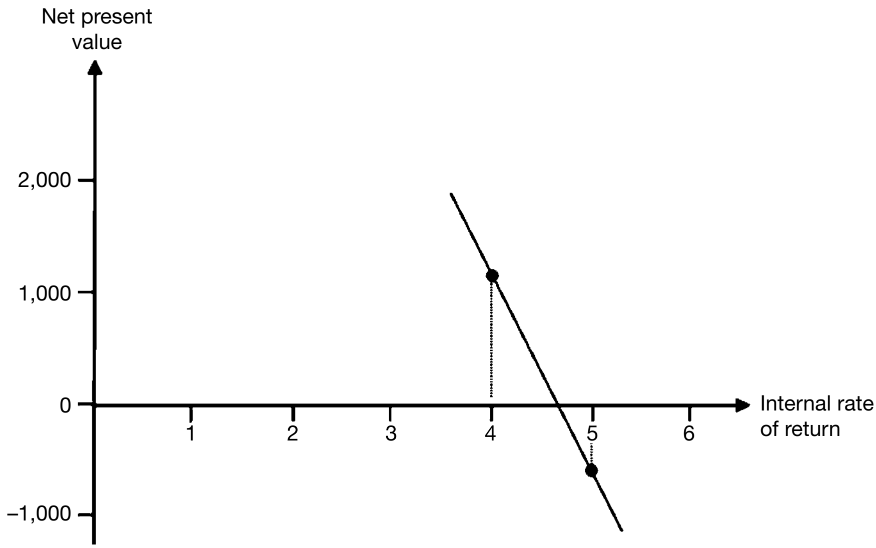

Figure 6.4 Graphic calculation of the internal rate of return (IRR)

– Uncertainty of information means that some data can only be estimated. The inherent risks of an investment can be taken into account by carrying out a sensitivity analysis – choosing a higher discounting rate, reducing the income flows and increasing the expenditure flows, or shortening the use period.
– There are often considerable uncertainties about allocation of cash inflows and outflows to individual investment objects.
– It is assumed that all surplus revenue is reinvested at the set discounting rate (using the DCF method) or at the IRR. This assumption needs to be checked in each case.

It can be of interest to compare the expected financial results from an investment with regular income. The following formula converts the NPV into regular net cash inflows (annuity) using the inverse annuity factors a_n from Table 6.2 known as the recovery factor. Time horizon and interest rate of the resulting annuity (A) must be set by individual assumptions.

$$A = \frac{1}{a_n} \bullet NPV$$

6.1.7 Reporting investments in company accounts

The term investment encompasses many kinds of business transactions. From an accounting perspective, investments are a transformation of funds (normally cash) into other types of assets. They affect the short- and long-term financial accounts of a company and, during the investment phase, trigger notable changes in balance sheet structures. The structure of liabilities and shareholders' equity may change because of investment activities. In the case of large investments, financing considerations are an important issue.

Since the purpose of accounting is to provide a consistent, fair and true picture of the economic situation of a company, proper accounting of investment activities is essential, and subject to detailed regulations. The application of accounting principles to investments requires expertise both in the accounting department and from certified public accountants. In international companies, local and international accounting standards are often maintained in parallel, which leads to additional complexity.

In *international accounting standards* the rules and procedures for specific investments are determined by the nature of the investment, the purpose of the transaction and the interpretation of determined criteria (Warren *et al.* 2009: 658–7):

a) According to the standard structure of a balance sheet, three kinds investment may be distinguished: investments in operations (property, plant, equipment), investments in financial assets (bonds and other interest bearing securities) and investments in equity (shares of other companies).
b) The purpose of the transaction depends on the company's business. This is especially the case for financial investments. Their treatment in accounting systems differs based on the company's intent and business model.
c) The interpretation of criteria provided by international accounting standards determines the treatment of a specific investment. Specific issues are also addressed in national accounting standards.

As a result, similar transactions may be represented differently under different accounting standards. Within a company, however, accounting principles require that the treatment and valuation methods for business transactions be consistent.

Investments in property, plant and equipment are often made by companies producing goods and services. Such investments include all relevant assets if their time of use exceeds the operating cycle or, in general, one year. This kind of investment covers everything from simple office furniture to complex production assets, including land, infrastructure, buildings and machinery. Property, plant and equipment are capitalised at procurement costs in the balance sheet. Planning and project management costs must be included. The time of activation is of major interest for complex investments that take time to become operable, as in building a factory. Activation normally takes place with the completion of the project and the transfer into operations. From this time onwards, depreciation is recorded as an expense in the profit and loss statement. Property, plant and equipment are valued and reported at their net book values (costs less accumulated depreciation) in company accounts.

Investments in financial assets may be part of the core business of a company (e.g. pension fund, insurance company) or part of a financing strategy. Companies with high cash flow from operations and a low level of investment in other asset classes may decide to transfer cash in financial assets to increase their profit. Purchased bonds and securities are recorded in the accounts at procurement costs, including brokerage commissions. Interest is accounted for as revenue in the profit and loss statement, usually in the 'other income' section. The sale of bonds normally results in a gain or loss, which is recorded in the profit and loss statement.

Accounting regulations govern the reporting and valuation of different types of financial assets. The application depends on the intention of holding and the purpose of the assets in the context of the company's business. Accounting regulations differentiate between trading securities, held-to-maturity securities and available-for-sale securities.

Trading securities, held to generate short-term profits from changes in their market prices, are reported as current assets at their 'fair value' – normally their market price on a stock exchange. Changes in fair value are reported as unrealised gain or loss in the profit and loss statement. Held-to-maturity securities, intended to be held by a company until their maturity date, are purchased primarily to generate interest revenues. They are reported and valued at procurement costs, as described above. Available-for-sale securities are bonds that are not intended to be held until their maturity date. Their accounting and reporting are similar to trading securities, and fair value is applied. Changes in fair value are excluded from the profit and loss statement and reported as part of the shareholders' equity on the balance sheet only.

The treatment of *equity investments*, which are basically the procurement of company shares, depends on their influence on company decisions.

a) If less than 20 per cent of shares are owned by the purchaser, the cost method applies. The shares are displayed in the balance sheet according to their purchase value. Dividends are recorded as revenue in the profit and loss account. If the shares are sold, the resulting gain or loss is accounted for in the profit and loss statement and at the end of the year in the equity section of the balance sheet.
b) If 20 per cent to 50 per cent of the shares are owned by the purchaser, the 'at equity' method is applied, reflecting the higher influence of the investor on the company. Again, in the balance sheet, the investment is valued at the purchase cost. At the end of a fiscal year, the proportional share of the investees' financial results is shown in the financial statements of the investor. If, for example, the investee generates a net income of €1 million and the investor holds a share of 30 per cent, the profit and loss statement of the investor displays a net income of €300,000.
c) If more than 50 per cent of the shares are owned by the purchaser, the company is fully controlled by the parent. Based on the principle of 'substance over form', the balance sheet of the investee is consolidated with the balance sheet of the investor. The financial statements represent the group of companies as one economic entity.

Other types of investment are not obviously covered by the above categories. Companies invest in development of products, markets, brands, employees' skills or research and development. For such investments to be capitalised, the transactions must generate a value that, with a high certainty, will last a long time. For investment in employees' knowledge and skills, such certainty cannot be taken for granted, since employees may leave or change their roles in the company. From a management perspective, 'investment' may be the appropriate term, emphasising the strategic importance of such activities; however, accounting treats them as part of operations and therefore as an expense. They are recorded in the profit and loss statement.

Research and development activities can generate values that have a high certainty of lasting a long time; patents, for example, enjoy legal protection. National accounting regulations like the German Commercial Law (HGB) offer the choice of capitalising R&D (research and development) results and other immaterial assets generated by the company itself. Like property, plant and equipment, they are valued at cost. International accounting standards (IAS 38) provide criteria for determining whether to capitalise R&D expenses. The application of the criteria is subject to individual judgement and allows companies some discretion.

Forest companies invest in product quality (pruning), the structure of forest stands (silviculture) and new forests (planting, planting stock). Silviculture is an 'investment' in forest stands and final roundwood assortments. Since it requires significant funds, with no payback for long periods, its fair representation in company accounts is important. Standing timber represents a significant value that is maintained and valorised by silvicultural measures and realised at harvest. However, because of the long-term nature of sustainable forestry, the application of standard accounting and valuation concepts generates significant problems in practice.

First, valuation of assets in accounting is based on detailed and precise annual inventories, which in a forestry business are so costly that most companies do not have such figures. Sampling methods need to be developed and used, and tools must be available to store and process the data, including models that determine the growth-and-yield of species on specific sites or assess the influence of climate on tree growth. Such tools and methods must be accepted as accurate enough for accounting purposes. Second, the application of valuation methods in forestry is not straightforward because of the long-term nature of the business. The long production cycles cause a high degree of uncertainty regarding market prices for products and interest rates to be applied in DCF calculations.

As a result, accounting standards provide varying guidelines for accounting of forests as biological assets and their maintenance costs. The US General Accepted Accounting Principles (US-GAAP) call for capitalising forest stands according to the costs method, as for agricultural land. The International Financial Reporting Standards (IFRS) also use the same regulations for agriculture and forest businesses; it requires that forest stands be valued at fair value minus the cost to sell, unless the fair value cannot be measured reliably (Wagnière 2011: 64–7). The value of forest stands can be assessed either based on market prices (for standing timber) or by using the DCF method (IAS 41, §20–21). The interpretation of the results depends on the underlying valuation assumptions and is specific to the production base of the company.

6.2 Financing

6.2.1 General aspects

The term financing refers to measures used to obtain the financial resources needed for current and planned entrepreneurial activities and make them available at the right time. Assessing the financial effects of a company's business activities is a central component of management work. A company's financial considerations focus on the following issues:

– What financial resources are required for the company to achieve its entrepreneurial goals?
– From what sources, under what conditions and with what instruments can ongoing expenses and investments of a company be financed?

Financing is needed to fund staff and expertise, equipment, machines, energy and raw materials for the production of saleable goods and services until the returns from sales come in. For the period between the outflow for procurement and the inflow from sales, financial liquidity is essential. The amount of funds (predominantly cash) to run ongoing operations is determined by the business volume and the time lag between consumption of cash for producing goods and services and the effective payments from customers.

The availability of funds for producing and selling market goods and services is a prerequisite for the very existence of enterprises and companies and for meeting contractual payment obligations with suppliers, employees and borrowers. The need for adequate financial resources to conduct business activities is expressed in the principle of financial balance (see Figure 6.5).

	Main business functions		
Type of process	*Procurement*	*Provision of outputs*	*Sales*
Flow of goods	Inflow of good	Production processes and supporting functions	Outflow of goods
Cash flo	Outflow of payment	Capital requirements	Inflow o payments

Figure 6.5 Equilibrium between flow of goods and flow of funds

Source: Peters *et al*. 2005: 76

Following the principle of financial balance is known as maintaining liquidity. This is ensured if the resources available for payment at least correspond to the amounts required for payment. For companies, having adequate liquidity is like having air to breathe: without it, producing outputs and further development would be impossible. If a company cannot meet its payment obligations, the situation is known as illiquidity. If there are no additional means of payment (e.g. temporary bank loans, injections of external capital), the company must make arrangements with creditors or declare bankruptcy. Ensuring operational liquidity is one of the central tasks of corporate financing.

The choice of financing method is determined by the types of financial sources available and by the legal status of the available funds (Lechner *et al*. 2006: 225–83; Peters *et al*. 2005: 79–80). A distinction is made between internal and external financing, based on the origin of the financial resources to be provided. Internal financing consists of financial resources derived from the sale of the company's own products and services; it may include funds provided by public bodies to encourage or reimburse services provided for the public. External financing, by contrast, consists of financial resources in the form of additional equity or loans from external parties.

Another distinction is between self-financing and debt financing. Self-financing involves using financial resources belonging to the owner or owners of the company. Because these resources are provided without a claim for repayment, they represent the company's own equity; they are entitled to a share of the business's profits and entitle their owner to a seat on the company board, depending on the proportion of joint ownership. Equity is capital for which liability to the company's owners exists – that is, payment of dividends. In the case of debt financing, the financial resources are typically supplied to the company by third parties, such as banks. The resources are usually provided for a set period and in exchange for a fee – interest – that depends on market conditions and the company's profit performance. These are bonds, which are not associated with any legal entitlement to a share in company management. Debt capital does not create any liability towards other creditors of the company.

The combination of the origins and legal status of the financial resources – internal or external financing, equity and debt financing – produces a financing matrix with four fields characterising the most important types of financing for companies and business (see Figure 6.6).

6.2.2 Corporate internal and external financing

Internal financing, or self-financing, describes funding options that come from the company's own resources – from operational cash flow, reserves or, under certain conditions, accrued liability reserves. Increasing demand for financial resources can also be met by capital restructuring and financing via retained earnings. No additional resources from the owners and no additional debt from third parties are to be provided for. Internally generated funds from market sales of business outputs are the most important form of financing activities in companies.

Legal status of financier	*Source of finance*	
	Internal	**External**
Company financin	Financing from net cash fl w	Equity financin
Company principal or debtor	Financing from accrued liability reserves	Financing from credits

Figure 6.6 Financing matrix

Source: Peters *et al*. 2005: 76

Funds from operations: A large proportion of the financial resources generated from operations is re-used internally to replace goods and services consumed during production and sales processes. Other surplus financing may derive from mobilising part of the open or hidden reserves. They arise from factors external to the company – for example, through increases in the value of company property. Building up reserves reduces the amount of profit shown, reducing the tax burden for the company. By contrast, reserves can be liquidated again when the tax burden is lower – for instance, during a period of weaker business results. Liquidity financing via capital restructuring is possible if fixed assets can be converted into cash. The financial resources released in this way may be used to increase liquidity or procure additional investment goods.

Funds from retained earnings: These are financial resources flowing into a company that exceed the amount equivalent to the goods used for output provision and not used for dividend payments. Retained earnings are equivalent to equity provided by the owners of the company. In open surplus financing, retained earnings can be shown as legal, statutory or voluntary reserves in special accounts, depending on the type of company.

External financing with equity: External financing with equity, also known as equity financing, is important when a company is starting up or requires additional funds to finance strong growth. Capital required to finance fixed and current assets is inserted into the company from outside by existing or new shareholders. Methods of acquiring equity and the structure of capital contributions are determined by the company's legal form. The role of equity may be characterised by the following points (Boemle and Stolz 2002: 39–40):

- Equity is the basis for financing a company's assets.
- It bears the entrepreneurial risk involved in business activities and provides assurance to creditors.
- It represents a profit-making capital investment for shareholders.

- It is the basis for shareholding, liability regulations and the distribution of profits.
- It contributes to a company's creditworthiness.

There is an international equity market in which institutional and private investors look for rewarding opportunities. The stock exchange represents that part of the capital market in which shares of listed companies are traded. Those able to offer investors prospective returns that are proportionate to the risk involved have access to this market. Potential investors use various analysis methods to evaluate companies and make quantitative and qualitative judgements about investment risks (Betsch *et al*. 2000: 186–7).

External financing with debt refers to financial resources that are provided for a specified time period in return for a determined rate of interest. The principals provide financial resources but are not involved in the management decisions of a company. A distinction is made between short- and long-term debts. Long-term forms are bonds and securities. Short-term forms include prepayments, accounts payable and short-term bank loans. Prepayments from customers are a common instrument for financing business activities; they generate the obligation to provide a product or a service to the customers and are shown in specific balance sheet accounts. Suppliers also participate in financing through agreement to payment terms (accounts payable). Authorised debt is a special case resulting from contingent liability from guarantees.

The importance of debt may be characterised by the following points (Boemle and Stolz 2002: 41):

- Debt reduces the cost of financing, since interest rates are usually lower than the returns expected from investors in equity. Guaranteed return of debt and first right of creditors to the company's assets in case of default lower the risk compared to equity investors and therefore carry lower expected returns.
- Debt increases flexibility by raising or repaying debt, depending on current capital requirements and capital market conditions.

Another form of external financing is leasing (Krather and Kreuzmair 2002; Spittler 2002). The owner of an asset (the lessor) transfers it to a user (the lessee) who is entitled to use the asset under certain conditions against payment of a leasing fee. The lessee has possession of the asset, and the extent of the use and management rights are determined by national legislation and jurisdiction. A distinction is made between two types of leasing:

- An operating lease is a short- to medium-term transfer of an asset. The lessee can usually terminate the contract within a set time. The object-related risks remain with the lessor.
- A financial lease is a long-term transfer of an asset. The lessee usually agrees to a nonterminable basic rental period that covers a large proportion of the economic use period of the asset. The object-related risks are contractually assigned to the lessee.

Assets capable of being leased range from movable objects, such as vehicles, computer equipment and machines, to office buildings, warehouses and entire manufacturing plants. From an economic point of view, there is little difference between a financial lease and ownership of the asset. Both assign the majority of economic rights to the user of the asset. Financial lease payments are therefore treated in IFRS and US-GAAP regulations like fixed assets and are shown on the asset side of the balance sheet. Liabilities deriving from leasing contracts are treated like debt. By contrast, operating leases are treated as expenses in the profit and loss account.

Leasing transactions are important in business for several reasons:

- Reduced transaction costs result from process standardisation in purchasing and using assets from the lessor.
- Business processes are simplified for the lessee if the lessor provides maintenance and repair arrangements against compensation of costs, in addition to the asset itself, as part of the leasing contract.
- From the point of view of the lessee, options for terminating the leasing contract may balance out the higher costs of leasing in comparison with purchasing the asset.
- Financial advantages may arise because of different tax effects for lessor and lessee – for instance, in connection with depreciation rules on assets.

6.2.3 Financing multifunctional forest management

Whereas the previous parts of this chapter address general investment and financing aspects in enterprises and companies, the following sections deal more specifically with multifunctional management and financing environmental benefits in both private and public forests.

Forest owners and forest managers face demands not only for wood and timber products but also, depending on location, region and country, for multiple environmental and recreational benefits. Many of these goods and services cannot be traded on free markets; they are, at least for the time being, public or club goods. Multifunctional forest management can satisfy these diverse demands. However, provision of public goods often generates costs and may conflict with the provision of private goods (e.g. in timber markets). Meeting the costs of different combinations of wood production, environmental protection and silvicultural practices requires an adequate financial basis (Klemperer 2003).

Organising a coherent system for the necessary combination of financing mechanisms is a difficult task. Revenues from roundwood sales and wood products may have to be combined with payments and fees from individual private beneficiaries and public entities. Financing is not the only problem. Often the costs of providing environmental and social benefits are not directly linked to the supply of such goods and services and cannot be identified separately. Opportunity costs may prevent or limit other uses, such as certain wood-production regimes. The provision of certain environmental benefits or the regulation of harvesting – without financial compensation – may increase costs.

The cost structure for roundwood production, nonwood forest products and marketable services differs substantially, depending on the region, the landowner and the chosen forest management goals. For example, the financing structure of private forest holdings, whose profits come mainly from roundwood sales, differs from that for private and public forests in and around large cities. Financing silvicultural operations to ensure stable and resilient protection forests in mountainous regions has yet another cost structure, to which the beneficiaries of environmental and social services need to contribute financially. Silvicultural and protection measures were traditionally financed from returns from roundwood production, which in many cases is not possible any more for economic reasons. But today, the large part of the population in Western Europe, who in cities and suburbs value forests more for recreational uses, sometimes has difficulties in understanding that forest management requires sufficient funding for silviculture.

Forest owners and forest managers confronted with increasing demands for tourist infrastructure, recreation, biodiversity protection and countryside conservation can broaden and adjust their management goals only if their multifunctional financing structure can bear the costs of production and meet their profit expectations. It follows that private users, user groups and public institutions need to contribute to ensuring multifunctional and sustainable forests and participate in joint management. In short, payment for ecosystem services implies a contractual or legal setting between supplier and user of services, with the supplier actually controlling the resource.

Direct payments for nonmarket forest benefits and services may be achieved with different combinations of financing methods. This includes sales of goods and services, individually negotiated cost contributions from private individuals, contractually or legally regulated financial contributions from public entities, and equity financing from forest owners. Analyses of the effective flows of financial funds from, for example, forest management practices in the Swiss Alps give insight into the range of required services and silvicultural targets and the corresponding sources of finance (Schmidhauser and Schmithüsen 1999).

Figure 6.7 shows a structural overview for long-term financing of multifunctional forest management for a variety of private and public benefits. It combines financial contributions from investments and current funding by forest owners with market proceeds from sales of roundwood, nonwood products and delivered social and environmental services. Contributions and fees from individual users, user groups and public entities and incentives and compensation from the state are the second pillar of the financing model. The concept of joint management responsibilities and business goals based on joint funding strategies implies that forest owners, customers and stakeholders committed to sustainable forest management need to cooperate as partners with a common understanding.

Contractually regulated financial contributions from private user groups or nongovernmental organisations (NGOs) to the production of nonprivate goods and public services have become important for financing silviculture and forest management. The demand for statutory or voluntary compensation from user groups for protective and recreational services can be expected to expand.

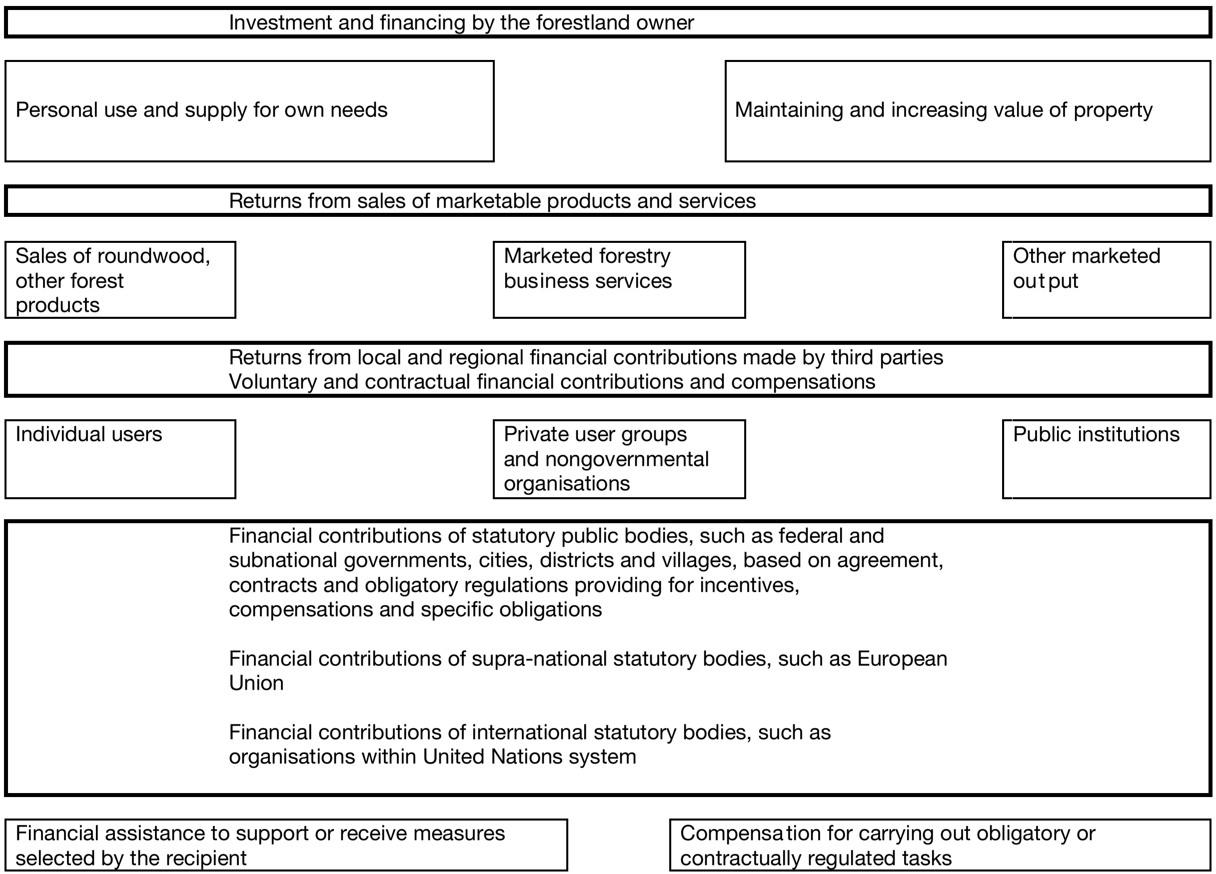

Figure 6.7
Financing multi-functional forest management costs

Source: adapted from Schmithüsen and Schmidhauser 1998: 103

Financial contributions from public budgets – local, regional or national – are the result of citizens' and voters' demands for maintaining forests for recreational use. Supra-national regulations and international conventions and agreement governing environmental and nature protection usually entail matching funding or cost sharing by national institutions and agencies.

An overview of financial instruments used in the Swiss Alps, for instance, shows that the proportion of public funds devoted to the forest sector for securing protection values and benefits is substantial. In the mountain region, covering about 50 per cent of the territory, the revenues from timber sales covered 40 per cent to 60 per cent of total costs for management, silviculture and protection, according to a country report evaluating financing of forestry from 1990 to 1999. Public funds from federal and cantonal governments, other public entities and communal forest owners provided the remainder (Baruffol *et al.* 2005, 2006). A major part of public expenditure comes from the Confederation and includes incentives and compensations allocated for forest care and silviculture, structural improvements and access infrastructure, and protection against natural hazards – in particular avalanches, landslides and rockfall.

The legal basis for funding is Article 35 of the section on financing in the Federal Forest Law 1991. It stipulates that, within the limits of the credits allocated, the Confederation shall promote measures to conserve forests and protect the population and valuable property against natural hazards; the measures include the necessary training, research and data collection. It provides that financing such activities shall depend on the cantons' participation to the limit of their ability, the recipients' direct contribution of services corresponding to their own financial resources and any other source of financing and personal commitment one may expect. The Federal Council (national government) may require that certain funds go only to recipients who are applying self-help measures in forestry management and the timber industry.

As part of the research programme, Quality of Life and Management of Living Resources, the EU launched a comprehensive project evaluating forest-related financing practices in 13 European countries (European Union 2005). The project aimed at the following outcomes:

- a survey of evaluation methodologies on public forestry interventions, especially concerning assistance and extension programmes;
- a database on spending on forestry, including costs and outputs of forestry assistance in different countries in Europe;
- tools for evaluating the effects of public interventions based on different methodologies;
- evaluation of effects of forestry-related funding policies, taking into account country-specific institutional factors, and economic development, ecological sustainability and social equity criteria;
- analysis of public choice and implementation issues, taking into account nonmarket failures that hinder the effectiveness and efficiency of sustainable forest management policies; and

– considerations on guidelines for development, implementation and evaluation of forestry-related funding programmes.

EU and national forestry assistance and extension programmes between 1990 and 1999, in both the private and the public forest sector, were studied with country examples for five European regions: Western Europe (Belgium, France and the Netherlands), Central Europe (Germany and Switzerland), Central and Eastern Europe (Czech Republic, Estonia, Poland and Slovenia), Northern Europe (Finland and Norway) and Western Mediterranean Europe (Catalonia, Portugal and Spain). The study is a major source of quantitative and qualitative information for comparative analyses of forest financing in European countries. The following points appear of particular interest.

It was found that four *types of activities* (forest protection, planning and forest inventory, infrastructure and afforestation and reforestation) accounted for more than half of public funding for forestry. Comparisons among countries were complicated by large ecological, socioeconomic and institutional differences. Nearly half of the programmes and activities analysed were financed through grant schemes. Other programmes were implemented through tax concessions, extension services, tax exemptions, compensation schemes and planning assistance. Some projects were implemented through a combination of measures, such as grants, extension services, soft loans and compensations. Programme outputs were determined from secondary data sources, such as administrative records and monitoring schedules. The eligible target groups comprised mainly private forest owners, farmers and participants in educational courses.

Starting in the 1980s, the study observes, environmental and social policy goals began to apply equally to public and private forests, with the consequence that economic, social and ecological forest functions became important for forest management in all landownership categories. This trend has continued and means that private forest owners are increasingly expected to provide public goods and positive externalities. It is at the same time the major reason why the private forest sector, in assuming these new responsibilities, is supported with public funds and technical assistance. In some cases, forest owners may be entitled to compensation. Information on the split of funds between the private and public forest sectors was difficult to obtain, since forestry assistance programmes were directed to both kinds of ownerships.

The study concludes that national forestry development policies and EU programmes have been addressing environmental and social dimensions more comprehensively. Policy goals defined in new legislation acknowledge the importance of sustainable forest management and multifunctional use practices. The same is true for the general objectives of measures to promote economic, social and environment forest management criteria. However, the objectives and outputs of forestry funding measures had often been imprecisely determined. Considerable improvements were needed to develop operational definitions of funding objectives and instruments, programme and project outputs and evaluation standards.

6.2.4 Promoting forest environmental services

In promoting and supporting environmental forest services, several kinds of public instruments may be used (Kaliszewski 2004; Sisak and Chytry 2004):

- normative instruments, such as legislation and administrative regulations setting limits, standards, permissions and licences;
- economic instruments, including financial and other economic measures;
- information and educational instruments, such as information campaigns, voluntary training and educational courses for forest owners and managers, the wood-processing industry and the public in general;
- voluntary and contractual measures, such as unilateral engagements and commitments and negotiated agreements and contracts, sometimes with payment for the contracted services, but sometimes without specific commitments for public payments;
- environmental management and planning systems, such as zoning for protected areas and landscape restoration; and
- institutional instruments used by state, regional or local public entities for the establishment, protection and promotion of environmental forest services.

Among the economic instruments used in financing forest environmental services for public demand, the following may be mentioned (Kaliszewski 2004):

Compensation programmes include public spending to produce goods and services of public interest, such as regular water supply, soil protection, nature conservation and recreation. The transfer of funds from national and regional governments is often directed to forest owners, tenants and managers and can be considered a purchase of nonmarket forest services sought by citizens or the state. Compensation may cover the costs of measures to secure the desired services or be a reimbursement of forgone benefits if the owner refrains from activities detrimental to those services. Extension, advisory and consultant services, either provided directly by public agencies or supported from public funds, may complement such programmes.

Tax concessions in forestry are justified by the multifunctional character of forests and their different use options, the long-term nature of forest management and silviculture, the economic restrictions imposed on landowners and managers whose forests have special protection values and their obligations to provide nonmarket social and environmental services to the community. Direct tax concessions usually relate to the land tax, hereditary taxes or property sales taxes. Concessions on indirect taxes may include a reduction of the value-added tax and exemptions from fuel taxes for machines used by landowners in agriculture and forestry production.

Fees for deforestation are a typical instrument of public land-use planning policies. They are used, usually as a complementary measure, to halt or slow the clearing of valuable forest areas for agriculture or development. The fees may be differentiated by zone, corresponding to either the prospective value of the land for other purposes or the estimated loss in nature or recreational values if the forest is cleared.

Purchase of forestland is another way in which public authorities may intervene to secure social and environmental benefits from forests. This measure is used, for instance, to limit logging in areas with high biodiversity values and protect landscapes. Production activities may be prescribed or excluded, operation technologies limited and wood cutting regulated. Purchase by the state, cities and local communities is usually an exceptional case and a last resort if other public instruments cannot be used more effectively, or if the measures considered desirable for public policy reasons would make forest management economically impossible for a private forestland owner.

A study by Kenneth Rosenbaum and Jonathan Lindsay (2001) reviewing legislation in 38 countries worldwide shows that many countries use national forest funds and similar arrangements to make a portion of national revenues available for forestry purposes. This means that public funding is set aside for more than the annual government budget cycle and earmarked for forestry-related investments. The structure and governance of these funds – the actors, activities and sources – vary greatly in different countries:

- A national forest fund may be a simple account within a government budget or a separate legal entity with a governing body and its own professional management. New funding for public institutions may be created in restructuring the public forest service with autonomous management functions that are at least partially self-financing.
- The fund may support public forestry agencies, private forest owners, mixed groups of public and private land users or, increasingly, decentralised actors in forest management, such as local governments and community-based organisations.
- Such funds may support a few activities or a wide range of services – public land management, land purchase, afforestation and reforestation and forest protection, including fire, insect and disease suppression. Private reforestation, afforestation, management planning and plan implementation may qualify under the funding system.
- The funding may come from forest revenues and be earmarked for reinvestment in forestry activities, such as replanting of overlogged forest stands. Other funding arrangements follow the principle of internalising externalities; that is, they capture environmental values of forests through various 'polluter pays' or 'beneficiary pays' instruments.

The role of national forest funds is changing, and their justification and usefulness need to be analysed in each country's socioeconomic and political context. Trends of particular interest are the use of funds to promote decentralisation and devolution and foster environmental and social benefits, the need for accountability and transparency in managing the funds, their role in internalising positive externalities and private sector initiatives. Forest funds, it is argued, can help meet the need for long-term investment, which may not be attractive in commercial terms. Depending on species composition, soil, climate and production goals, many decades may pass between the expenditure on planting, tending and protecting forest stands and the revenues from commercial thinning and final harvesting. Forest funds allow financing silviculture over extended periods; they contribute to regular and more effective forest management over time, and smooth large cash flow variations from natural calamities and fluctuating wood prices.

Arguments against forest funds include their potential to trap capital in the forest sector, prevent an effective allocation of government budgets and transmit misleading signals to the economy. In the EU, forest funds (e.g. Fonds Forestier National in France) have been phased out because they were considered public subsidies providing unfair advantages to the sector over its international competitors.

National and supra-national public funding systems have gained importance for protecting biodiversity, valuable ecosystems and natural sites and delivering benefits for nature and people (European Commission 2011: 1–3). A prominent example is the co-financing approach based on cost estimates of Natura 2000, the principal mechanism to achieve the protection objectives adopted by the EU. Natura 2000, based on the partnership of member states and the EU Commission, has a terrestrial component of around 750,000 square kilometres (18 per cent of the EU-27 land surface) and around 200,000 square kilometres of marine area. In fact, it is probably the largest coordinated network of protected areas in the world today.

The Natura 2000 network consists of special protection areas, established under the EU Birds Directive, and special areas of conservation, established under the EU Habitats Directive; both are classified under a common EU framework. Forests are the most prominent ecosystems of Natura 2000's terrestrial protection system, covering more than 50 per cent of the network's land surface. This includes significant areas of riparian forests along major European rivers. Agricultural lands and grasslands amount to more than 30 per cent and wetland ecosystems and peatlands account for another 10 per cent.

The large proportion of forests in the protected area programmes argues for creating and coordinating public funding measures for sustainable forestry and nature protection. Sustainable forestry practices are a basis for successful implementation of EU Natura 2000 goals. The owners and managers of forestland need to be equal partners in determining and implementing nature protection and biodiversity policies. Comprehensive financing approaches must match the diverse characteristics of forest ecosystems and landownership structures. From an entrepreneurial point of view, this implies that forest owners – the responsible land managers – be fully aware of conservation funding programmes and benefit from them so that they can combine production and protective forest management goals. Compensation and management support must be commensurate with public and private demands for sustainable forest management.

The financing system for Natura 2000 relies on several funding streams supporting different EU policy sectors (European Commission 2011: 6–13).

Several funding sources are relevant, in particular the Common Agricultural Policy (CAP); the European Agricultural Fund for Rural Development (EAFRD), which is part of CAP; several structural cohesion funds; and LIFE+, which provides a basis for demonstrating the feasibility of nature protection projects. The new LIFE programme can be a valuable tool for developing partnerships and sharing responsibility at local level. It may also leverage other EU and domestic funds through integrated projects. Multiyear plans set up by the member states are envisaged.

Financing multifunctional forest management, maintaining the biodiversity of forest ecosystems and protecting the forest cover should be seen in the broader context of valuing costs and benefits of alternative sustainable uses and nonuse options. This begs the questions of who benefits in the private and public sector, and who should pay for the benefits. Mechanisms to develop payments for environmental services (PES) need to be addressed at local and national levels, as well as in international forums. Cost-benefit analysis evaluates the relationship between economic activities and social and environmental benefits in quantitative terms and considers qualitative factors, including positive and negative externalities. This macroeconomic approach is an important tool in renewable natural resources decision making.

Scientific literature can contribute to a better understanding of the principles and methods of cost-benefit analysis, economic valuation of nonmarket goods and services and multicriteria decision making to produce science-based solutions (European Union 2008; Glück and Niesslein 1998; Koellner 2011; Merlo and Croitoru 2005; Palmer and Engel 2009; Quah and Toh 2012; Scholz 2011; Scholz and Tietje 2002). The challenge now is to use theories and analytical methods to address empirical problems in the forest and environmental sector and develop operational schemes and instruments for valuing and financing nonmarket forest and environmental goods, services and values.

6.2.5 Management of publicly owned forests

State and communal public institutions are entitled by statute and legislation to levy taxes and fees to finance public functions. Public expenditure is largely financed from general tax revenues. State parliaments review the budgets submitted by their subordinate executive and administrative branches and decide on the resource requirements, taxation levels and the groups of citizens on which taxes are levied. At the communal level, decisions are taken by city councils based on the proposed budgets of the administration. Tax laws and annual public budgets determine the specific measures for tax collection and public expenditure

A distinction is made between current administrative activities or public services and investment activities to finance large-scale projects. Administrative accounts (current accounts) and investment accounts (project accounts) are managed separately. The result of public financing activities can only rarely be measured by comparing direct monetary market returns with the public expenditure. The focus of spending in public entities is, rather, implementing tasks in the public interest and providing services to citizens as determined by public law and democratic decisions. Performance indicators for the efficiency and effectiveness of public outputs and the satisfactory fulfilment of administrative tasks are measured in political, economic and social terms: exploring to what extent the public expenditure serves the public interest and satisfies the expressed needs of citizens and the community.

In state and communal public budgets, expenditure and income are not directly connected. Each budget is voted on by the parliament (or the equivalent institution entitled to make the decision). There is a general prohibition against earmarking of taxes for financing by cost source and for coordination if the budget's expenditure and income structures are objectively linked. Exceptions to this rule apply in the case of earmarked fees and financial contributions determined by public law – for instance, in the case of large infrastructure projects that need assured financing over long periods. Fees (not taxes) for specific administrative activities and services delivered to the public or for exceptionally heavy use of infrastructure may be levied, if allowed by law and regulation.

Specific formal and material regulations determine the accounting practices of the public sector, which are different from accounting principles in the private sector. Public budgets set quantitative and qualitative targets within a budgetary framework, and the financial resources needed for the required outputs are made available through the act of budget approval. This means that liquidity and financing issues are located not at the level of the business or administrative unit but within the framework of a higher-level approved budget. External financing – that is, loan financing and equity financing – is not handled by governmental departments and administrative bodies. However, it is quite possible for loans to be raised by the statutory body in accordance with the applicable regulations.

Some flexibility in financial management has been introduced under the concept of new public management. Changes in fiscal rules may affect transfer options for budgetary funds not fully required within the budgetary period because of unforeseen events. Of special interest here is the ability to make use of savings from operational efficiencies. To promote cost awareness, for example, the new public management approach is often linked to an incentive scheme. Profits or unspent funds remain wholly or partly within the public administrative or operational units and are available to them within the framework of the goals that have been set. This type of regulation replaces input-oriented views of financing with a more realistic approach to satisfying public needs and demands: it encourages cost-effectiveness and the use of market potentials and marketing opportunities.

Forest conservation, preservation and multifunctional sustainable management receive public financing, to varying degrees. Some public funding promotes wood utilisation as a renewable natural resource for construction and energy that also addresses climate change and energy security. Because public forest owners generally operate according to the rules of public budgeting, understanding public financing is important. Financing public forest management depends to a large extent on the different types of forest tenure systems used in different parts of the world. A distinction may thus be made between countries with a large proportion of public forestland, such as Russia and Canada, and countries with firmly established mixed private and public tenure rights, such as the United States and the nations of Western Europe.

Financing methods for public forests depend on the legal status of the managing agency and the extent to which the federal government and member states – for example, the cantons in Switzerland and the federal states of Germany – have defined the scope of entrepreneurial activities. Management of publicly owned forests may be transferred to private commercial companies with access to national and international financial markets. This is the case, for example, in Canada, where wood production and other forestry activities in public forests are undertaken by private or semi-autonomous management companies, whereas regulating, maintaining and protecting the forest cover remains with parliament and government.

In many countries, sustainable management of state forests is organised, either exclusively or to a large extent, by the national or sub-national forest service. These agencies follow general administrative regulations for financing operations and must comply with the rules for using public funds. Expenditures of public entities must be balanced with available public receipts and have to be used according to principles of effectiveness and efficiency. At the state level, annual forestry budgets are proposed by government and discussed and approved by parliament. At the communal level, annual forestry budgets are prepared by the executive branch and approved by municipal and city councils or in some cases by citizens' vote.

Public entities, whether state or communal institutions, determine through their budgets which goods and services best serve the community and which goals in forest management are to be attained. Returns from sales of output produced in the public sector usually flow to the general budgetary account. Alternatively, the returns may stay with the public entity, which pays a percentage of its profits or a specific annual amount to the treasury, retaining the remainder to make investments like a private company.

In public forest management, special regulations may apply to extraordinary returns, as when roundwood sales from salvage harvesting exceed the annual allowable cut. A reserve fund may be set up to finance subsequent years' activities – for example, regeneration and tending operations in forest stands. In periods of lower cutting volumes and lower overall yields, a forestry fund allows the public agency to bridge liquidity bottlenecks in sustainable forest management. The authority to create a special forest fund for such purposes is usually provided for in the forest legislation.

The accounting system used by public forest owners depends on the forest management and production goals and the size and nature of the forests. Binding forest-related budgeting regulations for standardised account groups need to be agreed on to ensure comparability among different public entities. Public forest owners increasingly recognise that such planning variables as stocks of standing timber, increases in wood growth and annual harvesting volume are not sufficient for assessing the requirements for operating financial resources.

In Germany, accounting procedures used by public forest owners have generally been based on systems of administrative accounting. Such systems combine the current annual budget with expenditures and revenues accounts, the investment budget with receipts and disbursement accounts, and separate accounts for stocks and inventories. If required, managerial accounting data allow cost and return calculations. Many of the financial modules and tools used in the private sector, including those discussed in this book, can be combined in a modern administrative system. However, they need to be adjusted to the special requirements of forest protection and management. The software industry supplies modules that link the forest production cycle with the financial cycle and allow direct links to cost accounting, entrepreneurial personnel management and accounting and online banking services. These commercial software packages, designed for medium-sized and large private forests, generally use the double-entry accounting system.

The use of administrative accounting systems in public forest management is being questioned. Municipalities with large forest holdings are playing a pioneering role here. The establishment of municipal enterprises and the separation between operational and administrative units make it attractive to integrate forest management into a commercial budgeting structure. The transfer of state forest administration activities to public forest business entities with different legal forms, such as public-private partnerships incorporated under public law or constituted as public limited companies, is another reason to use commercial accounting and double-entry bookkeeping systems.

The advantages of a modern accounting system based on double-entry bookkeeping make its adoption by public forest administrators a competitive move. When market partners all along the wood value-creation chain are working with accounting systems that follow the same logic, they are speaking the same language. The administrative annual budgeting system that has been used in public forest ownerships is increasingly an artefact – not because it leads to different solutions but because it is based on different assumptions.

6.3 Further reading

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7 Logistics and production processes

7.1 Logistics

7.1.1 General considerations

Logistics is a holistic approach to optimising the flow of materials and related information in and between companies or entire value chains (Günther and Tempelmeier 2005: 9). The basic meaning of *logistics* is coordination of the various processes involved in value creation through a series of flow systems. The significant element in designing logistic systems is combining the flow and storage processes. The networks involved may be comparatively simple but can be extremely complex (Göpfert 2005; Pfohl 2010; Schönsleben 2007; Weber and Wallenburg 2010).

Logistics is concerned with managing, organising and controlling the flow of material goods: raw materials are transported from the producer to the manufacturer, and manufactured products are then delivered from the manufacturer to the purchaser, all in accordance with customers' needs in terms of the quantity, quality and timing of products and services. In rapidly growing markets, control of distribution logistics helps expand market share but requires specialist expertise.

Both goods and information flow via connections in a logistic network. However, the storage elements – such as warehouses – and the connections between them have limited capacity. It is not possible to deposit an unlimited quantity of products in every storage site, or to move unlimited numbers of products between storage sites at the same time. Storage and transport capacities are limited by technical restrictions, environmental factors and the need to keep costs as low as possible. Figure 7.1 shows connections involved in a simple logistic system.

The load on individual parts of the system, as well as on the logistic network as a whole, is not constant over time, since the demand for transport and distribution capacity may vary substantially within any given period. For example, demand changes with the current quantity of orders and the duration of individual production processes (processing time). The capacity in the system may also vary with changes in the number of employees or breakdowns of machinery. Figure 7.2 illustrates the link between changes in demand and capacity in a logistic system.

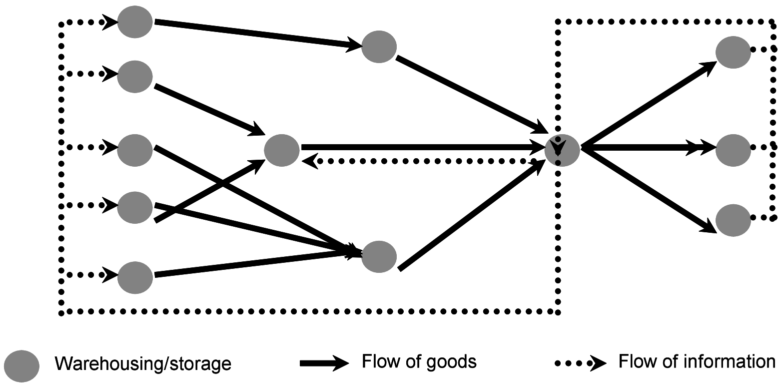


Figure 7.1 Model of a simple logistic network

Optimising the flow of goods and information and the need to design efficient logistics has led to rapid developments in business management. With functional specialisation, attention focused initially on optimising sub-sectors of logistic networks, particularly in the fields of materials management, production planning and production control. At present, the focus has expanded to the coordination of entire supply chains integrating suppliers and customers. Logistics has become a management field for companies seeking to implement general flow principles, rather than thinking in terms of specific business areas and industrial activities. Such principles require new management practices, performance indicators and strategic targets. Innovative information and incentive systems and organisational structures that follow processes instead of functions are essential.

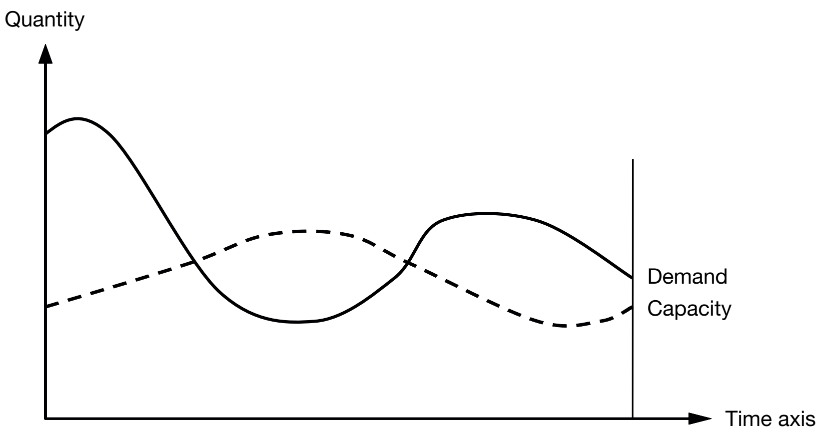


Figure 7.2 Variations in capacity and demand over time

Source: Schönsleben 2007: 30

The task of logistic management is thus to coordinate the individual parts of a system to provide the required quantities of objects at the right time, in the right place and in the correct combination. Central issues in logistics arise from the following two considerations (Weber and Kummer 1998: 170–1):

– the need to take full advantage of a company's potential and to create value by optimising logistic networks according to customer demands; and
– the need to limit costs associated with logistic processes.

The relative importance of these two factors varies by industrial sector and from company to company (Gudehus 2005: 130–1).

Logistic tasks have been increasing in number and complexity because of the transition from sellers' markets to buyers' markets and the associated increase in product variants and diversified customer requirements. Great complexity in distribution means and increasing performance rates in transport technologies speed up logistic processes. Service to clients means above all that distribution processes have to be coordinated with customers' needs in terms of delivery time, date and location. The best logistic systems are oriented precisely towards the expectations of customers.

Logistic costs comprise warehousing, transportation, procurement measures, supply activities, personnel and information technology. Costs for warehousing arise from increasing storage capacity while maintaining current operations. Building up stocks affects companies' liquidity. The costs of production have already been incurred, but income is received only after the goods have been supplied to customers. This is the case in sawmills, for example, which experience long periods between the purchase of roundwood and the sale of marketable, air-dried sawnwood products. Similar problems may exist in veneer production from hardwood tree species, which can be harvested only during winter and early spring. Because of the risks associated with long storage periods – customers' requirements may change and the stored products no longer meet the desired specifications, or the quality of products may deteriorate in the warehouse – companies incur the additional expense of risk insurance.

In general, the strategic focus has shifted from efforts to utilise capacity as fully as possible, if necessary operating with larger stocks, towards ensuring shorter delivery times in producing more varied goods and services for varying customers' demand. Approaches today are based on more efficient and cheaper flows of goods and information in analysing logistic systems as a whole. Isolated attempts at optimisation – only in the area of raw material procurement, for example, or only in production techniques – often reduce competitiveness and raise costs at the interfaces in logistic networks.

Logistic costs can be reduced by achieving a high degree of operating flexibility, with short processing times from receipt of order to dispatch and with low inventory levels. 'Just-in-time' (JIT) production, one version of this approach, is now widely used (Ehrmann 2005: 302–3, 455–6; Schönsleben 2007: 330–1). The main goal is minimising activities that do not create value. JIT production involves the following:

- reducing inventory along the entire logistic chain;
- closely coordinating suppliers and processing companies to achieve a partnership beneficial to both sides;
- replacing the pull-principle with the push-principle in procurement and marketing strategies;
- minimising set-up time, working time and waiting time; and
- reducing batch sizes, with the ultimate goal of a batch size of one.

JIT production requires continual and transparent information about the flow of raw materials, intermediate and final products throughout the value-creation chain. Without sufficient information for planning the interlocking sub-processes, JIT logistics cannot be implemented. Dispensing with inventory requires agreements and if necessary contractual arrangements (outline contracts) to ensure that the right quantity and quality of goods are delivered reliably. Inventory stocks can be reduced or eliminated when the materials required for further processing are delivered only as needed. The supplier knows when the processor will run short.

Substantial changes and restructuring processes have to be made in business manufacturing sequences. For example, reducing or dispensing with inventory stocks usually reveals weak points and unnecessary costs in the value-creation chain. However, reducing delivery time and batch sizes may also create additional production risks and reduce the advantages of scale effects. Set-up time, working time and waiting time can be shortened through improved planning and product design, well-coordinated production programmes and industrial engineering and effective information exchange and information technology (Schönsleben 2007: 145–6). The resulting flexibility in production and reduced time from receipt of order until dispatch can compensate for or outperform the scale effects that may be lost.

Over recent decades, the complex logistic and distribution systems involving producers, intermediaries and purchasers (often on different continents because of international trade) have become much more streamlined. Differences in distribution logistics arise because of the nature of intermediate trading levels and the organisation of sales and marketing. Intermediate traders play an important role in consumer goods markets with quality products. For instance, a producer of high-quality solid-wood furniture is likely to choose a distribution channel that provides access to customers who have the corresponding quality expectations and the ability to pay a higher price; such a company will probably primarily distribute its products through the specialist retail trade.

7.1.2 Characteristics of logistic systems

Characterisation by sectors develops logistic issues in accordance with the structure of economic activities and business branches (Schönsleben 2007: 205–6).

Using a classification – for example, based on the trade directory used by statistical offices – models and tools for planning and control can be developed that are adapted to the specific circumstances in a sector. This is useful to the extent that sectors and businesses share typical characteristics. Clearly, the chemical industry and the mechanical engineering industry face different logistic challenges. However, the differences between companies in the same sector are still so large that this type of systematisation leads to rather generalised approaches.

Systematisation along the value chain is another way of addressing logistic issues. The idea is that logistic tasks differ with the phases of value-adding processes. All the entrepreneurial activities within a network are divided into management tasks. Logistics for individual phases of operating output are then analysed in the overall context of value creation, according to company models based on typical components in a value-creation chain.

Logistics in a supply chain management process can be subdivided into the following business activities:

- procurement logistics;
- production logistics;
- distribution logistics;
- service logistics; and
- by-products and final disposal logistics.

Systematisation in accordance with logistic tasks: In the context of entrepreneurial planning and control, tasks are carried out independently of the specific circumstances in the sector or value-creation phase. The flow approach is the principle for company performance. Logistic problems are systematised in accordance with the tasks involved (Schönsleben 2007: 153–4): for example, demand forecasting, order planning, production planning, inventory planning, re-supply plans.

Logistic systems can take widely differing shapes, depending on the business context and previous entrepreneurial decisions. An analysis of existing systems and the development of alternatives facilitate the understanding of goal-oriented logistic management. A grid (see Figure 7.3) aids in this analysis.

The analytic grid accounts for characteristics that are relevant for planning and system control. Points of reference include the categories of customers, products, production processes and production capacities. It allows a qualitative analysis of logistic systems and the classification of the importance of its individual components. The results can be used in the following ways:

- To compare results for different products or groups of products in a company network and reveal the potential strengths and weaknesses of the logistic system used. Products with similar logistic characteristics are easier to handle than those with widely differing characteristics.
- To assess practicable approaches and methods for planning and control. The features of individual characteristics can be used as variables for designing logistic systems as determined by internal and external parameters.

Characteristic	**Form**				
Reference point	Customer				
Frequency of consumer demand	Once		Batches (sporadic)	Regular	Constant (continuous)
Long-term nature	None	Blanket order for capacity			Blanket order for goods
Supplier's flexibility	No flexibility (fixed delivery deadline		Poor flexibility		Flexible
Mark of origin	Not possible		Batch		Position in batch
Reference point	Product				
Depth of product structure	Many structural layers		Several structural layers		One-step production
Product structure type	Convergent		Combined upper/lower production level		Divergent
Product concept	According to (variable) customer specification	Product family with many variants	Product family	Single product with variants	Single or standard products

Figure 7.3 Characteristics of logistic systems and their potential forms (continued overleaf)

Source: Schönsleben 2007: 198–9, 366–7

Reference point	Production processes				
Physical organisation of production structure	Building site production	Isolated or group production	Workshop production	Production line	Continuous production
Production concept (stockpiling level)	“Engineer to order” (no stockpiling)	“Make to order” (development, raw materials)	“Assemble to order” (parts purchasing or production)	“Assemble to order”	“Make sto stock” (final products)
No. of production steps in the company	Many steps (e.g., system suppliers)	Few steps (e.g., supply businesses)		One step production (e.g., assembly)	Trade
Frequency of order	Single production or procurement		Production or procurement with infrequent repetition		Production or procurement with frequent repetition
Size of order or batch	Single production or procurement	Small series		Series	Mass
Production cycles	No cycles				With cycles
Reference point	Production capacities				
Qualitative or flexible capacities	Usable for various processes		Usable for various processes		Usable for one processes
Quantitative capacity flexibility	Flexible on time axis		Poor flexibility on time axis		No flexibility on time axis

Figure 7.3 Continued

- To make valid comparisons between companies, business branches or economic sectors.

Customer-related characteristics: Processes involved in creating output may be triggered by orders from customers or by production conditions (Schönsleben 2007: 16–17, 243–4):

- A customer order has been received; this may involve single orders or blanket orders.
- Production may be based on the estimated demand for future products and therefore takes place without a specific customer order. This is necessary, for example, if the delivery deadlines required are shorter than the production time. In this case, the producer bears the risk of incorrectly assessing demand.
- A production order is triggered when products held in stock are demanded by customers. In this case, the order leads to restocking.
- Production orders can be triggered when raw materials are procured or when semi-finished or finished products in various forms are manufactured.

Frequency of consumer demand: The frequency of consumer demand is assessed for a set observation period. It influences the degree of flexibility required in production and warehousing. The range may extend from one-off to continuous demand. Regular demand is present when specific time dependencies can be calculated for customer frequency. Otherwise, the frequency is triggered by sporadic demand.

Long-term orders: Long-term orders represent a specific type of demand frequency and are important for shaping product concepts. This type of order for goods and services in a logistic network gives suppliers and customers greater confidence in planning, but it requires regular sales opportunities or confirmed forecasts, as when customer demand is constant. Blanket orders are a special type that makes it possible to reserve fixed production capacities for partners in the logistic network; they reduce delivery times and lower warehousing capacity because production can be organised within defined periods. Production planning is important for flexible organisation of procurement of internal resources. It significantly affects the level of stock on hand and the entrepreneurial risk, and consequently costs.

Proof of origin: Proof of origin, used for quality assurance and as a marketing argument, is required for the certification of products and production processes. It must be taken into account in planning and operational control measures. In this context, a batch represents goods that have been produced or procured together and are jointly identified with proof of origin.

Product-related characteristics: A complex or deep product structure is present when the final products consist of many individual parts (components) (Schönsleben 2007: 25–6, 414–15, 882). Manufacturing such products creates complex logistic requirements that have to be managed in a comprehensive framework of planning and operational control. In many cases, the depth of the product structure needs to be analysed within a cluster network involving multiple companies and actors.

Type of product structure: Convergent product structures are present if the final products are assembled from components, as is the case in machine construction or technical installations. Divergent product structures arise in the processing of materials from which several different products are manufactured (combined production). This type of structure is typical for continuous production in the oil, forest and chemical sectors.

Strategic product concepts: Product concepts determine the strategy used to supply goods and services to customers. This involves considerations of how customers' wishes are taken into account in product design and whether variants can reach different customer segments. The more variable strategic product concepts are and the more customers' requirements diverge, the more complicated it becomes to plan and control logistic networks.

Production process characteristics: The requirements for complex logistic systems and ways of delivering combinations of goods and services are influenced by the technological and economic features of the output produced and the type of production involved (Schönsleben 2007: 414–15; see Chapter 2, Section 2.2.3).

Stockpiling level: The level of stockpiling represents the difference between the products' processing time and the delivery deadline granted by the customer. Companies benefit from carrying out a large proportion of their own value creation above the stockpiling level. Production is then carried out in accordance with actual demand. Below the stockpiling level, the production programme has to be planned and implemented using demand forecasts, leading to larger inventories and greater risks.

Number of manufacturing steps: This feature involves the depth of the production structure throughout the entire logistic chain of a company. It characterises the complexity of internal logistics in comparison with the logistics of the entire value chain. Although a single company can simplify its own logistic network by outsourcing processing steps, this does not alter the logistic complexity of the value-creation chain as a whole. Additional interfaces are created, leading to new optimisation problems. In the interest of organising the entire value chain efficiently right down to the final customer, joint logistic solutions have to be developed and all the companies involved must contribute. Reducing the number of manufacturing, transport and handling steps has the advantage that people can be involved more consistently in planning and controlling processes. Company employees better understand the interaction between various sub-processes and the critical connections within the cluster networks in which they operate.

Frequency of repeated orders: This characteristic predicts how often an order for the same product will be made within a given period. Orders represent the initiation of a production process in a logistic system and are placed in most cases as a result of actual customer demand.

Volume of orders and batch size: The volume of the order can be given in terms of quantitative characteristics or value. Batch size refers to the order quantity for a product. A distinction is made between individual ordering, small series and serial or mass orders. However, there are no clear boundaries here: frequencies of repeated orders and batch sizes are often complementary. A series may be produced only once, or single items (not unique pieces) may be produced several times in succession.

Production cycles: Production cycles arise when work processes are carried out several times on the same object to make the final products. Examples are seen in the precision industry, where individual processes are repeated until the required quality is achieved.

Flexibility in relation to capacity utilisation: A company's production capacity relies both on its employees' skills and work performance and on the available machinery, its physical installation and its technology. Qualitatively, flexibility is assessed in relation to whether the available capacities can be used for single or multiple processes. Quantitative flexibility is mainly related to time aspects. Using appropriate work hour schemes – for example, combining overtime with subsequent time off – may improve time flexibility within certain limits. For plants and machinery working at full capacity, flexibility can be achieved by resorting temporarily to overcapacity or to ad hoc arrangements with other companies. The more ways in which operating capacity can be assured, the easier it is to respond to supply and demand variations over time.

Relationships between characteristics: Some characteristics of logistic systems are internally related and influence one another (Schönsleben 2007: 151–2). Important relationships exist, for instance, between type of product structure, organisation of production infrastructure and size of orders or batches.

Convergent product structures tend to occur alongside types of production organisation that are aimed at manufacturing individual items or specialised series. Divergent product structures, by contrast, are seen in mass production, serial production and continuous production. There are links between the characteristics of product concept, production concept and frequency of repeated orders. A product concept matching a customer's specification usually means that parts of the product still have to be developed ('engineering to order'), as in one-off production.

The stockpiling level and production concept are closely related. Various types of production are conceivable here. In the 'making to stock' approach, value creation is below the stockpiling level – that is, the entire production process is carried out on the basis of predicted demand. This is usual for products that are manufactured for everyday use, whose customers are unwilling to accept delays in delivery. The opposite case is 'engineering to order', in which the production process – including product development – responds to a specific demand. Production, frequency of consumer demand and type and batch size of the products manufactured therefore correlate with each other. Products for which there is constant or periodic demand for everyday use can be produced 'to stock' below the stockpiling level. By contrast, products for which there is only one-off demand or that are custom made – particularly capital-intensive investment goods – are usually manufactured to order.

7.1.3 Management of logistic systems

The purpose of logistic management is to design efficient sub-processes and internal and inter-company networks and align them with higher-order entrepreneurial goals. A structured reference model for managing logistic systems (see Figure 7.4) provides an overview of the sub-processes and tasks that logistic management takes into account.

The model can be used for reference purposes and adapted to forestry and the wood industry. It specifies time horizons, type of planning and control processes and tasks to be carried out in logistic networks. The inclusion of information management is important: interconnected databases provide essential information to everyone involved. The tasks and sequences in planning and controlling

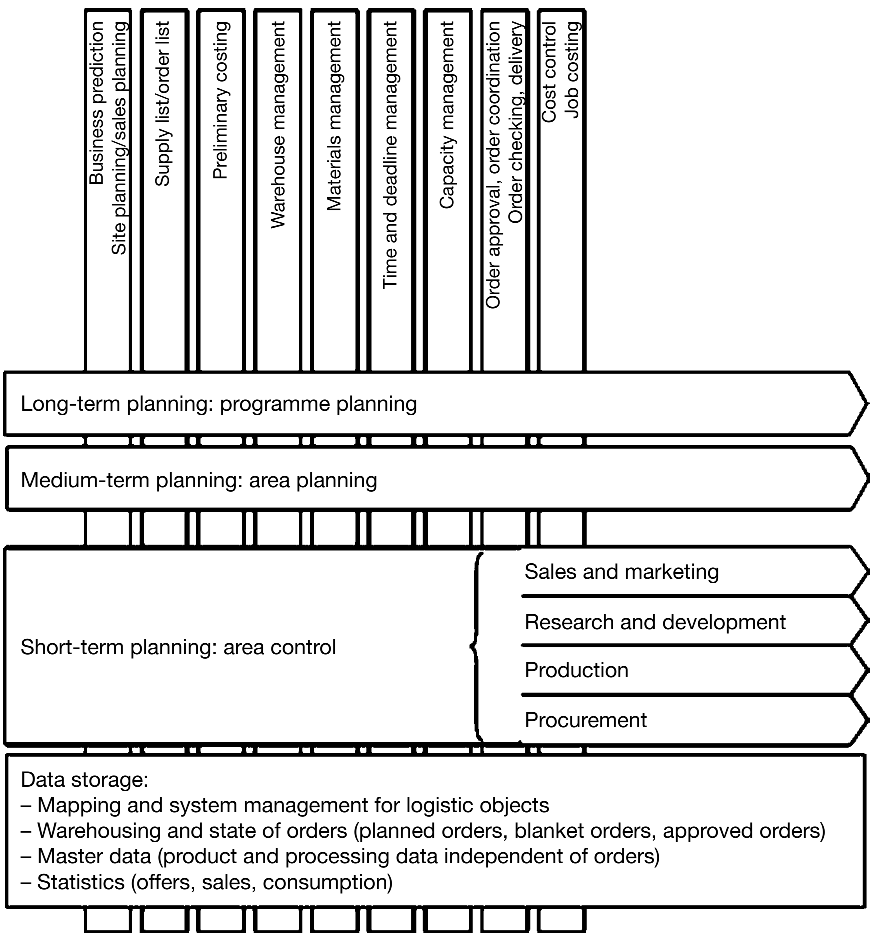


Figure 7.4 Reference model for business processes – planning and control tasks

Source: Schönsleben 2007: 479

logistics are presented as sub-processes whose importance depends on the type of company and the time horizon involved. Procedures and tools, including complex mathematical and statistical methods, have been developed for managing them. The appropriateness of the methods needs to be assessed in each case and matched to the type and scale of logistic management required.

The value of planning processes and the importance of logistics in a company depend on its management approach, its size and the type of its activities (Schönsleben 2007: 47, 215, 226–7). In companies that are primarily managed on the basis of process flows, logistic planning is more important than in companies that have a largely functional organisation. The classification into long-term programme planning, medium-term area planning and short-term area control shows that planning and control tasks are weighted differently relative to the time horizon. The degree of detail and the organisational range involved differ at the three process levels. In *long-term programme planning*, consumers' total demand for products is estimated and used to calculate the resources needed to meet the demand. The aim of long-term planning is to establish the cornerstone values for the logistic system. In *medium-term area planning*, demand is placed in an operational perspective relative to individual products (see Figure 7.5). This is important for a company that must meet temporal fluctuations in demand. Estimated demand and availability have to be compared with each other.

Specific work orders are handled using *short-term area control* covering the time period in which individual production processes physically take place. During this part of logistic management, information is collected and fed into data systems, making it possible to check operating processes and the company's results. The information analysed in turn forms the basis for updating short- and medium-term planning.

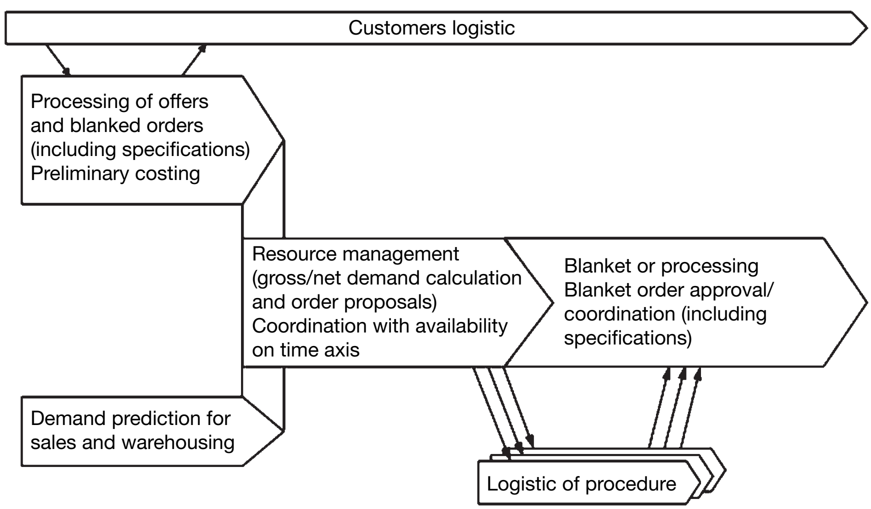


Figure 7.5 Medium-term planning and control: area planning

Source: adapted from Schönsleben 2007: 230

Demand forecasting: Information regarding future demand from customers provides the basis for planning a production programme (Schönsleben 2007: 10, 228, 245, 480). The aim of demand forecasting, at the strategic and operational levels, is to quantify current and potential demand at the least possible cost. The forecast determines the required strategic and operational capacities, particularly for inventory and sales planning. Data from completed orders and current and foreseeable orders or offers are used to determine demand. The validity of the forecast of course depends on the quality of the information. When demand is constant, future demand can be estimated using moving averages. As long as there are direct connections between product demand and other measurable variables, regression models can be used to make estimates. Other options include empirical surveys of current and potential customers, test purchasing and analysis of expert opinions. Trend extrapolation as a prognostic method needs to be used with caution.

Offer and order processing: This involves registering offers and orders based on the type and quantity of goods and services and the distribution of the demand over time. In long- and medium-term planning there is usually no definitive information on quantities, qualities and deadlines. Planning resource use therefore needs to take into account that only some offers will be successful. The precise quantities and deadlines for blanket orders are often not specified. Uncertainties in coordinating demand and capacity are a given, and possible bottlenecks need to be identified at an early stage.

Preliminary costing: Preliminary costing is carried out at the strategic level for the company as a whole and at the operational level for individual orders. The probable direct costs and contribution margins associated with producing specific outputs are calculated. Costing provides the basis for deciding whether to accept orders, setting production targets and establishing controlling procedures. Preliminary costing can be done with standard products calculation, since the business information system usually has the required data. With products that are produced only once or orders that are not adequately reflected in the information system, costing is more difficult. The challenge is obtaining accurate, reliable information in time – and in a suitable form.

Order clearance: The trigger for implementing logistic planning is given by order clearance, which starts the actual production or delivery process. If orders are processed simultaneously rather than sequentially, the sub-processes have to be coordinated in the logistic network. Quality control measures required for production and delivery processes must be efficiently integrated into the logistic system.

Cost control and order calculation: Costing that follows the processing of orders is best carried out using the same classification as in preliminary costing. This helps managers draw conclusions regarding the accuracy of the targets set during the preliminary work phase. A cost variance analysis reveals where, to what extent and why the targets have been reached, exceeded or undercut. The closer cost controlling is done to order processing, the faster the logistic control system will be able to respond.

Warehousing and materials management: Warehouse management is needed to balance supply and demand for objects over time in a logistic system. Although one goal in logistics is to have little or no stock in inventory, this is not always possible with all types of production processes. In addition to balancing the supply and demand for objects over time, there are other reasons for holding inventory (Weber and Kummer 1998: 53):

– It makes it possible to reduce risks such as unpredictable supply breakdowns (stock security function).
– Price fluctuations can be compensated for or taken advantage of (speculation function).
– Price advantages for large quantities can be exploited during procurement (cost-reduction function).
– Sorting processes for materials or material flows are necessary during production for technical reasons (sorting function).

The benefits and costs have to be weighed in each case to decide on the type and level of warehousing. Benefits consist of avoiding shortfalls if products are not available in the right quality and quantity at the right time. Shortfalls lead to interrupted production, low capacity utilisation, loss of turnover due to reduced delivery quantities, poor delivery services and fewer market opportunities. The result may be a general reduction in revenue and operating performance, and even penalties for non-performance of contract. Additional costs may arise from rebuilding inventory, shrinkage and loss of value of the stored products. On the other hand, there are substantial operating costs for handling – placing items in storage, moving them, taking them out of the warehouse – as well as for administration, planning, supervision and insurance.

Models and methods are available to help optimise warehouse management (Schönsleben 2007: 237–8, 531–2). Uncertainties regarding the timing of supply and demand for objects can be incorporated into these using stochastic models. In addition to determining the optimal level of stock on hand, they can identify procedures for replacing stock over time.

Materials management: The purpose of materials management is to coordinate the flow of materials needed for operating output (Günther and Tempelmeier 2005: 178–9). This includes determining the timing and quantity of raw materials and intermediate products required to produce the final product and determining the optimal batch size. Important target and control variables are time from receipt of order to dispatch, procurement deadline and procurement time. Coordinating demand depends on the product structure and product concept. Uncertainties in customer demand in particular lead to stocks below the optimal stockpiling level. Raw materials and intermediate products required for output provision should be procured just before they are needed or used, according to the principle of process flows, which seeks to avoid intermediate storage. Some materials or intermediate products are required multiple times, at different points in time. Combining these quantities into larger batches reduces costs per unit, through scale effects.

Time management: Short delivery times and compliance with delivery deadlines are important for quality of service and strengthens a company's competitive position. Setting deadlines and dates is an important task in medium- and long-term logistic planning and control (Schönsleben 2007: 236, 626–7). As in materials management, the target is the time from receipt of order to dispatch, which comprises the time required for each working process, waiting time between working processes and administration time. In typical workshop production, for example, waiting times represent more than 80 per cent of the time from receipt of order to dispatch. Reducing this proportion is a goal for time management.

Scheduling the sequential phases of output requires making decisions about feasibility, capacity utilisation and reserve capacities. Schedule management is a matter for the individuals involved in issuing and carrying out orders. Deadlines can be set on the basis of the starting point for production – that is, forward scheduling – or based on the delivery deadline. To coordinate sub-processes in complex production sequences, the network planning technique can be used (Schönsleben 2007: 657–8).

Capacity management: Production capacity must be adequate to meet the demand for products in the time (delivery deadline) and quantity (demand) expected by the customer. To keep the costs of production capacity low relative to turnover, capacity has to be utilised as fully as possible. At fixed capacities, fluctuation in demand over time will mean not meeting the total customer demand or not fully utilising capacity. The focus of capacity management is therefore on planning capacity requirements and adapting production capacity to changes in production and customer demand (Schönsleben 2007: 191, 236, 271–2). If products have contrary demand cycles, the available capacity can be used to make several different products alternately.

Overall, logistic planning and control are part of a company's general management system: they cannot be carried out in isolation only for specific subordinate areas. Feedback processes link logistics to other areas of business management – goal setting and strategy development, financial planning, investment planning and personnel planning.

Improving the logistic interfaces within and between companies is a promising way of creating value (Hartmann 2002; Thaler 2007). The more the value-creation chain is fragmented – for instance, by establishing profit centres or by outsourcing production steps to specialised companies – the greater the potential offered by interface optimisation (Schönsleben 2007: 95–6).

If short-term collaboration is required, virtual organisations can be formed (Schönsleben 2007: 95–6, 111). This may be the case, for example, when customers' unique requirements cannot be met by a single company but do not justify establishing a new entity. *Virtual* in this context means an ad hoc project organisation that does not necessarily have a legally established form. Virtual organisations are flexible and can be formed quickly and then quickly dissolved. The prerequisites for this type of temporary collaboration among partners – such as good communications, facilities for exchanging information and trust – usually need to exist in advance.

Choosing partners for formally structured cooperation is a decision of strategic importance. The choice depends on what contributions the partners can make to shortening processing times and lowering overall costs. However, reducing the numbers of suppliers or customers may create increasing dependency among the companies involved. Moreover, the partners have access to internal conditions of the other participants, which may have to reveal their production costs, price expectations, capacity, staffing and financing. Potential misuse of such information exposes the partners to risks of information insecurity and legal issues, such as anti-trust regulations. A long-term and stable foundation of trust is necessary for successful collaboration.

Logistics and supply chain management are interdependent pillars of the overall business strategy followed by a company. *Supply chain management* characterises strategies aimed at optimising value-added networks through intensive collaboration among suppliers, producers and customers. A more process- and goal-oriented definition is 'the management of upstream and downstream relationships with suppliers and customers in order to deliver superior customer value at less cost to the supply chain as a whole' (Christopher 2011: 3). A simplified model of the supply chain shows suppliers delivering raw materials, energy and information at various stages of production on the one side, and distribution centres and regional or client-specific sales points for marketing of goods and services on the other side. Complex supply chain links generally lead to complex logistic networks and activities.

A comprehensive approach to logistics and supply chain management offers competitive advantages in making intra- and inter-company collaboration more efficient and profitable. The following aspects may be noted:

- *Quality*: Ensuring the quality of the final product is not the sole responsibility of the last link in the value chain. The companies involved in previous processing stages also need to be committed to product quality and involved in the development of quality standards.
- *Costs*: A smaller number of suppliers makes larger sourcing volumes possible. Intensive and long-term collaboration with suppliers may lower purchasing prices and reduce inventory levels.
- *Logistics*: Better integration of companies' logistic systems facilitates more coherent process planning and better control systems throughout the value chain. Operating processes and their connections can be standardised within the supply chain.
- *Innovation*: Product and process innovations and changes in the organisation of value chains can be conceived and initiated jointly by the companies involved in a given supply chain. When innovations have been implemented, all members of the value-creation chain participate and benefit.

7.1.4 Logistic management in forestry

Specialisation generates more subdivided value-added chains, greater opportunities for diversified supply chains and consequently more complex logistic networks. It creates new interfaces in the production and distribution of goods and services and requires better coordination among business units and companies. For example, when production steps are separated from each other geographically, different modules of intermediate products are manufactured and suppliers in various locations become involved. Raw materials may come from different sources, then be combined in several stages to intermediate products, transported to final manufacturers and ultimately delivered to customers in large and increasingly global sales markets.

In multifunctional forest management, which combines wood production, nonwood forest products and provision of environmental and social services, forest management activities are organised in the form of building-site production – that is, a particular forest stand or area to be planted with forest trees. Wood quantities, log quality, specific wood assortments and batch sizes depend on the extension and quality of the forest site conditions, the harvested tree species, the length of rotation and the age and dimensions of the trees. With many standard products – roundwood for sawmilling and plywood production, wood for particle board production, wood for pulp and paper production, wood for heating and power generation – large quantities can be produced and marketed. By contrast, high-quality wood assortments at veneer quality are best described as individual products.

Management of protection and recreational forests requires measures designed for specific locations and forest stands and thus can be considered one-off production. Other examples of one-off production in the forest sector are services for maintaining biodiversity, nature protection sites and landscape conservation. In each case, site-specific approaches to protection and tending are developed and then implemented.

Divergent product structures predominate in the wood industry, involving production processes that can be described as line production or continuous production. There is a wide range of order and batch sizes, from single-item to mass production. A typical example is the processing of roundwood in many small and medium-sized sawmills, where final products and by-products are made from various roundwood assortments. Chips, slabs and sawdust are used for own energy requirements or supplied to other industrial companies or private consumers. Diversified production structures are found in many areas of the wood industry, such as furniture and construction. At the level of semi-finished products, for example, divergent product structures may predominate, but the manufacturing structures for the final products may be convergent.

No single approach can meet the varied logistic requirements in forestry and the wood-processing industry. Overall, changes in production conditions and market structures are continually increasing the complexity of logistic and supply chain networks. A combination of horizontal and vertical dependencies, cross-linkages between value chains and dynamic business activities of individual agents gives rise to multidimensional value creation between material and energy wood uses.

Figure 7.6 shows links within the value-chain model presented in Chapter 2, Section 2.1.3, illustrating the flows of materials and energy use that arise between roundwood and processed forest products and actual or potential use as bioenergy.

Typical combined production arises from roundwood and its further processing, which yield several products even though there is only one primary production goal. Combined production may run in parallel over several steps and sometimes leads to competitive and mutually exclusive raw material demands. For example, the production of saw logs from a single tree is usually combined with the production of small wood dimensions for pulp wood, firewood or industrial energy. Such products, particularly from coniferous species, may become particle board or the raw material for paper and paperboard. The price and cost relations of the competitive uses are the deciding factor. Efficient, cost-effective logistics can optimise the economic benefits from wood resources and help managers compare alternative production options and marketing opportunities.

The energy component comprises wood harvested in the forest (firewood, green wood chips, pellets and bark), by-products of sawmills and the wood-working industry, lignin from pulp mills and by-products of the manufacture of paper and paperboard. Energy wood also comes from recycled wooden household products. Cross-linkages that arise, for instance, in the separate sawnwood and bioenergy value chains highlight the complexity of optimising logistics, involving technological and commercial considerations in organising a supply chain of the raw material or semi-finished product (e.g. in drying, cutting to dimensions and

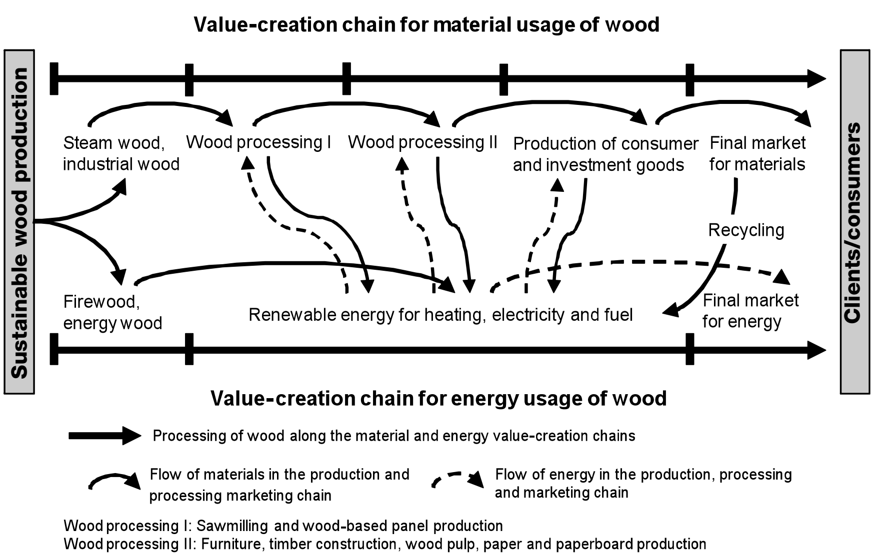


Figure 7.6 Value-chain networks in the wood-based sector

finger-jointing). The contribution of the wood-based sector to energy supply must be analysed along the whole procurement, production and consumption process.

The following starting points can help improve collaboration among the actors engaged in value-creation processes and promote international, regional or local supply chain and logistic networks:

- improving information flows between participating or concerned agents;
- optimising the flow of materials and services within value chains and networks through the formation of clusters;
- streamlining financial flows and balancing costs and benefits for delivering marketable and nonmarketable goods and services; and
- using incentives to motivate actors to participate in value chains, both within the sector and in local, regional and national production and services networks.

Technological conditions and communication facilities fostering value chains and networks have received considerable attention, but motivational research has so far produced few findings that actually support implementation. In fact, many potential agents do not participate in developing or improving value chains because they do not expect that their share in the success of the collaboration will be commensurate with their contributions (e.g. in reducing overall processing costs). The material improvements and economic success of value-creation processes are mainly felt by those agents that have a strong position in the value chain.

Integrating the wood value-added chain: Wood-based value-creation networks arise ad hoc for undertaking a specific job such as forming a consortium to win a large construction contract. Or they are established for structural and technological reasons as in producing sawnwood, wood-based panels and furniture. In both cases, there are operational and marketing reasons for collaboration between several agents or economic branches. For instance, a company that builds wooden houses may make a tender in collaboration with an architect and a structural engineer. There are also strategic goals and technological reasons – such as joint supply of products and services – and innovations combining new technologies and materials. Collaboration may be organised horizontally, with several companies cooperating at the same level of the value chain – for instance, a common joinery centre for several carpentry shops. Or collaboration may be vertically organised by increasing the depth and breadth of the range of products supplied in combining timber harvesting and transport companies cooperating with the wood trade and the paper industry.

Value creation is less integrated via logistics in Central Europe than in Scandinavia and North America. In particular, the commercial and operational relationships between forest owners and companies in the wood-processing industry are somewhat traditional. Arrangements for planning harvest quantities, quality assortments and delivery cycles often take place with little consideration of the subsequent stages in the value-creation process. Raw wood may be put on the market in accordance with the push principle – that is, in a supply-oriented way. However, the situation is changing fast. Flow-oriented management for wood is becoming more sophisticated thanks to better collaboration between forestland holding cooperatives and wood-processing companies that are vertically integrated and operate internationally. Customer-specific grading rules using computerised harvesting equipment, combined with JIT delivery programmes, have become standard. Modern control engineering for automated grading of timber assortments in sawmilling is increasingly used.

Information for logistic partners – particularly about assortments that are in demand and short- and medium-term use potentials – is needed to integrate the steps in value creation. Forest managers need sound forecasts of the demand for raw materials from their most important roundwood purchasers – the sawmilling and plywood industry, chipboard and fibreboard companies and pulp and paper producers. Prompt feedback regarding completed orders allows for updating raw materials and demand data. Another aspect in optimising the interface between forestry and the wood industry is prompt transport of wood assortments. A case study of a traditionally operating company showed that only approximately 15 per cent of the time from felling, roundwood transport, wood processing and sale of joinery products consisted of actual processing time (Heinimann 1999: 26). Information and communications technology would have helped this company's managers shorten the interval between wood harvesting and delivery to customers.

Road cable systems, high-performing harvesting equipment and sophisticated information technology require considerable investment, which in turn means sufficiently large volumes of business. The challenge is to organise integrated logistic networks on an inter-company and inter-ownership basis. One innovation is creating electronic platforms for exchanging information on roundwood offers, processing demand and transport capacity. These platforms act as exchange markets for raw materials, providing information about price and delivery conditions and enabling suppliers and customers to negotiate. The aim is to cut the high transaction costs at the interfaces between wood harvesting, transport logistics and wood processing. Customers' demands can be directly included in use and management planning within a previously defined regional radius, leading to a time-optimised value-creation process.

Supply demands from potential buyers – quantity, tree species, log quality and time of delivery – can be stored in a database and compared with demands from other customers. The information can then be communicated to the most favourable felling site for a specific order and the subsequent finishing steps can be calculated. Factors such as harvesting bottlenecks, roundwood transport capacity and the availability of drying kilns at the sawmill site are part of the calculations. Unnecessary waiting and storage times are avoided, risks are reduced and cultivation strategies optimised. The Global Positioning System (GPS) and Geographic Information Systems (GIS) increase the quality of forestry planning and provide better orientation for nonlocal participants. This is an important consideration against the background of ever-expanding working radiuses for harvesting machines and wood transporters.

Logistics of roundwood procurement from small-scale forest owners: Integration of the forestry value-added chain through improved logistic management is a particular challenge in European countries, where small and medium-sized forest holdings prevail. Modern industry's concentrated demand for large amounts of roundwood contrasts with the fragmented and decentralised supply from numerous forest owners, complicating the interface between forestry and wood processing. Integrated logistic networks on an inter-company and inter-ownership basis would improve roundwood procurement logistics from small-scale forest owners.

A pilot project undertaken in Germany developed practical measures for improving logistics at the interface between wood harvesting and processing in small forest ownership structures (Kaiser 2002). The project dealt with a typical case in which a large number of private suppliers with comparatively small quantities were supplying a customer that required a continuous, large flow of roundwood. The customer had an automated inventory management system that produced large quantities of particle board, medium-density fibreboard and oriented-structural board. The most difficult problem was not how to mobilise quantities of wood but rather how to motivate the forest owners to supply it; in other words, it was foremost a problem of communication, instruction, practical training and organisation.

The pilot project's primary goal was to increase value creation in the production chain by avoiding unnecessary costs during primary conversion, sorting, sales and transport to the factory. This required establishing new procedures, increasing the offer of roundwood, rationalising harvesting techniques, creating new reception and stocking measures at the mill site and overall developing new abilities in personal communication, business negotiation, data processing and regular information exchange. Several years of intensive discussions between forest owners and company representatives, testing of new proposed solutions and external professional tutoring followed.

Now, stockpiling of roundwood and finished products is organised and controlled by a sophisticated electronic system that registers every item as it enters and leaves the warehouse. Entry is recorded using incoming inspection measurements. Arriving trucks pass through a special gate that records the loading weight or transported volume of wood. By constantly comparing inventory in the raw materials warehouse and stores, production speed and the stock of finished goods, the system calculates optimal ordering volumes, delivery quantities and ordering times.

Orders are sent online and semi-automatically to an Internet platform jointly run by the forest owners. It stores a wood crop database for interested sellers and specific regional units. The database compares orders received from wood customers with upcoming or possible uses and either accepts or rejects each order. If it is accepted, the required felling is planned such that the harvesting equipment and transportation are optimally timed and can be carried out with as little transport damage and storage processing as possible. The basis for planning is provided by GIS mapping. The precise felling sites can be visualised geographically at any time.

Drivers of skidders, harvesters and trucks no longer require detailed local knowledge, since they are guided to the logging site by GPS. The journeys are planned such that vehicles never meet on the narrow forest roads; elaborate turning manoeuvres are avoided. The harvesters automatically calculate the precise length and diameter of the processed wood. The GIS–GPS system makes it possible to assign each individual trunk section processed to a specific forest plot or forest owner. In difficult cases, the driver can confirm or correct the data. Any quality information required or cutting needed can be arranged for by the driver. The data provided by the measuring equipment on the head of the harvester are so precise that they are used to calculate remuneration and payment for wood harvesting and transport.

Each forest owner receives payment at the agreed price in accordance with the amount and quality of wood delivered from his or her own plot, based on information collected by the harvester. To allow speedy handling and minimise time between the flow of goods and payment, another database contains the names of the forest owners, their bank details and plot numbers. The size of the area is recorded to allow automated plausibility testing. If the forest stands are not homogeneous, the harvester calculates additional quantities and qualities of those wood assortments that are not used by the particular client. These are automatically registered by the harvester and transported to central storage sites with good transport links to the eventual customers.

The project has been developed in difficult conditions in a forest area with small-scale forest ownership (Schulz and Kaiser 2002). Approximately two-thirds of the forest owners were previously not involved in selling wood and a substantial proportion of the area consisted of sites with difficult access for forest machines. By using a professionally planned and implemented communications approach, it was possible to contact approximately 90 per cent of the landowners, representing 95 per cent of the forest area involved. On the basis of forecast revenues, around two-thirds of the owners agreed to participate in the project. Using GPS, haulage companies from northern Germany and harvester drivers from Finland were able to find their way in forests previously unfamiliar to them and to assign the wood correctly to individual forest owners.

An average of 1.6 days passed between felling and processing, and less than eight days until the forest owners received payment. Thus the overall through-time in the wood chain fell by two-thirds, from approximately 21 days. As a check on the electronic data from the harvester, the stands to be felled were callipered electronically; discrepancies were so small that measurements made by the harvesting machine were found adequate for purposes of remuneration and sales. A database-supported prognosis for the wood crop has been developed that can be used online by the participating forest owners. With this component, the element of pricing is incorporated into the overall supply and demand system as a dynamic factor.

The improved logistics of this harvesting, transport and delivery system amounts to an interactive, Internet wood exchange market. The system can be initiated and controlled by both clients (wood industry) and suppliers (forest owners). It makes the market more efficient and adds value in roundwood processing and utilisation. When major storm damage occurs, well-coordinated and efficient logistic systems of this type can contribute even more to logging operations and roundwood sales.

7.2 Determining production capacities

7.2.1 Cost drivers and cost dimensions

Companies are constantly faced with the question of whether to produce goods and services internally or to contract with third parties. 'Make or buy' is not just a well-known saying but a central issue that has to be resolved repeatedly in specific cases. Make or buy decisions are important in efforts to achieve operational flexibility. The extent to which external services can be used economically depends on technology and production installations, internal know-how and experience and staffing. A decision in favour of purchasing from third parties is taken when the operating costs for doing the work oneself is higher and cannot be reduced to the same (or lower) level through rationalisation measures. Managers determine the proportion of fixed overheads involved in doing the work internally that would not be reduced by outsourcing. Entrepreneurial decisions have to be deduced from and justified by economic calculations.

Managers responsible for cost centres need to know how costs arise, what factors influence them and whether they can be reduced. Cost determinants that are caused by the business area in which the decision has to be taken and the factors that can be influenced by decision makers are separate issues (Thommen and Achleitner 2006: 456–7). The factors that usually cannot be influenced at all or only to a limited extent include market prices for wages and interest rates, purchasing prices for machines, vehicles and materials and the technical properties of machinery and plant.

By contrast, the factors that determine the extent of production as a variable can be defined by the company. They mainly involve decisions affecting the short term and medium term:

Activity:	Quantity produced
	Distribution of production
	Depth of processing
	Utilisation time
	Production programme
	Size of workforce (medium- and long-term)
Order sizes:	Number of set-up procedures
	Set-up sequence
Planning time sequence:	Assignment of orders to machines
	Sequence of orders
	Waiting and delay times
Time distribution of production:	Quantities of finished products stocked
	Quantities of semi-finished products stocked

The procedures used in managerial accounting are not sufficient to allow cost aggregation to be calculated in relation to price, consumption and employment variations. Necessary procedures include standard cost accounting as a system of full costing, or direct costing as a system of partial costing. Fluctuations in business activities affect the type and level of cost developments. This is closely connected with production capacities, which depend, for instance, on the production technology used, the staffing pattern of the company, the available machinery and equipment, the physical business infrastructure, such as buildings and land, and financial means. Capacity considerations refer to the actual and potential capability of a company to deliver goods and services, in both quantitative and qualitative terms.

The following aspects of quantitative capacity may be distinguished:

- The technical and economic maximum capacity that should not or cannot be exceeded, for technical reasons.
- The technical and economic minimum capacity below which production should not or cannot fall, if the production procedure has a minimum capacity.
- The economic, or optimum, capacity, which lies between the maximum and the minimum. The factor consumption evaluated for a specific amount of output per time unit is smallest here.

The relationship between available capacity and effective utilisation is known as the level of capacity utilisation. Utilisation is usually measured as a ratio between actual and potential production. Potential production is the utilisation level that can be maintained for a prolonged period of time while taking all other factors into account.

Cost dimensions: The total for the evaluated factor consumption for producing an output quantity of q during a specific period represents total costs C. Taking variable costs (VC) and fixed costs (FC) into account, this gives:

- total variable costs: VC = quantity of factors used x factor price = $q \cdot p$
- total fixed costs: FC
- total costs: C = VC + FC

Total costs may involve the costs for an entire company or for a specific cost type, cost centre or product.

If total costs C refer to a unit of output x, this gives a cost per unit (= unit costs) of c. As with the overall costs, this can be subdivided, as follows:

Average variable costs:

$$vc = \frac{VC}{q}$$

Average fixed costs:

$$fc = \frac{FC}{q}$$

Average costs (=unit costs):

$$c = \frac{C}{q}$$

Or, with constant average variable costs vc.

Total costs:

$$C = FC + vc \bullet q$$

The costs arising from the production of an additional unit are known as marginal costs MC. Increasing the production quantity by Δq causes an increase in costs of ΔC. To calculate MC, the corresponding cost differences are divided by the differences in quantity. With a proportional cost development pattern, the marginal costs MC are identical with the average variable costs vc:

Marginal costs:

$$MC = \frac{\Delta C}{\Delta q}$$

7.2.2 Simple cost function with linear costs

With any kind of production, fixed costs FC at a certain level arise. For each unit produced, additional variable costs VC accrue. This gives the total costs C. Once a company knows its cost function, it has to decide what quantity needs to be produced to achieve its performance goals, such as profit or return on investment. To do this, it has to have information about revenue as the product of quantity q sold at unit price p. The intersection between the revenue line and the total cost line indicates the break-even point (see Figure 7.7). It is the point at which total costs are equal to total revenues from sales and no profit or loss has been made. Break-even analysis calculates the sales volume in units, using the unit selling price that is required to cover fixed and variable costs. With one additional unit sold, the profit line is reached; with one unit less, a loss occurs.

In unit costs, the average fixed costs fc decline with increasing production quantities; they approach a value of zero asymptotically (see Figure 7.8). This means that the total fixed costs FC are distributed over more and more products. With a linear cost behaviour pattern, the average variable costs vc are the same for any quantity produced. They correspond to the marginal costs MC.

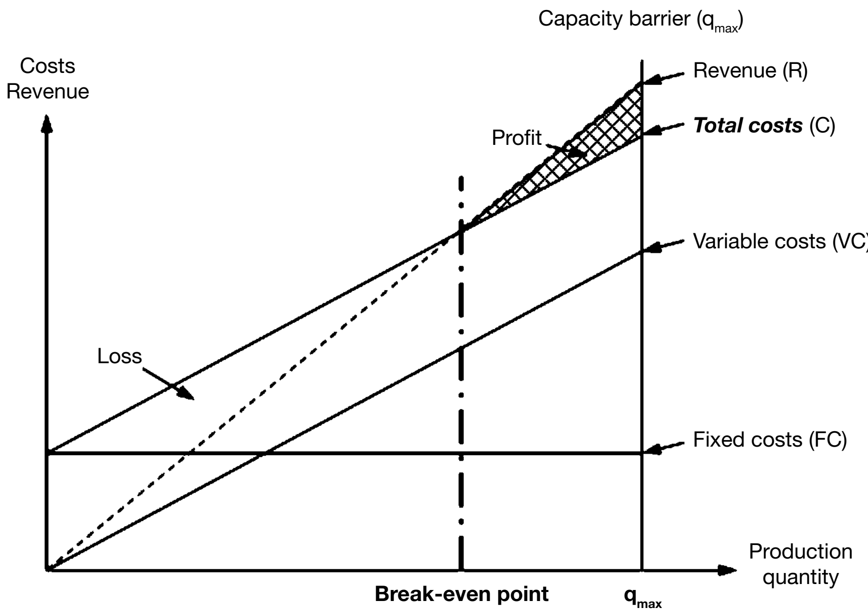


Figure 7.7 Break-even point with linear cost and revenue process: total cost view

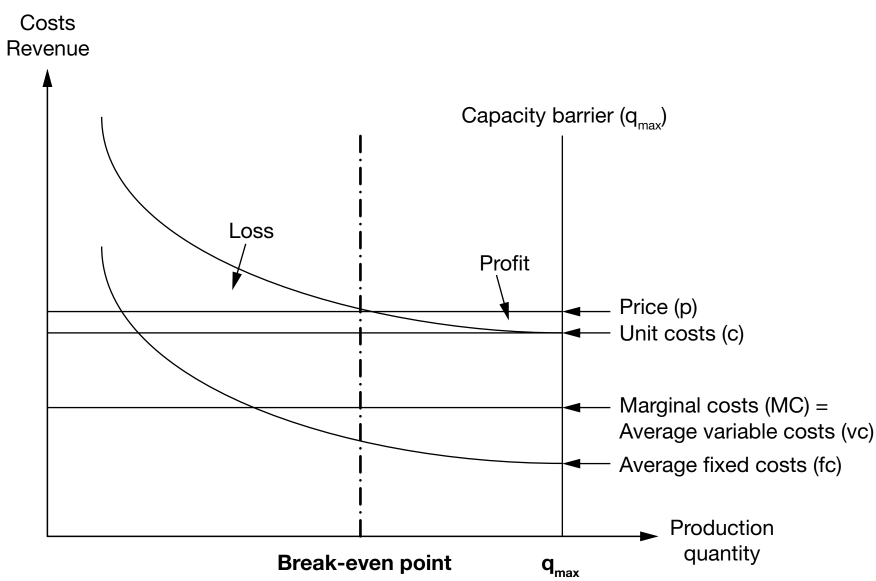


Figure 7.8 Break-even point with linear cost and revenue function: unit costs

The higher the production level is above the break-even point, the larger the absolute profit achieved. The maximum profit point in this case arises at the capacity barrier q_{max} for the company, business area or production process.

7.2.3 Type A production function

The output achieved is the result of a combination of various factors of production that are entered into the productive system as input. Production theory investigates the functional relationships between the quantitative input of production factors and the corresponding output; the purpose is to identify inherent rules and present them as models.

The type A production function is based on the law of diminishing marginal returns. This is well demonstrated in the field of agriculture, according to which increasing input of production factors initially leads to growing increases in yield, which decline after a maximum level has been reached (see Figure 7.9). The type A production function applies to contexts involving substitutional production factors. *Substitutional* here means that the production factors used in producing a specific output are interchangeable and thus do not have a fixed relationship to each other. Human labour in industrial production, for example, is a substitutional production factor because it can be replaced to a smaller or larger extent by energy and machinery.

The functional relationships between the input of production factors (input of resources r_1, r_2, [.] r_n) and the output (production quantity x) can be shown as follows:

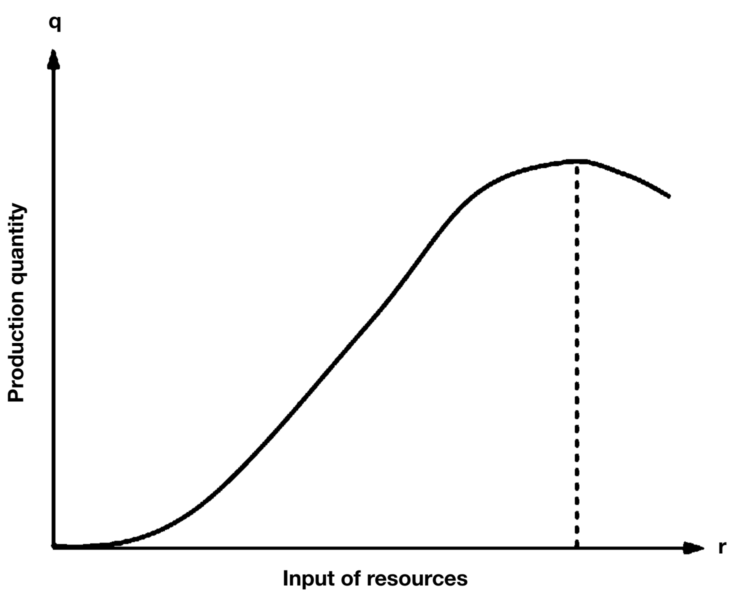


Figure 7.9 Yield curve for type A production function

(1) $q = f(r_1, r_2, [.] r_n)$

If the input of resources r_1, r_2, [.] r_n are given the values of their factor prices p_1, p_2, [.] p_n, which are assumed to be constant, the result is a function that describes the production quantity relative to the costs.

(2) $q = f(r_1p_1, r_2p_2, [.] r_np_n)$

This production function is based on the following assumptions (Thommen and Achleitner 2006: 391–2):

– A constant production factor and a variable production factor are combined in a way that the production quantity can be increased solely by increasing unit quantities of the variable factor.
– The variable production factor is completely homogeneous – that is, all units are of completely equal quality and interchangeable.
– The variable production factor is arbitrarily divisible.
– The production technique is constant.
– Only one type of product is produced.

To simplify this, it can be assumed that there are only two inputs of resources – r_1 and r_2. The production function is then:

(3) $q = f(r_1, r_2)$

The production function with two inputs of resources r_1 and r_2 can be illustrated in a three-dimensional coordinate system (see Figure 7.10). The two inputs r_1 and r_2 are represented by quantities 0A and 0B. The yield from the interaction between the inputs of resources r_1 and r_2 is the production quantity q entered on the y axis.

Each point on the base area 0ACB represents a meaningful combination of production factors with which a specific production quantity q can be produced. However, complete substitution of r_1 by r_2 must not occur, since it would imply a transition to a different production procedure. The resulting production quantities on the base area 0ABC show a curved yield surface, known as the yield paraboloid.

Among the possible combinations, several give the same production quantity. When these combinations are linked, the resulting line represents the indifference curve (the upper edge of the vertical cut surface in Figure 7.10). As the term implies, all the combinations linked by this line behave indifferently with regard to production quantity.

A vertical section through the yield paraboloid at point B parallel to the r_1 axis gives an intersection curve that shows all production quantities for an increasing input of resources of r_1 with a constant r_2 = 0B.

(4) $q = f(r_1, r_2)$ with r_2 = constant

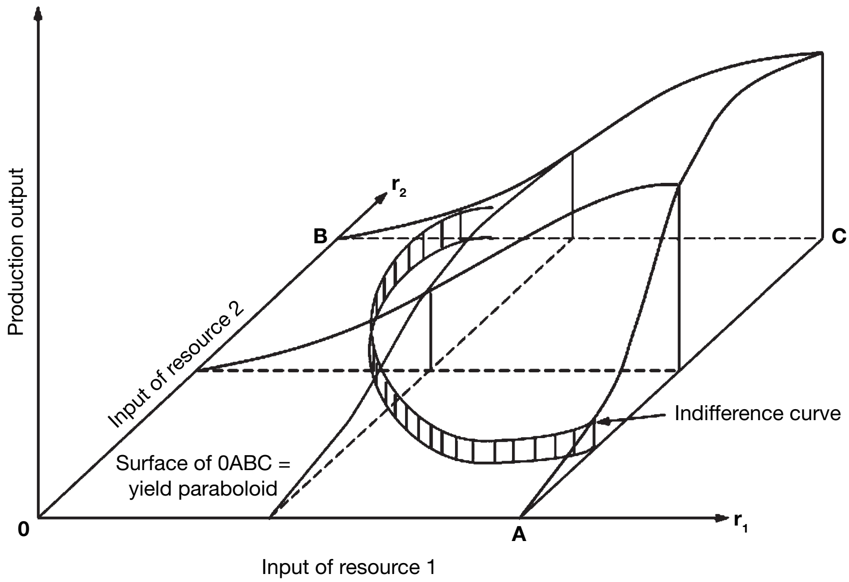


Figure 7.10 Yield paraboloid and indifference curve for type A production function

This intersection curve is identical to the yield curve or production quantity for the type A production function shown in Figure 7.9.

7.2.4 Type A cost function

Determining the costs of output provision requires switching from a quantity-oriented viewpoint to a cost-oriented one. The inverse function of the production function with two inputs of resources given in equation (3) above is formed. This is the total cost function C = f (x), which describes costs relative to the production quantity. In the graph, the yield curve is reflected at the angle bisector, and the axes are switched. The result is the type A cost function (see Figure 7.11).

(5) $r_1 = f^{-1}(q)$

To obtain the cost curves from the cost function, input of resources r multiplied with factor prices p are used in the formula C = VC + FC for the variable costs VC.

(6) $VC = r_1 \cdot p_1$; with r_1 from equation (5), $VC = p_1\ (f^{-1}(q)$

The variable costs VC increase with increasing production quantities, as in the linear cost behaviour pattern. In the type A production or cost function, however, increases are not constant. In a further step, the fixed costs are added to the variable costs to obtain the overall cost curve.

(7) $C = p_1\ (f^{-1}(q) + FC$

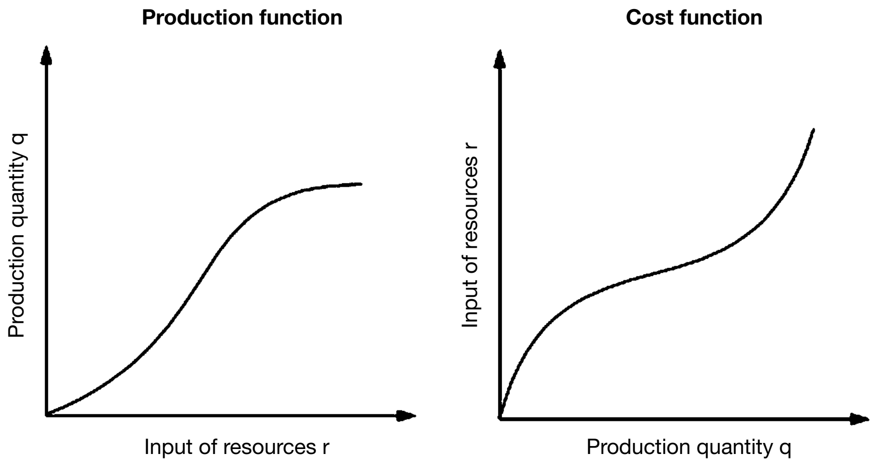


Figure 7.11 Type A production and cost functions

Assuming constant revenues, the overlapping of the cost curves with the revenue lines, in contrast to a proportional cost behaviour pattern, produces not just a break-even point beyond which profits are achieved but a profit zone, which is marked by the break-even point and the profit limit (see Figure 7.12).

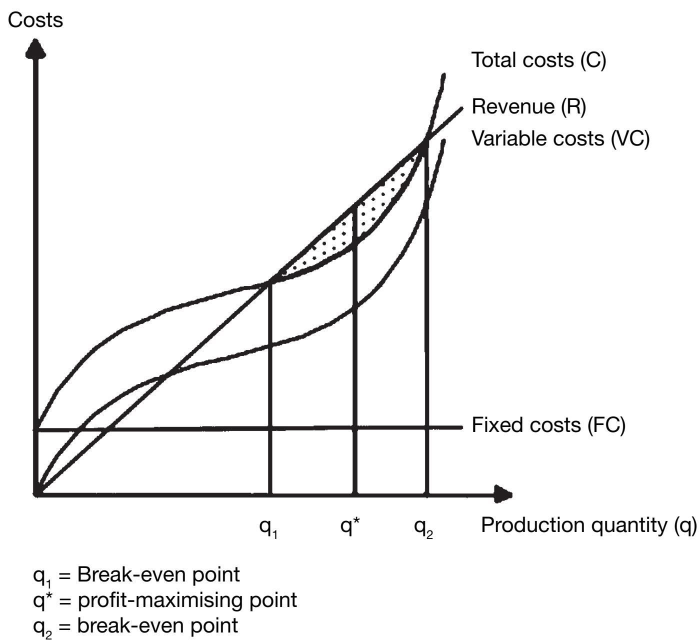


Figure 7.12 Cost and yield curves for type A cost functions: total cost view

From the unit costs point of view, various cost curves can be deduced that are important for the company's decision making.

- The course of the average fixed costs fc is the same as in the proportional cost behaviour pattern. Fixed costs decline with increasing production quantities.
- The first derivation from the overall cost curve C produces the marginal cost curve MC. This transects the curves for unit costs c and variable unit costs vc at their minimum levels.
- Average variable costs vc are no longer equal to the marginal costs MC. They are initially higher, then lower.
- Average unit costs c initially decline with increasing production, and then they increase again.

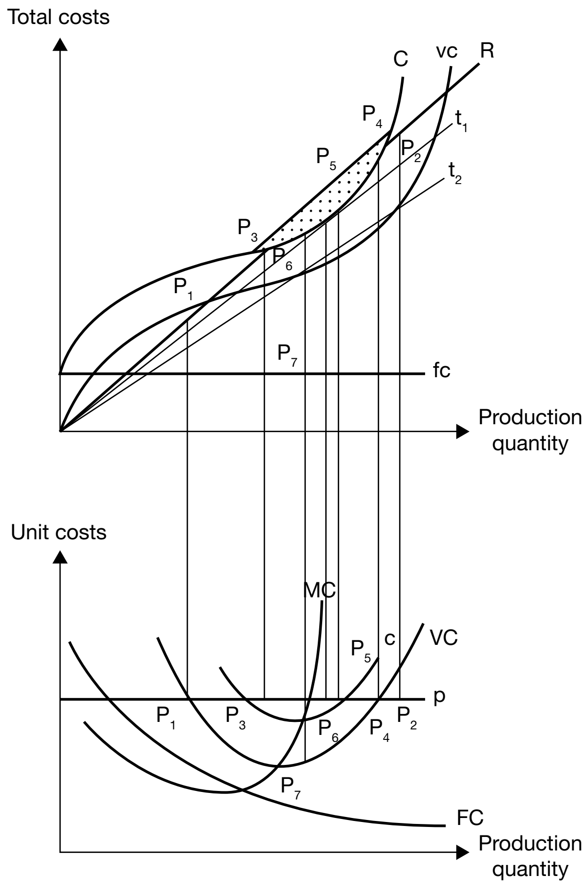
With a constant unit price of p that is equal to the marginal revenue and average price, critical cost points P_1 to P_7 can be calculated (see Figure 7.13):

- The P_1 operating minimum and P_2 operating maximum show the limits that must not be undercut or exceeded. Otherwise, fixed costs would not be covered and variable costs would be covered only partially. If P_1 is not reached in the longer term, the company's operating activities will be at risk.
- The P_3 break-even point and P_4 profit limit mark the points of entry and exit from the profit zone.
- P_5 profit maximum: the maximum overall profit is obtained at this point. If production quantities increase beyond P_5, the marginal costs MC will exceed the constant unit price p.
- P_6 optimal cost point: at this production quantity, the unit costs c are lowest, so production is at its most economic here.
- P_7 lower price limit: this is important if the price is varied, instead of the quantity. P_7 is the limit to which the unit price can be maximally reduced in the short term. Only variable costs are covered here, not fixed costs. If the price falls below, then the variable costs will also not fully be covered.

The starting point for the above illustration of cost curves for the type A production function was restricted to two inputs of resources, r_1 and r_2. However, the simplification should not conceal the fact that real production processes are more complex.

7.2.5 Type B production function

In industrial production, factors involved in output processes are set in a fixed relationship to each other. Unlike in the type A production functions, they are not interchangeable. For example, it is not possible to use either labour or energy as a substitute for roundwood to produce sawnwood. Within specific limits, the production process used and the resulting yield determine the amount of roundwood required. Roundwood being processed thus represents a limitative



VC	= Variable costs	vc	= Average variable costs
FC	= Fixed costs	fc	= Average fixed costs
C	= Total costs	c	= unit costs
R	= Revenue	MC	= Marginal costs
t_1	= Tangent from C	p	= Price (constant unit price)
t_2	= Tangent from VC		

Figure 7.13 Cost and yield curves for type A cost functions: total and unit cost view

production factor with a fixed input of resources relationship to product output quantities. In limitative production processes, there are no distinctions between different inputs of resources combinations (which would represent factor substitution). Distinctions exist between different production processes such as a switch from a gang saw to a chipper canter.

A limitative factor combination means that a specific machinery output level can be achieved only by simultaneously inputting several factors such as raw materials, energy and lubricants. It is not possible to increase the production quantity by varying only one set of factors. Increasing the production quantity would require the entire system – consisting of people, machinery and materials – to work at a higher performance level. The input of raw materials and other materials increases, as does the amount of energy and lubricants used. The same is true for wear and tear on tools and machinery and for employees' efforts.

Industrial production with limitative production factors can be accounted for using the type B production function. It distinguishes between operating resources such as tools and machinery, and other production factors or consumption factors such as energy and raw materials. Operating resources or use factors are not directly connected with the input of consumption factors and the resulting output of products. Input materials and the expected output depend on the technical characteristics of the raw materials, the technology and the intensity with which it is used, and the expected quantities and qualities of the product. The relationship between input and output is indirect and can be demonstrated by using what are known as consumption functions (Wöhe and Döring 2008: 321–2).

The consumption function represents the use of indirectly consumed factors relative to the parameters for the set of machinery. These parameters can be presented as follows (Ellinger and Haupt 1996: 121):

- Parameters for the operating resource are determined by technical design features that are regarded as constant – for example, the maximum passage for a band saw.
- The output level (intensity) of the machinery cannot be altered during operation.

The output level y corresponds to the quotient of work (the technical output units) w and time t:

$$y = \frac{w}{t}$$

The factor work b in the quotient's numerator is the product of force and direction. In many production processes, force can be regarded as constant, so direction can serve as the measurement unit for work. In the sawing process, for example, the force required for the cutting depth and some other variables remain constant during the production process. Work then depends proportionately on direction – the number of gang saw movements or the number of revolutions of a circular saw. Output y changes in proportion to movement per time, and speed is the measurement for the level of output. The speed is reflected in terms such as cutting speed and processing time.

The level of output is the independent variable for the consumption function. Its dependent variable is resource consumption r_j per technical output unit u – for example, the amount of energy consumed per cubic metre of sawnwood. The quotient of r and u is the output coefficient z_j:

$$z_j = \frac{r_j}{u}$$

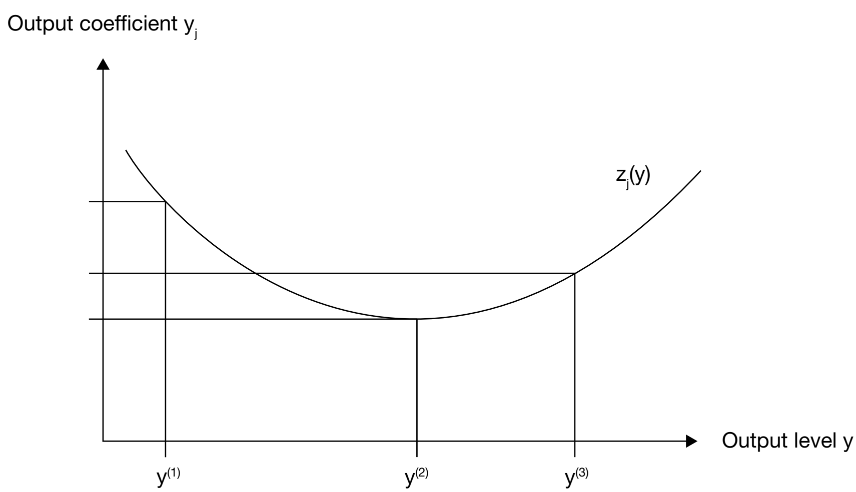
If technical characteristics are constant, the consumption can be calculated as follows:

$$z_j = z_{j\,(y)} \text{ or } \frac{r_j}{u} = \frac{r_j}{u}\left[\frac{u}{t}\right]$$

Figure 7.14 shows a typical U-shaped course of the consumption function. At an optimal output level – here, $y^{(2)}$ – resources consumption r_j is minimal. If the output level deviates from $y^{(2)}$ – whether it is reduced or increased – factor consumption necessarily increases.

7.2.6 Type B cost function

To move from the consumption and production functions to the total cost function, the factor consumption quantities for specific production quantities, with their factor prices p_j (which are assumed to be constant), have to be evaluated and added. Depending on the course of the underlying consumption functions, the total cost functions may be linear, progressive, digressive or S-shaped or they may have



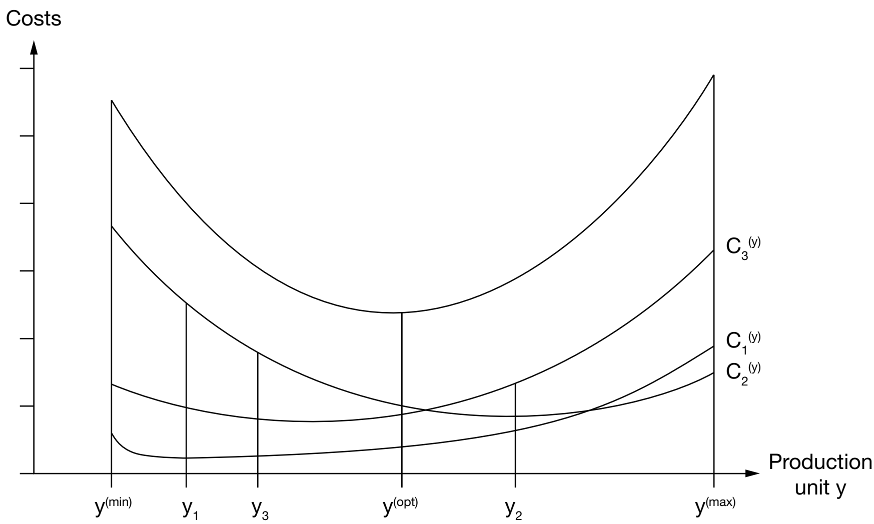
$z_j(y)$ = Output coefficient at the given output level y
$y^{(2)}$ = Optimal output level
$y^{(1)}$ = Reduced output level
$y^{(3)}$ = Increased output level

Figure 7.14 U-shaped consumption function other courses. In contrast to type A cost functions, there is thus no general course for type B total cost functions; instead, the course is derived from the company's production technology (Wöhe and Döring 2008: 321–2).

The total cost function is:

$$C(y) = \sum_{j=1}^{n} z_j(y) \cdot z_j$$

Figure 7.15 shows the situation for three consumption factors (electricity consumption, lubricant consumption and wear and tear on tools) that are each evaluated with their constant factor prices and added to form the total cost function. Each of the three consumption functions has its own minimum (y_1 = minimum electricity consumption, y_2 = minimum use of lubricants and y_3 = minimal wear and tear on tools). The minimum for total costs, or the optimum output level $y^{(opt)}$, of the three added quantity-specific cost functions must in this case lie between y_1 and y_2, since outside the two individual minimums, all three consumption functions increase.



$y^{(opt)}$ = Optimum output level
$y^{(min)}$ = Minumum output level
$y^{(max)}$ = Maximum output level
y_1 = Minimum output for electricity consumption
y_2 = Minimum consumption of lubricant
y_3 = Minimum wear and tear on tools
$C_1^{(y)}$ = Cost curve for electricity consumption
$C_2^{(y)}$ = Cost curve for lubricant consumption
$C_3^{(y)}$ = Cost curve for wear and tear on tools

Figure 7.15 Consumption functions of three factors and aggregated cost function

As a general statement, it can be deduced that enterprises with a given amount of equipment normally operate within a relatively small output range. Deviations from the optimum output level $y^{(opt)}$ have almost proportional effects on total costs (Wöhe and Döring 2008: 324).

Type B production and cost functions provide a relatively accurate picture of industrial production by distributing production costs into subordinate areas. However, it is difficult to extrapolate from them. For example, it is not possible to include the substitution effects that certainly occur in practice. A synthesis of both substitutional and limitative production effects can be represented as a type C production function. Additional production functions have been developed on this basis (Ellinger and Haupt 1996: 191–2).

The increased use of technology in the forestry industry, particularly with the expanding use of fully mechanised wood harvesting, suggests that forestry production processes increasingly follow the laws of type B production and cost functions.

7.2.7 Industrial capacity and flexibility

If a business's output quantity is changed, its total costs inevitably change as well. As shown for the type B production and cost function, total costs are dependent not on the output quantity directly but rather on the underlying consumption functions. This means that the output quantity depends on factor input quantities. These in turn change with the number of machines available, the intensity of their use and the usage time. There are four ways of altering the output quantity or adapting production to changed employment situations (Wöhe and Döring 2008: 323–4, 1002):

- adjusting the number of machines (quantitative adjustment);
- adjusting the intensity of use (intensity adjustment);
- adjusting the period of time the machines are used (time adjustment); and
- combining the above three types of adjustment (combined adjustment).

Quantitative adjustment: In this case, the number of machines is changed, but the intensity and period of use for each machine remain the same. If machines with different total costs can be operated for the same output, then the machines with the lowest production costs are used. If employment declines and the output quantity has to be reduced, then the machines that operate least economically are switched off. If employment rises again, then the most cost-effective of the machines that have not been used in the meantime are put back into operation.

Intensity adjustment: In intensity adjustment, the number of machines and their use period remain unchanged. The change in the output quantity is achieved by adjusting the intensity – that is, the output per time unit. The aim is to find the optimal adjustment to a new output quantity by identifying the intensity of machine use associated with the lowest average costs per output unit. Machine-specific average costs per output unit are calculated in the same way as for the

U-shaped consumption function. On the ordinate axis, the minimum for the total cost curve gives the minimum average costs per output unit for the machine (= the minimum average costs at $y^{(opt)}$). Because the output quantity has a linear relationship to the intensity, if other conditions remain unchanged, the level of output quantity can be read on the abscissa. If the machine is working at its optimal performance level, the average costs per output unit will inevitably increase when use intensity changes. A heavier increase in costs can be expected here than with other types of adjustment. This option is therefore used in industry only when no other type of adjustment is possible, for technical reasons.

Time adjustment: Time adjustment is a common method of altering the output quantity. The number of machines and their use intensity remain unchanged. Instead, the period of time during which the consumption factors are used is varied. If the costs for the factor input quantities per time unit remain unchanged, then total costs have a linear course. Total costs are proportionally dependent on utilisation time and output quantity. By contrast, if individual production factors change as a result of the time adjustment, then the total cost function may take a different course after the change.

The example in Figure 7.16 shows the change in wage costs resulting from overtime payments when working hours are increased beyond standard working hours. The additional costs due to overtime payments are shown in the hatched area.

Combined adjustment: In this case, adjustment is made to changes in the employment situation or a change in the output quantity. The chosen adjustment gives the lowest average costs per output unit for each new employment quantity.

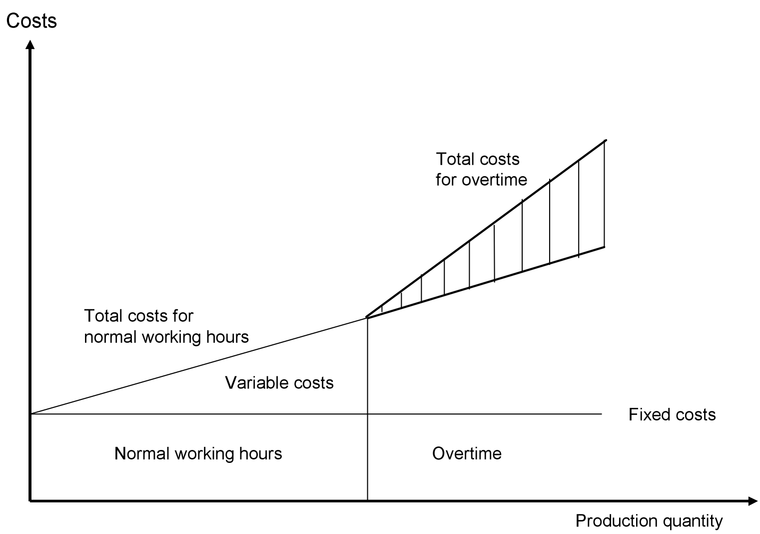


Figure 7.16 Cost behaviour pattern with time adjustment

Source: Wöhe and Döring 2008: 325

7.3 Analysing production programmes

7.3.1 Direct costing

The full cost principle implies that a 'fair' share of all costs can be passed to the cost units (see Chapter 5, Section 5.3). Each product has to bear the costs that are independent of the production volume. Examples of costs that are independent from volumes include depreciation, interest charges and management costs. Full costing, however, has some disadvantages. Implementation is elaborate, and in some cases it is difficult to apply the causation principle consistently. Cost shares and the breakdown of cost unit overheads often have to be apportioned by experts or set on the basis of prior assumptions.

These disadvantages are addressed by direct costing, in which such costs are offset to each produced unit that occur directly in the production process. This gives managers a planning tool for evaluating a product's contribution to company profitability independent from overhead charge allocations. It points to necessary or desirable changes in production programmes. Direct costing also makes it possible to calculate quickly the effects of short-term price fluctuations and determine price limits that are tolerable in the short term.

Direct or variable costing is based on a procedure that shows the following characteristics:

- There is no distribution of fixed costs to individual cost units.
- Cost-unit accounting shows only the variable costs per produced unit that can be clearly assigned.
- If revenues are included in the calculation, direct costing becomes a contribution margin calculation. The proportion of fixed costs that is not offset to the cost units has to be covered by the sum of contribution margins from all cost items to gain a profit.

The task in direct costing is to split cost types into variable and fixed components:

- Variable costs represent the valued amount of materials, services and labour consumed directly during production. This includes the costs for raw materials, auxiliary materials and operating supplies consumed by a unit of production output, as well as the personnel costs correlating directly with the production unit. The variable costs respond to changes in the level of machinery and plant utilisation.
- Fixed costs do not respond to changes in plant utilisation; they remain constant. Fixed costs can only be used for purposes of maintaining the company – for example, for depreciation, rental payments and interest on debt and personnel costs that are independent from production output.

Costs remain fixed only for a defined time period. In direct costing, the period selected must be short enough to ensure that no important organisational adjustments in production technology or production programmes have taken place.

7.3.2 Single-level contribution margin calculation

Capacity issues repeatedly arise during production processes. The determination of operating capacities is important for making long-term, strategic decisions, such as investment in operating resources and selection of efficient production targets. In the shorter term, changes in costs and prices, fluctuations in demand and changes in procurement of materials and labour may require adjustments to the envisaged production programmes, working procedures and planned production volumes. To react to rapid change, managers must have suitable tools to represent and analyse a new situation, show the options for adjustments, the limits of profitable business activities and the effects of changes in the production process. Direct costing, particularly in the form of contribution margin calculation, can give valuable information in such situations.

The difference between the revenue for an item and the variable costs of the item is known as the contribution margin. The main interest in contribution margin calculation is to determine the contribution that a product or service makes to covering fixed costs. As long as the selling price (revenue) is higher than the variable costs, at least some of the fixed costs are covered. The insight here is that even production at a loss may still contribute to covering fixed costs, as long as there is a positive difference between revenue and variable costs per output unit. Therefore it can be rational, at least in the short term, to continue production and sales until variable and fixed costs fall to a level that makes production profitable again. If this cannot be achieved in an acceptable timeframe, the product portfolio and cost structure need to be restructured.

The operating profit of a company can be calculated from the total contribution margins minus the company's fixed costs (see Table 7.1). This procedure is known as single-level contribution margin calculation. It allows simple and effective assessment of a company's ability to generate profit. Single-level contribution margin calculations provide information about an entire business area of a company (Schmidhauser 1994: 22–3). For roundwood production, for example, the amount of wood sold and the revenue obtained are entered, along with the fixed costs block and the line for variable costs. Because the business cannot influence revenue decisively, at least in the short term, the revenue line is assumed to be given.

Table 7.1 Scheme for single-level contribution margin

	Total sales returns for n product types
–	Total variable costs for n product types
=	Total contribution margins for n product types
–	Company´s fixed costs
=	Operating profit

The graphic presentation of a single-level contribution margin calculation reduces production processes to the three variables of fixed costs, variable costs and revenue (see Figure 7.17). The intersection of the total costs line with the revenue line shows the break-even point. It indicates the sales volume at which the total for the contribution margins achieved is equal to the block of fixed costs. The area to the right of the break-even point and between the total costs line and revenue line represents the profit contributing zone.

Five possible cases are discussed based on Figure 7.17.

Case 1 (CM = FC): The revenue line and the total costs line intersect at the break-even point. Roundwood production covers total costs (CM = FC). The business does not accumulate losses, but no resources are available for additional investment, subsidiary business or nonprofit activities.

Case 2 (CM > FC): Profit (free of harvesting costs) is generated. Total costs of roundwood production are covered. The generated profit can be used for investments, subsidiary business or nonprofit activities. If the stated sales quantity exceeds the annual sustainable allowable harvesting volume – say, because of salvage harvesting after storms and wind throw – the revenue less harvesting costs has to be assessed in relation to the reduced value of the forest stands.

Case 3 (0 < CM < FC): This case shows a reduced contribution margin and a loss in the amount of FC – CM over a period of time. However, sales revenues are still above the variable costs. Despite producing at a loss, a contribution to coverage of fixed costs is still achieved.

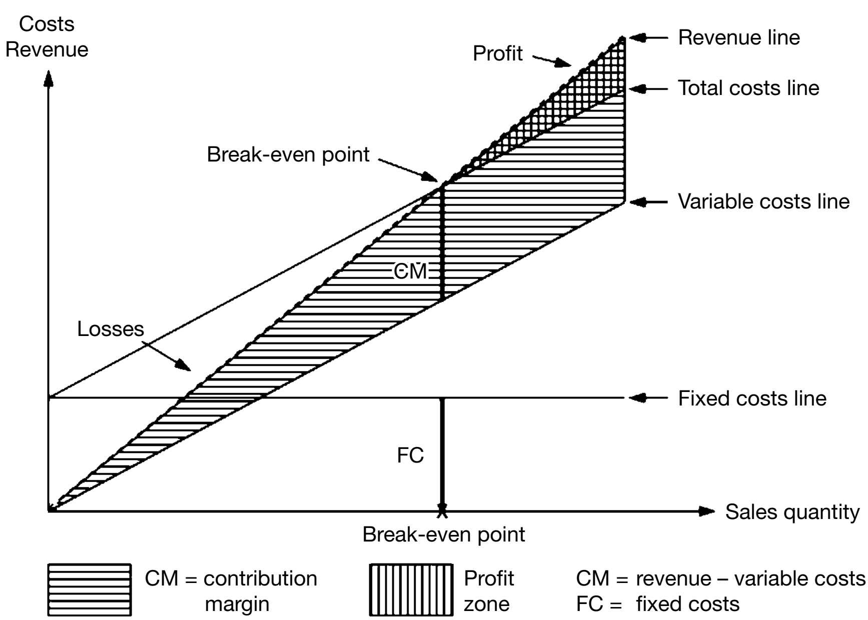


Figure 7.17 Cost and revenue development relative to sales quantity

Case 4 (CM = 0): The revenue line runs parallel to the total costs line. The contribution margin of revenue minus variable costs is zero (CM = 0). Only the variable costs are covered by revenue and no contribution is made to covering fixed costs, no matter what quantities are produced or sold.

Case 5 (CM < 0): The revenue line has a gradient lower than that of the total costs line; they never intersect. Sales revenues are not capable of covering even variable costs. The contribution margin for fixed costs is negative (CM < 0). Changes in sales quantities have equivalent effects on the absolute level of the negative contribution margin.

The following calculation for a chipper canter illustrates contribution margin calculation in the wood industry (see Table 7.2). Company-specific adjustments affect the revenue for the main product, machine-dependent production output and variable and fixed operating costs. As the example shows, the chipper canter operates with a contribution margin > 1. The example corresponds to case 2 (CM > FC) for roundwood production.

The break-even point is reached at a daily output of 455 m^3, a level at which total costs are covered. A daily saw output below the break-even point leads to a period-related loss amounting to FC – CM (case 3: 0 < CM < FC). Sales revenues are still above variable costs, so despite producing at a loss, a contribution to covering fixed costs is still made. Production under these conditions may make sense in the short term in order to maintain business activities temporarily. How long a company can afford to operate below the break-even point depends on the strength of the balance sheet (equity ratio, cash reserves).

The above example shows a break-even point at 93 per cent plant utilisation. The lower limit is set by the break-even point at 455 m^3 per day. The upper limit – assuming that general conditions remain the same – is set by a maximum sawnwood output of 480 m^3 per day. This is a critical situation, since the production facility requires continuous full utilisation to generate profits. It is neither economically viable to operate in times of reduced demand nor possible to take advantage of peak demand situations. Reducing fixed costs and increasing operational efficiency are essential to moving this business to a more stable economic situation.

Similar calculation schemes can be applied to other sawing technologies and to the manufacture of other types of product. This type of calculation is also of interest in other areas of the wood industry, such as carpentry shops, joinery production, prefabricated building construction and furniture production.

7.3.3 Multiple-level contribution margin calculation

The multiple-level contribution margin calculation can be used if proportions of the total fixed costs can be clearly assigned to specific production facilities, cost centres or other business areas of a company. A proportion of the fixed costs will remain unallocated. Multiple-level contribution margins show whether a business area – including its specific fixed costs – generates enough margin to cover fixed costs of the superior organisational area. In essence, multiple-level contribution

Table 7.2 Contribution margin calculation: production of sawnwood

	Product, measurements, quality (rounded values)			
1	Main product	Proportion	45%	
		Revenue	€245/m^3	€110/m^3
2	By-product/N	Proportion	20%	
		Revenue	€170/m^3	€34/m^3
3	By-product/K	Proportion	2%	
		Revenue	€100/m^3	€2/m^3
4	Industrial waste wood/H	Proportion	16%	
		Revenue	€13/m^3	€2/m^3
5	Industrial waste wood/S	Proportion	17%	
		Revenue	€12/m^3	€2/m^3
6	Revenue total			€150/m^3
	Revenue net	Discount	–2%	€147/m^3
7	Roundwood	Purchasing		€80/m^3
		Bark allowance	€0/m^3	€80/m^3
		Discount	–2%	€78/m^3
8	Transport and incidental costs			€10/m^3
9	Material costs (7 + 8)			€88/m^3
10	Gross margin (6 – 9)			€59/m^3
11	Saw output		60m^3/h	
	Working hours per day		8h/day	480m^3/day
12	Gross yield (10 x 11)		€28,320/day	
13	Variable operating costs		€9,600/day	€20/m^3
14	Contribution margin (12 – 13)		€18,720/day	€39/m^3
15	Fixed operating costs		€17,760/day	€37/m^3
16	Total production costs (9 + 13 + 15)			€145/m^3
17	Excess or insufficient coverage		€960/day	€2/m^3
18	Minimum output ([15 / 14] x 11) (break-even point)		57m^3/h	455m^3/day

margin calculation extends the logic of the method from single products to business areas (see Table 7.3).

The managerial accounting system must provide sufficiently precise details for distributing fixed costs to individual products, cost centres and business areas. Fixed costs that can be attributed to a business area typically comprise fixed wages of workers engaged in specific production unit, depreciation for machinery and buildings necessary in this unit or salaries of management staff dedicated to the specific business activity. Multiple-level contribution margin calculation can be applied to production processes, joint production arrangements and enterprises

Table 7.3 Scheme for multiple-level contribution margin calculation

	Revenue for a product
–	Variable prime costs for the product
=	Product contribution margin
–	Product fixed costs
=	**Contribution margin I**
	Total of all contribution margins I for a product group
–	Fixed costs for product group
=	**Contribution margin II**
	Total of all contribution margins II for a cost centre
–	Fixed costs for cost centre
=	**Contribution margin III**
	Total of all contribution margins III for an area
–	Fixed costs for an area
=	**Contribution margin IV**
	Total of all contribution margins IV for a company
–	Fixed costs for company
=	**Net profit**

with multiple-product programmes. This applies in particular to forest production and management (Speidel 1984: 107–8).

Table 7.4 starts at the level of the product group of roundwood. In this general form of presentation, individual assortments by species and grades are not analysed separately. What is examined is the total sales quantity in harvesting operations. Only contribution margin IV provides resources for financing investment, building up reserves and payment of dividends. Business equipment, working procedures and capacities can be checked using multiple-level contribution margins. For forest enterprises, this is important because selected working procedures in the wood production area influence both fixed and variable costs.

Table 7.4 Multiple-step contribution margin costing: roundwood production

	Revenue from wood sales
–	Variable costs for wood harvest
=	**Contribution margin I**
–	Fixed costs for wood harvesting
=	**Contribution margin II** (pure wood harvesting)
–	Fixed costs for wood production area
=	**Contribution margin III** (for wood production area)
–	Fixed costs other business areas (subsidiary business, nonprofit activities)
=	**Contribution margin IV**
–	Fixed costs for entire forestry business
=	**Net profit**

To compare the costs of working processes – felling, bucking and grading of logs; ground winch haulage or cable-crane usage; helicopter transport in difficult terrain – procedure-specific total cost curves can be calculated. Cost comparisons help determine alternative, more cost-efficient logging practices, particularly in protection forest management, where silviculture measures must be close to nature and the use of cost-intensive technology is required to ensure the stability of forest stands, prevent work accidents and prevent flooding and soil erosion.

The following example of multiple-level contribution margin calculation in sawmilling production is based on the data used in Table 7.2. The variables for daily output have been extrapolated to a full year of production. At an operating utilisation capacity for sawnwood output of 480 m^3 per day and a production time of 240 working days, annual production volume totals 115,200 m^3. Using rounded values shows a revenue difference of approximately –€40,000, or –0.2 per cent compared with the unrounded figures. The basis for the contribution margin calculation is provided by three product groups within the sawmill business cost centre: main product, by-products and industrial waste wood. The latter two product groups are each further subdivided into two individual tradable products. The main product includes several assortments of sawnwood, although these are not distinguished here.

Table 7.5 shows the sawmill business area and its cost centres. The Σ line for all contribution margins III for a business area shows that the contribution margins for additional cost centres within the business area can be combined provided the business activities are subdivided and recorded for calculation. For example, transport facilities following felling can be treated as one cost centre or differentiated as two cost centres for each product group.

Companies in the wood industry may have other operating areas, such as a fleet of vehicles for roundwood supply and transportation of finished products, or wood energy facilities for producing processing energy or supplying district heating systems. Multiple-step contribution margin costing for these additional business areas can be structured and shown in a similar way. Combining contribution margin costing across the full range of business areas would be indicated in the Σ line for all of the company’s contribution margins IV.

Fixed costs for products only arise with sawnwood as the main product. These include all costs for technical drying. By contrast, fixed costs for product groups arise for all three groups. These involve specific fixed costs for warehousing facilities for each product, consisting of costs for ground, halls, transport facilities and warehousing equipment, such as high racks and bulk materials silos. Fixed costs for cost centres include costs for the sharpening shop and other workshops in the sawmill business cost centre. The company’s fixed costs are disregarded in the given example, since other business areas have been omitted for reasons of space. Their contribution margins IV are thus not included in the costing scheme. However, this would be a necessary and indispensable calculation to show the full picture of the company as a whole, allowing assessment of the net income from its entire output provisions.

Table 7.5 Contribution margins for sawmilling production (monetary values in €)

	Main product 51,840m³	*By-product/N 23,040m³*	*By-product/K 2,304m³*	*Industrial waste wood/H 18,432m³*	*Industrial waste wood/S 19,584m³*
Sales revenue	12,700,800	3,916,800	230,400	239,616	235,008
- Variable product costs	1,555,200	460,800	46,080	147,456	94,464
= Product contribution margin	11,145,600	3,456,000	184,320	92,160	140,544
- Fixed costs for products *	2,599,200	0	0	0	0
= Contribution margin I (CM I)	8,546,400	3,456,000	184,320	92,160	140,544
Σ of all CM I	8,546,400	3,640,320	←	232,704	←
– Fixed costs for product groups[a]	777,600	380,160		304,128	
= Contribution margin II	7,768,800	3,260,160		–71,424	
Σ of all CM II for a cost centre	10,957,536	←		←	
– Fixed costs for a cost centre[b]	1,152,000				
= Contribution margin III	9,805,536				
Σ of all CM III in a business area	9,805,536	← CM III from additional cost centres in the business area			
– Fixed costs for business area	8,178,592				
= Contribution margin IV	1,626,944				
Σ of all CM IV for a company		← CM IV for other business areas			
– Company's fixed costs					
= Net income					

* Drying chamber for the main product.
a Warehousing facilities for the productgroups.
b Sharpening shop and machine workshop for sawmill operations.
c Wood purchasing and raw wood storage.

7.3.4 Contribution margin analysis in forest management

Multiple-level contribution margin costing provides insights and a basis for determining efficient ways of planning and controlling forestry production programmes. Table 7.6, adapted from the group average for Alpine forestry enterprises in Switzerland (BFS and BUWAL 2000: 86–7), shows multiple-step contribution margins in Swiss France for forest management in the business areas of saw log production, subsidiary activities and a special protection forest management programme in mountainous terrain.

The following points may be noted:

- The assortment groups for saw logs, industrial wood and wood for energy purposes are shown, but not the assortments by species and quality grades. Details of costs for wood production are provided by the cost centres for felling, cable crane transport and wood piling. Other costs for wood production – warehousing and administration – appear as fixed costs for this business area.
- The area of subsidiary business covers the cost centres for nursery production of 5,000 plants and manufacturing of garden furniture from wood.
- The special programme for protection forest management includes silviculture measures for forest stand stability and regeneration along a major railway line. Turnover consists of reimbursement from the railway company for work done and additional revenue from the sale of marketable wood assortments that can be harvested cost-effectively during the silvicultural work.

The results of multiple-level contribution margin calculation for such a combination of business activities lead to the following managerial conclusions:

Industrial wood production: Contribution margin II for industrial wood production is negative. The production programme needs to be checked to see whether this product category should be abandoned in favour of producing a larger quantity of wood for energy and/or whether a higher yield of saw logs is possible. Industrial wood production can resume as soon as rationalised working processes become available and/or prices rise to a level that covers costs.

Production of wooden garden furniture: The contribution margin for this cost centre is negative. The fixed costs for the cost centre – depreciation for special machinery – are particularly high. The costs need to be checked and the revenue situation needs to be analysed. Because revenue is above variable costs, the cost centre, despite producing at a loss, makes a small contribution to covering fixed costs. In the longer term, however, the contribution margin has to be made positive overall or the activity should be abandoned.

Stability tending: A critical point involves turnover for marketable wood assortments. Reimbursement for work done in connection with maintaining the forest's protective functions has to be raised to a level at which all the costs attributable to this cost centre are covered, independently of any additional revenue from harvested wood. These include work output, fixed costs for product groups

Table 7.6 Contribution margins for a forest management plan (monetary values in Swiss francs)

	Wood production			*Subsidiary business*		*Protective forest*	
	Stem wood	*Industrial wood*	*Energy wood*	*Nursery*	*Garden furniture*	*Stability tending*	*Protective facilities*
	7000m³	*1000m³*	*2000m³*	*5000 pc**	*Various*	*75 ha*	*Various*
Sales revenue	560,000	15,000	50,000	15,000	4,000	90,000	270,000
- Variable product costs	21,000	4,000	10,000	6,000	3,500	60,000	130,000
= Product contribution margin	539,000	11,000	40,000	9,000	500	30,000	140,000
- Fixed costs for products	0	0	0	0	0	0	0
= Contribution margin I (CM I)	539,000	11,000	40,000	9,000	500	30,000	140,000
Σ of all contribution margins I	539,000	11,000	40,000	9,000	500	30,000	140,000
– Fixed costs for product groups	140,000	20,000	10,000	5,000	1,500	10,000	90,000
= Contribution margin II (CM II)	399,000	–9,000	30,000	4,000	–1,000	20,000	50,000
Σ of all CM II in a cost centre	420,000	←	←	4,000	–1,000	20,000	50,000
– Fixed costs for a cost centre	100,000			1,000	2,000	5,000	15,000
= Contribution margin III (CM III)	320,000			3,000	–3,000	15,000	35,000
Σ of all CM III in a business area	320,000			0	←	50,000	←
– Fixed costs for area	80,000			3,000		45,000	
= Contribution margin IV (CM IV)	240,000			–3,000		5,000	
Σ of all CM IV for a company	242,000		←		←		
– Fixed costs for company	219,000						
= **Net income**	**23,000**						

Note: * Plants produced (pieces)

(e.g. for depreciation on cable-crane equipment) and fixed costs for other cost centres (e.g. administrative and managerial overheads).

Altogether this costing method is a powerful tool to evaluate a company's strategy and ensure that the output of every activity contributes to absorbing parts of the fixed costs and the total business achieves the expected returns:

– *Fixed costs for products*: Important information is obtained on adapting depreciation periods for a technical plant, debiting or crediting of production costs for products, for tax effects and determining the optimal time for investing in replacements with more cost-effective production means.
– *Fixed costs for product groups*: If the fixed costs for warehousing industrial waste wood (e.g. in silos) exceed contribution margin I, immediate action must be taken – either abandoning warehousing or reducing inventory. Continual transport removal might free the space for other uses by either the company or third parties.
– *Fixed costs in cost centres*: Cost centres have to be checked to assess the potential for reducing internal business costs. Perhaps the work can be carried out more cost effectively by outside services while maintaining quality and safety in the production processes. Fixed costs include wood purchasing and roundwood storage. The costs of wood purchasing are assumed to be predetermined for the company, but the costs for roundwood storage can be influenced. If roundwood can be procured from suppliers in a comprehensive production chain, the costs of storage facilities and materials transport will be lower, and capital turnover will accelerate.

7.4 Further reading

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8 Strategy, controlling and wood-based sector development

8.1 Strategy

8.1.1 Strategy formulation

The type and extent of the company's strategy and its implementation are presented in a business plan (Benzel and Wolz 2000; Ludolph and Lichtenberg 2002; McKinsey & Company 2007; Stutely 2007). Its aim is to provide a convincing argument for financing an innovative idea or expanding current activities. The plan gives a solid factual explanation of the envisaged undertaking expressed in clearly understandable terms, since the intended audience may not necessarily have expert knowledge of the subject. A good business plan presents the new and promising elements of the proposed business strategy in such a way that it is comprehensible and convincing for outsiders as well as insiders, and it should arouse their interest in the project.

In preparing business plans, three tasks have to be accomplished:

- The implementation of the strategy has to be divided into individual measures (objective task).
- The sequence of implementation has to be structured in an operational manner (organisational task).
- Suitable conditions among employees have to be established to enable them to implement the strategy in a professional and efficient way (personnel task).

A business plan makes it possible to approach actual and potential financers – and particularly representatives of banks – who will accept or reject the proposed strategy. A good business plan has to provide a great deal of specific economic, business accounting and financial data. This means presenting a sound and comprehensive framework of figures so that the business idea's yield mechanism can be evaluated. Factual information should be adequate for a detailed feasibility assessment of entrepreneurial opportunities and risks as well as the strengths and weaknesses of entrepreneurial capabilities. The plan should be structured and written such that clear conclusions regarding the feasibility of the business project can be drawn. The focus is on identifying how and where the company will be able to sell certain products and services, and how much turnover and profit they will generate.

A convincing business plan is essential when the strategy requires external capital or additional equity capital. No bank or private investor will invest in an idea whose strategy or economic basis is not fully developed and explained. The content analysis required for preparing a business plan is in itself a valuable aid to developing effective business models and measures. The systematic and largely standardised procedure used to develop such plans is helpful for the outsiders who will check the soundness and feasibility of a business idea and search for logical inconsistencies and critical omissions. Connections must be logical; figures or estimates must be justified; anything presented as fact must be documented; any assumptions must be realistic.

The typical scheme for a business plan is as follows:

- Summary: Project, turnover and profit prospects, financial requirements with deadlines, risks (one page).
- Contact persons: For each, name and area of responsibility, specialisation, address and phone number, fax number, e-mail address.
- Business idea: Concise description of the new business or strategy, goal, starting position, earnings mechanism.
- Products, services: Customers' requirements, benefits to customers, product and service, life cycle.
- Market, customers, competitors, competition, society: Market overview, market capacities, market assessment, market trends, customer structure, competition, company's own market position, target customers and markets, planned sales trend (customer and product orientation).
- Marketing: Marketing strategy, market segmentation, pricing policy, sales objective, advertising, public relations, sales and distribution.
- Owners, managers, employees: Curricula vitae, professional and management experience, training and continuing education for managers and employees, personnel planning and social plan if appropriate.
- Company: Concise information on the company, including business model, development to date, values and standards in the business or company.
- Products, partnerships, sales agents: Production (technical means of production, capacities, bottlenecks), partnerships, sales agents, capacity planning and capacity utilisation in production and services provisions.
- Risks, scenarios, sensitivities: Risk analysis, risk management, sensitivity analyses for normal-case, best-case and worst-case scenarios.
- Sales projections: Quantity of sales to be achieved with which customers, when and where.
- Financial planning: Profit and loss statements for the first five years, cash flow, cash forecasts for one business year, liquidity plan (per month for the following year), liquidity requirement, break-even point, capital structure, capital requirement, sources of finance, risks and precautions, pre-investment

analysis for major investment projects, time point at which the company or project will become self-supporting (economically viable).
– Scheduling, project targets, implementation: Milestones, implementation planning.
– Rights of control: Rights of control for owners, financiers, sponsoring bodies (public bodies providing finance).
– Appendices: Contracts and statutes, basic data and initial data, and sources of information, background on the plan's estimates and assumptions, statutes or contracts for the form of collaboration selected; databases used for market analysis, financing, cash forecast and pre-investment analysis.

In setting measurable intermediate goals for implementation, the business plan provides the basis for subsequent steps. Statements on the following points are to be considered:

– Aims and expected results: Goals are set and expected results are recorded in writing to provide an objective measure for monitoring and control procedures.
– Information: Records of steps to be taken to keep employees informed and help the company communicate with its business partners and the public.
– Customer orientation and sales trend: Products and services, target customers and markets, as well as expected sales trends, are explained.
– Capacity planning: Capacity utilisation for operating equipment or investments needed to deliver production of goods and services is analysed.
– Financial and material resources: Resources needed to implement strategies (initial investment, current budget and project finance) are indicated, along with their implications for management of personnel, technology and information.
– Schedules: Strategic and operational measures are arranged and coordinated to indicate which steps will be taken, when and with what expected results.
– Milestones: Milestones indicate critical time points in implementation so that specific results can be evaluated and any corrective decisions made.
– Communications: Communication between managers and employees as well as with stakeholders and the public is important for successful implementation. Communication targets and measures are specified in the business plan.
– Incentive measures for personnel: Behaviour patterns, qualifications and job performances are described and appropriately rewarded to ensure that the strategy is implemented according to schedule.

Implementation of a strategy requires monitoring of economic performance, market goals, means of production, sales procedures, turnover, profit, capital volume and capital structure. Social approaches to the new activity include wage policies, job organisation and continuing training schemes.

Employees with expert knowledge play a decisive role in planning and implementation. Particularly when strategic reorientation leads to substantial changes in the status quo, managers may anticipate information deficits and resistance. Strategies that are good in principle sometimes fail because employees lack motivation or are anxious about its possible effects – problems that may arise because of inadequate information and lack of opportunities to participate in the process of restructuring.

8.1.2 Strategic planning process

Strategic planning in business management dates to the 1960s and 1970s (Lombriser and Abplanalp 2005: 25–6). Following an extended period of growth after the Second World War, many companies faced stagnating markets and ever-faster technological developments. New budgeting methods and new approaches in management were needed: no longer could one assume continuous development and merely extrapolate past results into the future.

The purpose of strategic planning is to ensure long-term company success using appropriate methods in an increasingly dynamic business environment. Strategic planning primarily means the use of information-processing methods capable of coordinating multiple requirements of a competitive environment with the company's potential and objectives (Bea and Haas 2005: 49). Planning processes can be divided into five phases (see Figure 8.1).

The characteristic element in all forms of planning is analysis of future conditions for company action. Strategic concepts, planning tools and detailed data analysis can be used and comprehensive short-, medium- and long-term plans elaborated. The quality of strategic development depends on the ability to understand the way other people think and to grasp the changing conditions that determine entrepreneurial opportunities (Gälweiler and Schwaninger 2005). The planning process may be visualised as a cascade of sequential steps involving iterative loops. During strategy development some formulated goals may not be achieved, or only achieved in modified form. This leads to a reassessment of the target identification process.

Figure 8.1 Phases of strategic planning

Responsibility for strategic planning lies with company staff as a whole. Managers and employees are responsible for the planning process, or are at least involved in it (Kreikebaum 1997: 191–2). In large enterprises, directors and managers receive support from specialists in their own planning departments and from external consultants preparing analytical studies and collecting information. It is the directors and managers, however, who set the strategic goals and make decisions on strategy.

Planning systems, used to conduct and organise strategic planning (Bea and Haas 2005: 59–60), are set up to ensure a systematic and deliberate approach to decision making. Planning systems allow coordinating complex and often recurrent activities and provide guidelines for the following:

- specific offices in charge of company planning (the planning body);
- sequence of planning (the planning process);
- methods and tools to be used (planning techniques);
- activity areas to be included in the planning process (planning areas); and
- information required and needs to be analysed, particularly regarding essential quantitative and qualitative data (planning account).

A number of methods for strategic planning were developed for multinational corporations with multiple business units and are not easily transferred to small and medium-sized companies. However, the strategic concepts behind these tools have general relevance, and are adaptable to the characteristics of specific business practices. The tools and methods should not be mistaken for recipes for problem solving, however: their mechanical and thoughtless application is not recommended.

Familiarity with the assessment of global, regional and local sector-specific situations is a prerequisite for effective and efficient planning in forestry and in the wood industry (IIASA 2007). Computer-aided tools combine analysis, planning and strategy development. Modelling scenarios and outcome assessments make it possible to visualise present and future consequences of strategic and operational decisions. Forest inventories, comprehensive medium- and long-term management plans and geographic information systems (GIS) are important tools for achieving the sustainable use of forest resources (Sekot 1991).

8.1.3 Business environment analysis

Strategic planning processes start with an analysis of the business environment (the 'outside–in' approach). Planning procedures focusing largely on management processes inside the company (the 'inside–out' approach) are no longer adequate (Bea and Haas 2005: 85). The business environment can be divided into a global competitive environment and a task-specific environment (see Figure 8.2). First, the relevant external economic, social and political factors need to be identified and the associated opportunities and risks assessed. Second, the internal factors for a company's success or possible failure have to be clearly understood.

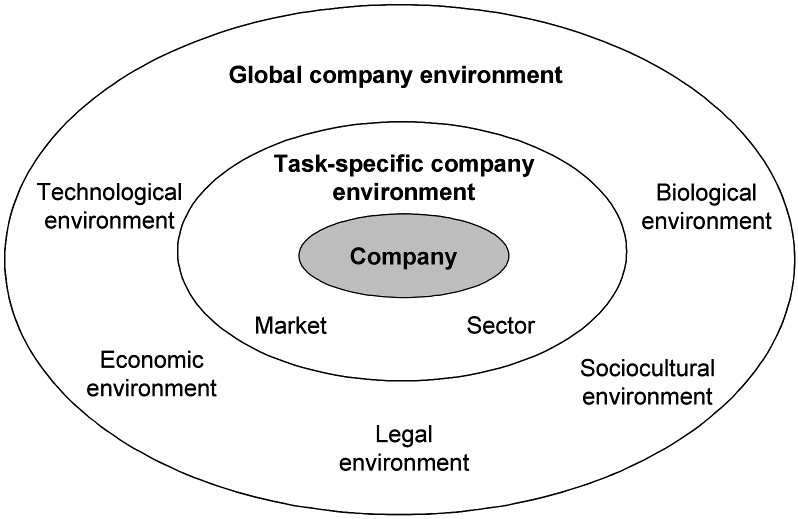

Figure 8.2 Company and its environment

Source: Bea and Haas 2005: 88

The business environment is determined by factors such as technology, economic drivers, social changes, legal framework, social and cultural conditions, as well as the biological and ecological environment. They vary with the particular circumstances of an economic sector, the prevailing or targeted markets and the company's resources (Kreikebaum 1997: 41–2). Natural resources, ecological factors and environmental conditions form part of companies' global environment. Corporate success is influenced by a wide range of factors, even if only a limited number of variables form the framework for developing strategies (Aeberhard 1996: 163–4). From the vast amounts of available information, appropriate and valid data must be selected, structured, clarified, confirmed and reconciled.

It is important to anticipate fundamental changes in trends, or discontinuities. Change is often heralded by weak and largely uncertain signals, and the earlier they are identified, the more unspecific the information usually is. Companies that can interpret these signals have a competitive advantage: they can adjust their strategic orientation to cope with radical changes more rapidly and react faster to new trends than their competitors. Analysis of the company's environment thus requires early recognition processes indicating general, sector and company-specific trends and their possible consequences for the company in the near future and beyond (Lombriser and Abplanalp 2005: 48, 93–4, 123–5).

The environmental analysis has several important elements:

– The technological environment: Technological changes are shaped by constant dynamic forces. Technological innovations take place in ever-faster cycles and are the reason for major changes in the competitive situation.

– The economic environment: Analysing global and regional economic trends makes it possible to recognise factors that shape one's own sector and the relevant markets. These influences include general economic developments, changes in trade relations and international commodity markets, growth rates of industrial production and trends in consumer demands.
– The legal environment: Analysis focuses on the external framework for entrepreneurial activities. Of major interest are, for instance, the effects of trade policy, tax policy, technology and research policy, environmental policy and social policy.
– The social and cultural environment: This analysis is concerned with changes in people's needs and values. Citizens' and consumers' behaviour patterns and attitudes, as well as their expectations for companies, are important here. In an era marked by worldwide trade relations and extensive interregional trade, culture-specific information has increasing value.
– The ecological environment: Changes in the physical and ecological environment and their consequences for entrepreneurial scope for action are necessary elements in modern analysis of the business environment. This involves both the contributions that entrepreneurial activities can make to development – for example, the benefits from using efficient production technology – and the environmental pollution associated with production and consumption (Eyerer and Reinhardt 2000; Karjalainen *et al*. 2001). Using renewable natural resources in a sustainable way is required to a considerable extent by public regulations. At the same time, reducing environmental pollution may increase companies' competitiveness, since nonrenewable resources are becoming scarce as the world's population grows, and exploiting them may be associated with rising costs.

The weighting given to those aspects of the business environment differs from company to company, depending on owners' goals, sector-specific opportunities and external or internal threats. For instance, forests owned by the state, municipalities or local citizens' associations require forestry practices that emphasise the public interest of stakeholders and multifunctional management goals. For a profit-making forestry enterprise in private ownership, public expectations and the political sphere may carry less weight. For an international wood products manufacturer, currency exchange rate developments and changes in trade policy are of strategic importance, whereas for a local wood construction enterprise, land-use planning decisions on new building sites in the region could be critical.

Corporate strategies are primarily directed towards current and future sales markets. The first step in the analysis involves defining the market segments. This determines the course and intensity of subsequent data collection and is based on the needs and wants of the customers to whom goods, services and integrated solutions are to be sold. Target markets are described using quantitative and qualitative criteria (see Figure 8.3) (Thommen and Achleitner 2006: 149–50, 306, 923–4).

Quantitative market data	Market volume Market lifecycle phase Market saturation Market growth Market share Stability of demand
Qualitative market data	Customer structure Demand structure Buying motivation Buying process and behaviour Customers' bargaining power

Figure 8.3 Checklist for analysing sales markets

Source: adapted from Thommen and Achleitner 2006: 925

The assessment of market attractiveness covers the extent to which individual goods and services in each market contribute to the company's success, as measured by profitability. Growing markets are classified as attractive, since companies can grow as the market expands and larger profit margins may be expected with higher demand. Important elements in strategic decision making are the available operating resources, skills and qualifications needed to enter new markets and coordination of the company's market portfolio.

Michael Porter's framework for analysis of the competitive situation and strategy development in an industry (Porter 2004a) traces profitability and attractiveness of business sectors back to five factors defining market competition in the form of driving forces:

– intensity of competitive rivalry;
– threat of entry of new competitors;
– threat of substitute products or services;
– bargaining power of customers; and
– bargaining power of suppliers.

The first two are internal factors that determine a company's chances of success. The other three involve competition from outside the company. Porter's approach provides a comprehensive framework for investigating industries and describing the type and importance of the competitive factors (see Figure 8.4).

Industry analysis can be supplemented by additional structural analyses (Aeberhard 1996: 135–6). For example, comparable companies can be combined into strategic groups for which the competitive forces are then analysed. Comparisons show whether the competitive forces differ among the groups and what potential responses are available to them. Of particular interest is the profit potential that can be deduced when the groups are compared. This type of internal

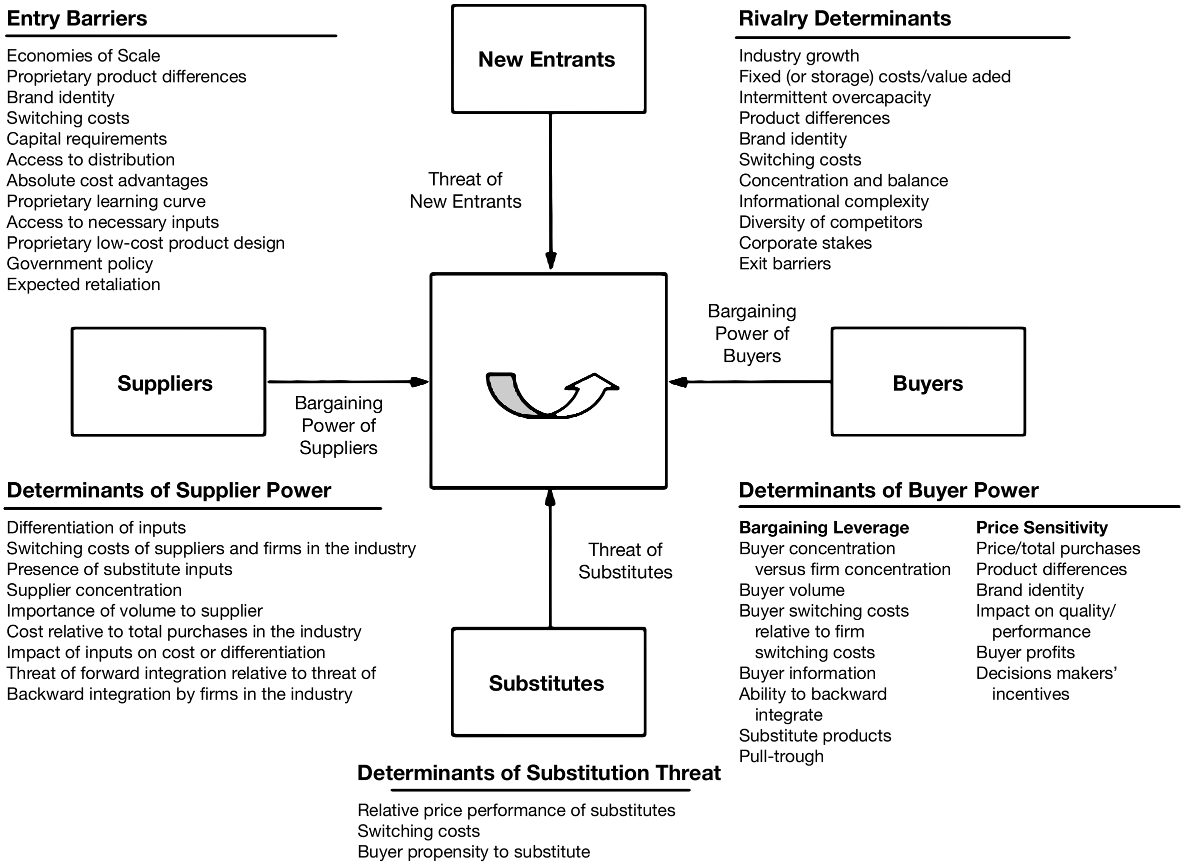

Figure 8.4
Elements of industry analysis

Source: Porter 2004a: 6, Figure 1-2. Reprinted with the permission of Free Press of Simon & Schuster, Inc., from *Competitive Advantage: Creating and Sustaining Superior Performance* by Michael E. Porter.

structural comparison deepens the results of industry analysis and provides information about alternative strategic approaches.

8.1.4 Company analysis

The options of companies for decisions and action are determined by their strategic and operating resources. Company analysis thus consists of a systematic investigation of the strategic and operating potential of a company or business. In strategic planning, this applies to every aspect of management and output provision. Several aspects in particular must be analysed (Thommen and Achleitner 2006: 926–7):

- customer structures;
- product and service programmes;
- employees' qualifications and skills;
- quality of management and type of corporate culture;
- the company's performance, development and policies; and
- the company's policy, goals and value system.

At least in larger companies, the main problem is how to select for strategic planning the relevant data and experiences from the plethora of available information. Moreover, the data are rarely pre-structured in such a way as to correspond to strategic issues. In small and medium-sized companies, the data are obtained only with considerable effort. When interpreting current strategic and operating data, the analyst must be aware that they reflect the past and in the best case the present; they may not necessarily apply to the future. The findings may be condensed into a catalogue of business strengths and weaknesses. The goal is to take advantage of the strengths that have been identified and determine to what extent any weaknesses can be compensated for or eliminated.

Establishing *strategic business units* separates the areas of a company for which specific strategies can be elaborated (Bea and Haas 2005: 135–6). The selection of business segmentation criteria depends on the company's previous development and corporate culture. Establishing business units alters the structure and hierarchy levels of a company. Strategic business units might include the following:

- Products and product groups: Units are oriented towards products and product groups.
- Customers' requirements: Customers' requirements provide the criterion for distinguishing between business units. The idea that the company provides solutions to meet customers' needs represents a basic attitude to markets and marketing.
- Customers: Organising units in accordance with the customer structure leads to the establishment of market segments.
- Technology: The establishment of units is guided by specific technologies that are used by the company for its value-added activities.

– Regions: The units are established according to geographic areas involving specific entrepreneurial approaches and objectives.

A company's activities may be categorised as *primary*, defined as the design, production and marketing of products, and *supporting*, such as determining goals and objectives, planning activities and work procedures, organising information and communication circuits and engaging research and development projects. Primary and supportive activities together, in various combinations, are the basis for value creation and successful coordination of business activities.

Individual analyses may be carried out (Aeberhard 1996: 180–1; Lombriser and Abplanalp 2005: 150–1). Examples of this type of investigation include the following:

– Costs of activities: How and to what extent do the costs of the various activities influence the profit margin?
– Value creation in individual activities: Which activities lead to the creation of value and at what amount?
– Comparison with competitors: How does the company's value chain compare with those of its competitors?
– Potential for differentiation: What activities can the company use to stand out from its competitors and obtain competitive advantages?
– Customer orientation: Are activities oriented towards customers?
– Synergies: What synergies between individual activities are available to increase value creation overall?
– Links: In what ways are activities linked to suppliers' and customers' value chains?

The analysis of internal value chains allows a consistent evaluation of, for instance, manufacturers. It provides strategic and operational information on the network and links among value-adding activities, suppliers and customers. Analysing value creation is important in projects aimed at cost reductions and rationalisation. An important indicator is the hours of labour required for individual activities, as recorded in work reports or determined by activity sampling (Daenzer and Huber 2002: 507). The difficult part is the assessment of the value arising from the individual activities. Direct costs can be immediately linked to a particular value-creation process. Special attention should be given to overheads, which often increase unnoticed. The influence that overheads exert can be examined by a value-creation analysis (Seiler 2007: 76–7). Figure 8.5 shows an example of the relation between activities by cost types causing costs for procurement of goods and services, manufacturing, administration, costs for research and development and selling costs.

Gap analysis is a useful tool in strategic planning (see Figure 8.6). *Strategic gaps* arise from a difference between the level of achievable improvements and the target projection for company development set during strategic planning. The size of the gap provides information about the changes required for strategic

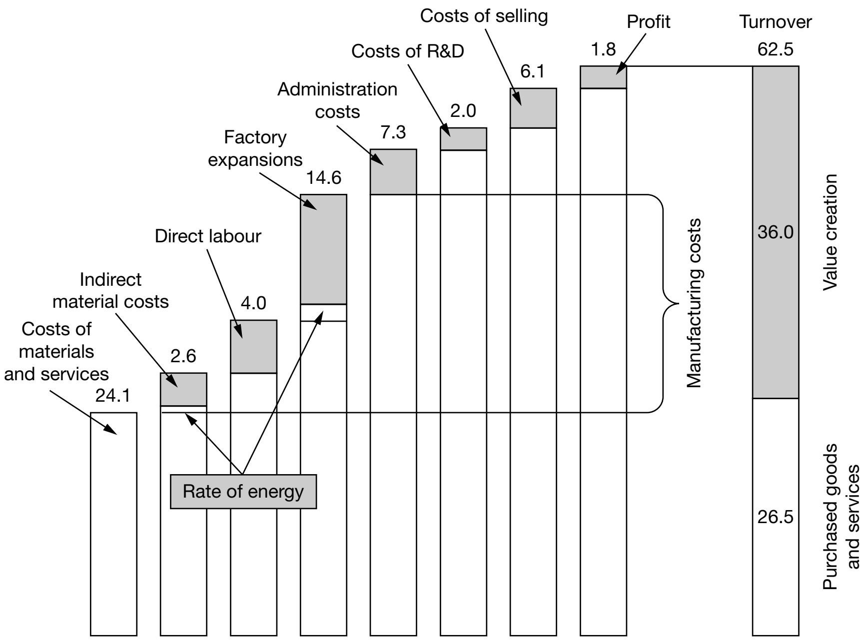

Figure 8.5 Example of a value creation analysis (modified)

Source: Seiler 2007: 75. © 2007 Orell Füssli Verlag AG, Zurich.

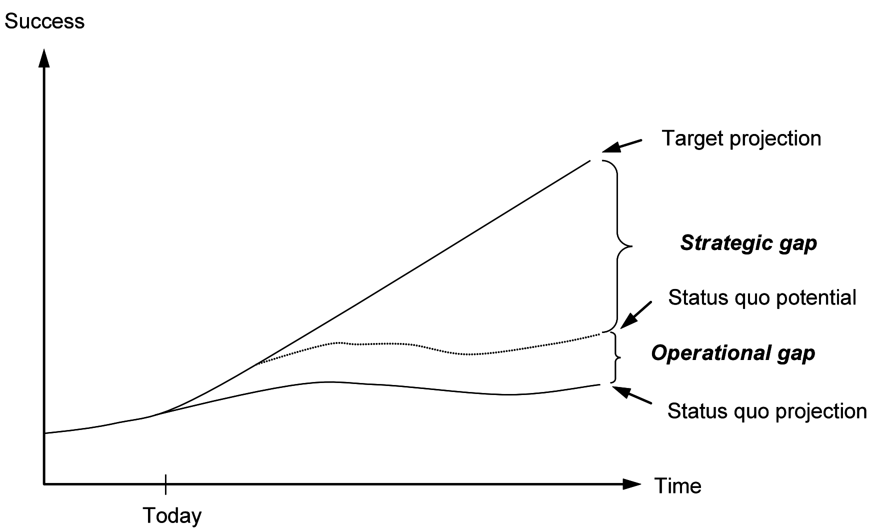

Figure 8.6 Strategic and operational gaps

Source: Bea and Haas 2005: 162

reorientation. *Operational gaps* describe the difference between projected developments without changes (the status quo projection) and potential improvements at the operational level that can be achieved without applying additional strategic measures. Potential operational improvements may lie in cost management, for example, or in providing employees with consistent motivation.

Unique selling propositions (USPs) are capabilities and potentials that enable companies to achieve above-average results for a longer period than their competitors. Successful positions are identified by a strategic analysis, and the aim is to maintain those positions and establish new ones. A USP may be present in any business area of a company. Long-term above-average success may result from competitive products, penetration in attractive markets and better access to resources. Capable and innovative employees and competent control over the different activities in the value chain contribute to additional value creation.

Establishing and maintaining a competitive position in production and in the market depend on a concentrated application of operating resources. Because business resources are limited, it is not possible for companies to establish any number of USPs, and often a company must choose among alternative USPs. Such propositions can be established if all operating areas contribute through intensive collaboration. This is a medium- to long-term task, and defining the USP is a far-ranging decision in management and strategic planning.

In a business environment marked by changing products and technology as well as by consumer demand, long-term success is based on *core competences* (Eschenbach *et al*. 2003: 124–5) – the expertise and skills that enable a company to operate successfully and take advantage of forward and backward links of the value chains in which it operates. Core competences form the basis for successful company development. Profitable links to business fields are provided by core products – essential goods and services or substantial components to final products that make a major contribution to their market value (see Figure 8.7). These products give a company long-term advantages because they represent market niches that have not yet opened up (Lombriser and Abplanalp 2005: 167–8, 295).

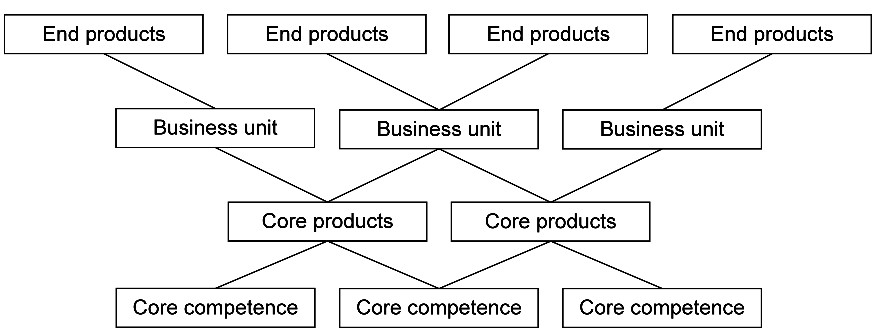

Figure 8.7 Competence as basis for competitiveness

Source: Eschenbach *et al*. 2003: 125, © 2003 Schäffer-Poeschel Verlag für Wirtschaft, Steuern, Recht in Stuttgart.

A company must recognise its core competencies and formulate them clearly as strategic goals. Identifying core competencies focuses attention on the prerequisites for competitive success. The process of identification is best carried out by a team that comprises employees from different areas of the company. To prevent blindness to the company's own failings, it is useful to include external experts. Because expertise and skills play a central role in developing new core competencies, the company must compete in acquiring the necessary resources and employees.

The concept of core competencies was developed in companies operating in dynamic global markets driven by technology. As an important strategic approach, it is still comparatively new, and few tools are available. The extent to which a focus on core competencies can be applied to small and medium-sized businesses is yet unclear.

8.1.5 Assessing strategic options

Assessing successful business strategies involves weighing alternatives, since the first one developed may not necessarily be the best. The alternatives should not only differ in details but also represent fundamentally different approaches (Daenzer and Huber 2002: 161–2). The focus is on thinking about how future business models can be designed by combining value-creating and auxiliary activities that suit the company's goals and purposes: which current activities should be continued, which new ideas should be undertaken and which should be dispensed with. Many sectors have business models, developed during a period of growth, that are in widespread use.

Strategic considerations in forestry and the wood industry refer, for instance, to optimal combinations of wood-assortment programmes and to the determination of wood harvesting potentials at the country level (Hofer *et al*. 2011; Kaiser 2008). Business options involve the choice of efficient production technology, strategic partnerships in procurement and selling activities or outsourcing of entire sections, such as harvesting and logistics, within the value-creation chain (Schewe 2007; Scholtissek 2004).

Other questions are whether to own or lease forestland or buy raw materials, whether to focus on exports or domestic markets and whether to aim at integrated plants controlling all raw material flows or sell certain wood assortments and co-products from intermediate production processes to other companies. A decisive factor for assessing a strategic business option is its appropriateness for given entrepreneurial conditions, the adequacy of the resources available to implement it and its versatility and adaptability to changing external conditions.

The concept of the learning curve was formulated in the 1960s and 1970s by the Boston Consulting Group on the basis of empirical investigations (Lombriser and Abplanalp 2005: 185–6, 251). It was found that doubling the cumulative production quantity led to a 20 per cent to 30 per cent reduction in unit costs (see Figure 8.8). Such an empirical finding may have a variety of causes:

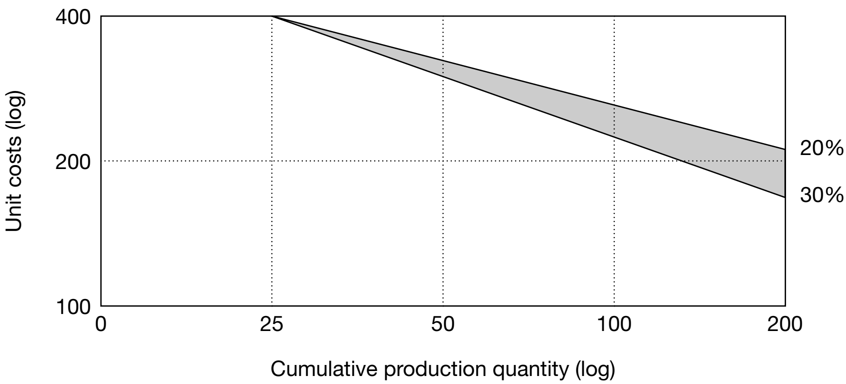

Figure 8.8 Learning curve

Source: Bea and Haas 2005: 128

– Increased experience and training produced by temporal and quantitative repetition of work processes lead to a reduction in individual input time, increased quality and lowered costs – hence the term learning curve.
– Increasing production quantities are usually associated with improvements in plant facilities and equipment with better performance, which in turn may lead to higher productivity and lower unit costs.
– Large production quantities provide greater scope for standardising products and employing more specialised staff.
– Manufacturing efficiency increases the knowledge of product characteristics and leads to higher familiarity with product quality among customers. This provides new opportunities for product modifications with better services and eventually a reduction in product costs.
– Increased production quantities make it possible to take advantage of economies of scale. This reduces fixed costs per unit and offers new opportunities to use low-cost production processes.

Cost advantages play an important role in competition, and the learning curve indicates that larger market shares can lead to corresponding competitive advantages. It is an argument in favour of efforts to advance concentration and rationalisation. However, this approach is just one of several options; the learning curve by itself does not indicate which operational and strategic measures will be most appropriate. Consistent cost management is essential, particularly in saturated markets with relatively homogeneous products. Small and medium-sized companies must consider other competitive factors, such as specialisation and know-how, close contacts with clients and flexibility in providing goods and services.

The portfolio technique was developed in the field of securities trading with the intent to monitor and control the opportunities for profit and the risks of financial investments. The approach can be transferred to other business activities, and the portfolio technique has thus become a standard tool for strategic planning (Bea and Haas 2005: 131–2). Establishing a portfolio allows one to compare factors of the business environment that the company cannot influence with those that it can. Its application is illustrated with the example of a market attractiveness and competitive strengths portfolio developed by the consulting firm McKinsey & Company.

The example analysis assigns strategic business fields to a portfolio with a nine-field matrix, providing a visual assessment of the earnings capacity and risks involved in the overall operating activities (Seiler 2000: 270–1; see Figure 8.9). The relative market share (x-axis) of the portfolio is compared with the market growth rate (y-axis), and the relative competitive strength of different business fields is assessed based on selected parameters (e.g. low, medium, high) for each market or product. The size of the circles shown is related to central strategic factors, such as the turnover achieved in each business field. The positioning of business fields in zones A, B and C indicates different strategic thrusts.

Zone A represents fields with few current prospects for future success. However, there may be reasons for maintaining some activities – for instance, because they deal with stable and reliable markets. Or there may be opportunities to increase market growth rates by employing new technology and design. In any rate, the A product group needs careful analysis, and it may be necessary to abandon these

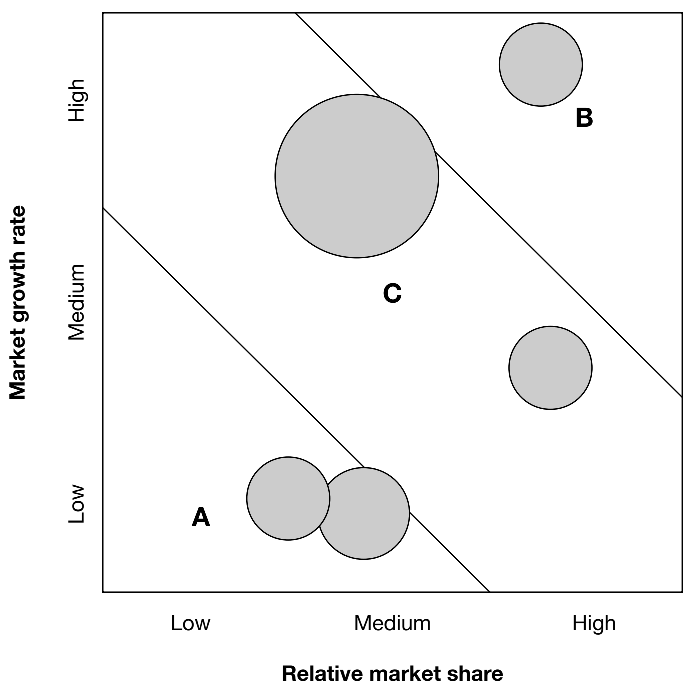

Figure 8.9 Market attractiveness and competitive strengths portfolio

Source: adapted from Seiler 2000: 283. © 2000 Orell Füssli Verlag AG, Zurich.

activities down the road. The resources they generate could then be used for strengthening other product groups in the market portfolio.

Zone B shows fields in which the company's market position could be expanded. However, the company has already reached a strong market position, and future growth would depend on the total market volume of the product. Considerable additional investment and financial resources may be needed.

Selective strategies need to be developed for business fields in zone C. In general, the fields should release resources to finance activities in zone B. This requires a decision about which fields need to be strengthened and which ought to be abandoned in the medium term. Further considerations concerning zone C lead to the development of a target portfolio based on a market attractiveness prognosis. Measures are then developed to reorient the current portfolio towards the target portfolio.

Portfolios can be constructed with different variants, and the number of selected fields can change. The strength of this assessment technique is that it applies to many situations and provides an analytic screen to systematise economic connections, expose problems and generally develop strategic thinking. The analytic screen can be adapted to a specific problem and used to explore options. However, the portfolio technique has its drawbacks, as the strategic conditions involved are usually reduced to only two dimensions (Bea and Haas 2005: 156–7). It thus simplifies the complexity of the factors involved in entrepreneurial activities. Dependencies and synergies between different business fields need to be taken into account. Activities in zone A may still be attractive, for example, because they are a prerequisite for business fields in zone C. The standard strategies described for parts of the portfolio can be used as templates but should be questioned.

SWOT (strengths, weaknesses, opportunities and threats) analysis links findings from the business environment analysis with those of a company (Lombriser and Abplanalp 2005: 197–8). It starts with the idea that successful companies take advantage of their strengths and use the opportunities found in their business environment, while recognising their internal weaknesses and reacting quickly to external threats. Strengths and weaknesses can be compared with opportunities and threats in a matrix (see Figure 8.10). The question is which strengths or weaknesses are related to specific opportunities or threats and which combinations are important in evaluating strategic alternatives.

Different considerations can be applied to the four fields of a SWOT matrix:

- Strengths/opportunities (SO): Opportunities in the business environment can be exploited using existing strengths. If the SWOT analysis shows a clear emphasis in this field, then the initial strategic situation is good.
- Strengths/threats (ST): In this case it is possible to respond to existing threats from a position of strength. The question is whether foreseeable threats can be avoided.
- Weaknesses/opportunities (WO): To exploit opportunities, the company must neutralise existing weaknesses and convert them into strengths. This requires a change of strategy and concentrated application of operating resources.

Environmental factors / Company factors	Opportunities	Threats
Strengths	*SO Combinations*	*ST Combinations*
Weaknesses	*WO Combinations*	*WT Combinations*

Figure 8.10 SWOT matrix

Source: adapted from Lombriser and Abplanalp 2005: 198

– Weaknesses/threats (WT): This combination indicates that the company is in a critical situation. It cannot respond to threats from a position of strength, and business activities are associated with a high level of risk. New strategies must be developed.

Product life-cycle approaches may be used to assess strategic alternatives in dealing with markets, products, industrial processing and specific technologies (Lombriser and Abplanalp 2005: 189–90). Life cycles generally have four phases: introduction, growth, maturity and decline. An important aspect, when analysing product life cycles, is the timing of profit and turnover. The course of profits is a sensitive indicator; it increases later than turnover, peaks almost simultaneously and then may decline earlier. Life-cycle analysis plays an important role in the definition and evaluation of strategies. For instance, the standard strategies for market growth and market share portfolios in the Boston Consulting Group are based on a life-cycle approach (Thommen 2007: 1142, 1157). The approach may be used in assessing such strategic decisions as choosing production technologies and evaluating general management concepts. However, the boundaries between each phase are often unclear, and it is difficult to predict prospective developments.

The purpose of *sensitivity analyses* is to identify critical factors in achieving strategic goals based on planning assumptions, which are critical to the outcome of a chosen strategic option (Daenzer and Huber 2002: 215–16). Given the company's strategic planning standards, critical effects and limits and their consequences are evaluated for acceptability. Qualitative and quantitative planning parameters whose values do not meet the standards are identified. In a second procedure, planning parameters are divided into consecutive steps and the combined effects on foreseeable results are analysed. Planning parameters considered critical for success are regularly monitored during the implementation phase.

In *scenario analysis*, the decision-making situation is represented in a mathematical model reflecting connections between planning parameters and the anticipated results of a selected strategy. Potential parameter effects are incorporated into the model in the form of probability distributions to allow for assessment and calculation of risks. Since there is 'no certainty about uncertainty' and probability estimates are often based on further assumptions that would need to be confirmed empirically, the anticipated risks require caution and careful interpretation. Risk assumptions apply only when the factual technical or socio-economic assumptions underlying them are proven valid during implementation.

Decision tree analysis is based on an assessment of options for alternative actions during implementation of a strategic decision. The assessment of the estimated degree of uncertainty, once the project is started, and subsequent monitoring confirm or refute the validity of the chosen options. The strategic problem is divided into individual decisions and events that build on each other successively. Decisions and events, concrete situations and possible alternative options that follow each other are represented as nodes and linked with lines to form decision-making 'trees' (Daenzer and Huber 2002: 466–7). The advantage of this kind of analysis is that it provides opportunities to choose alternative actions along the route towards the goal. This allows a differentiated analysis of strategic problems and provides flexibility in implementing the selected strategy. It requires a very good understanding of cause-effect relationships and the various possible options, fast and accurate data monitoring and regular and critical feedbacks between line managers and the strategic and controlling units.

Strategies deal with the future and are thus associated with uncertainties and risks. Various procedures can be used to estimate risks and uncertainties and incorporate them into decision-making processes (Culp 2001: 209–10). *Risk assessments* are commonly applied to investment decision making but are becoming important in other business areas as well. One risk that may need to be analysed in more detail is climate change, which may increase the risk of fire, flooding and wind throws and thus weaken the assumptions underlying current practice.

In risk analysis, the given decision-making situation may be represented in a mathematical model that reflects the connections between planning parameters and expected results of the selected strategy. The potential effects of the planning parameters are incorporated into the model in the form of probability distributions so that the risks of a strategy can be calculated. Because probability estimates are often based on assumptions and there is no certainty about uncertainty, the results of this type of calculation require careful interpretation. They certainly apply only when the basic assumptions underlying them are valid. In addition, the risk assessment is based on probabilities and not on the actual causes of the uncertainty.

PIMS, which stands for *profit impact of market strategies*, is an empirical approach based on results for more than 3,000 strategic business units in more than 450 companies in various industries and regions (Seiler 2000: 301–2). Statistical analysis of the factors affecting business profitability (return on investment, or ROI; see Chapter 5, Section 5.2.5) and cash flow showed that 80 per cent of the differences in profitability between companies could be explained by 37 sometimes interdependent factors (Bea and Haas 2005: 117–18). Moreover, 60 per cent to 70 per cent of the differences were attributable to only eight factors:

- Intensity of investment: High investment has a negative influence on ROI. It leads to high fixed costs and prolongs high-capacity utilisation rates, making it more difficult to modify or withdraw from business operations.
- Productivity: High productivity leads to a high ROI. It is indispensable when there is a high level of investment activity.
- Relative market share: A high market share has positive effects on profitability because of the positive effects on the learning curve and greater market power.
- Market growth rate: High growth rates in markets generally have positive effects on ROI. However, expanding the business requires extensive financial resources for additional investment.
- Relative quality: High quality has positive effects on ROI. If price competition is not possible because of the cost structure, high-quality products contribute to maintaining or increasing the market. It is the customer rather than the producer who decides what counts as high quality.
- Innovation: A high rate of innovation requires a certain level of turnover. For companies with small turnover levels, it is usually difficult to finance the necessary research and development.
- Vertical integration: The effects of vertical integration depend on the market situation. It is advantageous in mature, stable markets but not in unstable markets. Even when the company has a small market share, vertical integration has positive effects on ROI.
- Customer profile: Small numbers of customers are advantageous at a similar level of turnover because less marketing activity is needed.

Analysis of the PIMS database shows only correlations and not causal connections. Problems arise in relation to the transparency of data and methods used in the original analysis. There are successful companies that pursue different strategies. Although the PIMS results cannot take the place of independent critical thinking, they do support rigorous analysis of existing and new strategic alternatives.

8.1.6 Choosing strategies

Strategy determines a company's medium- and long-term development and the allocation of operating resources to business activities. In choosing strategies, managers face myriad decisions. Strategic options include both the standard strategies of business management and strategies specific to the situation of a particular company. For a sawmilling company, for example, a basic decision is whether to enter a new business field with competitors in the building materials industry. Promoting wood as a versatile and modern building material may be a promising way to compete against other construction materials. The company may also continue competing with other companies using the same technologies in the sawmilling branch. For strategic positioning, it needs to emphasise price competition. And it may look for other ways to distinguish its output – for instance, highlighting fast and reliable supply capacities, consistent sawnwood quality and drying standards and certification for roundwood material origin. In the first case, a major strategic aim is probably reaching a strategic size through cooperation with another wood-processing sub-sector. In the second case, the challenge lies in distinguishing one's own business by highlighting flexibility and attention to customer demands.

Table 8.1 provides an overview of business strategies that are relevant in different companies. It distinguishes basic, secondary and niche strategies as well as personnel strategies. The latter are essential in strategy implementation.

Thommen and Achleitner (2006: 960) identified the following aspects to be considered in selecting strategic directions.

Changes in company size: Depending on business environment, company policy and market changes, it may be useful for a company to alter its size structure within the following options:

– Expansion strategies: the company grows.
– Consolidation strategies: the company's current activity level is secured.
– Shrinkage strategies: the company's size is reduced by focusing on more rewarding products and activities.

Strategic cooperation: Several options exist, each with implications for a company's legal and economic position:

– Cooperation strategies between independent companies involve collaboration with one or more market partners in one or more business areas. The partners remain legally independent but use contractual arrangements to structure their cooperation.
– Participation strategies allow a company to influence business areas that it does not handle directly. Joint stock companies are an example.
– Acquisition strategies depend on the level of participation by third parties, which usually takes the form of purchasing equity. A company may remain independent or merge with the investor (the purchaser of the equity) to form a structurally new company.

Behaviour towards competitors requires a strategy that may take one of two approaches:

– In offensive strategies, targeted measures are used to create competition with other companies' activities. This takes place at the level of pricing policy and may lead to countermeasures.
– Defensive strategies are taken by companies attempting to stand their ground or defend themselves against competitors pursuing offensive strategies.

Table 8.1 Overview of business strategies

Basic strategies	*Secondary strategies*	*Niche strategies*	*Personnel strategies*
Growth strategies	Growth strategies	Regional	Recruitment
• Market penetration	• Expansion		
• Market development	• Consolidation	Target market	Social innovation
• Product development	• Downscaling		
• Customer diversification		Product group	Attractive working conditions and arrangements
	Cooperation strategies		
Competition strategies	• Independence	Branding of special products	
• Cost leadership	• Cooperation		High productivity
• Differentiation	• Participation	Rapid response to market demand	
• Focus on selected activities	• Acquisition		Staff motivation
		Innovation	
	Attitudes towards competitors		Reduced costs
	• Offensive strategies	Cooperation (e.g., in procurement)	
	• Defensive strategies		Salary incentives
		Differentiation of markets	
	Extension of business domain		
	• Concentration	Complementary goods	
	• Lateral extension		
	• Forward and backward extension		
	Synergistic potential		
	• Raw materials		
	• Technology		
	• Clients		

Source: modified from Perchthaler 2012: 33–7

Range of business fields: Independently of other market partners and competitors, a company may decide to limit or expand its business field for strategic reasons:

- Concentration strategies on core competences have the advantages of relying on greater specialisation among the agents involved and benefitting from better knowledge of the markets.
- Standardisation of mass assortments offers cost advantages in warehousing and reduction of fixed costs.
- Diversification strategies seek to reduce business risks by increasing the range of potential business opportunities. Industrial conglomerates, for example, use this approach.
- Strategies for forward (or backward) integration incorporate to a greater extent the sales (or supply base) potential into the business's activities.

Exploring potential synergies: Synergies can be achieved when a business goal, particular product or traditional market segment is integrated into corporate activities instead of viewed as an isolated component. Strategies for identifying potential synergies can be oriented in different ways:

- Strategies based on a raw material achieve synergy when it is used in an innovative way, achieving higher productivity in the value chain.
- Strategies based on more competitive technology use innovative manufacturing processes.
- Strategies based on customer demand and preferences attract specific customer groups interested in a combination of goods and services.

The focus of economic growth as a basic strategic goal may be either products or markets (Bea and Haas 2005: 163–4; see Figure 8.11).

A *market penetration strategy* aims at growth in existing markets with products that are already available. It is comparatively easy to implement in expanding markets, since growth in demand provides new opportunities in both quantity and quality of products and services. In saturated markets, however, this strategy requires gaining market shares through a substantial commitment of resources and at the expense of competitors.

A *market development strategy* makes inroads into previously unexplored demand to gain new customers for well-established products. This can be done by expanding into new regions or by acquiring new customer segments through market research. Examples are promoting the use of laminated wood with controlled strength standards as a load-bearing component in the construction industry and selling medium- and high-density fibreboard for furniture production.

In a *product development strategy*, new products are developed and introduced into existing markets. This requires research and development effort and appropriate marketing strategies. In forestry, an example is providing marketable environmental and recreational services where demands are only just emerging.

Product Market	Current	New
Current	Market penetration	Product development
New	Market development	Diversification

Figure 8.11 Product-market combinations

Source: Bea and Haas 2005: 163

In roundwood supply, there is considerable potential for developing more customer-specific assortments. New wood-based products, including composite materials, illustrate the importance of product development strategies in the wood industry. Markets regarded in the past as static are in fact open to innovation, providing opportunities for new processed wood products that are competitive with other materials.

Diversification strategies can be undertaken horizontally (i.e. at the same step in the value-creation chain) or vertically (i.e. at prior or subsequent steps). They may be unrelated to the company's previous activities or based on its current strength and experiences. Diversification may reduce entrepreneurial risks, since it represents a form of targeted portfolio management. Examples of diversification in forestry and the wood industry include offering new types of services and goods in collaboration with companies in other sectors. However, it is difficult to manage areas of business that require different competences and resources.

Porter (1990: 38–40) distinguishes four generic strategy types in facing international competition within an economic branch and among companies. A differentiation strategy builds on offering high-quality products and services at premium prices to the market. With a cost leadership strategy, companies aim at keeping and expanding their market share with low prices for their products and services. Focused differentiation is a strategy of offering highly specialised products and services to customers, and finally, strictly cost-focused strategies consist of relatively simple standard products and services that can be produced at low cost and sold at low prices. The possible combinations between broad and narrow targets in competitive scope, cost and sales price considerations and product differentiation levels show that there are important options and strategic decisions to be made within an industrial branch or among companies (see Figure 8.12).

With a *differentiation strategy*, a company improves its competitive position by offering products that are highly specialised, unmistakable or unique. Differentiation approaches are possible in every area of a company, including product utility, design, advertising and distribution. Specific product characteristics or designs that are difficult for competitors to provide at the same quality ensure a strong competitive position. Differentiation is aimed at competition within the entire industry.

A *cost leadership strategy* achieves a cost advantage over a company's competitors. Companies having a large market share make use of the learning curve, exploit scale effects in production and negotiate favourable terms with suppliers and customers. Pursuing a cost leadership strategy is particularly useful for standardised products that offer little scope for differentiation. A typical example is the pulp and paper industry, in which the strategy is leading to concentration and development of worldwide operations with high production capacities. There are other opportunities as well; product design, innovative technologies and production process efficiencies can likewise help a company reach a favourable position in cost management.

A *focal points strategy* means taking advantage of niches, such as specific customer groups, products or services, or concentrating business activities in certain countries and regions. Focal point concentration is based on the assumption that a company with specialised knowledge and experience can exploit a limited sphere of action better than its competitors. Regional niches are seen, for example,

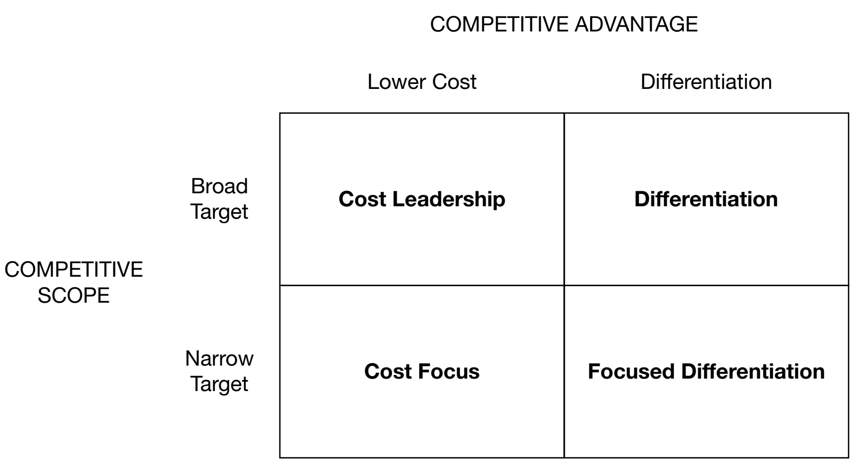

Figure 8.12 Generic strategies

Source: Porter 1990: 39, Figure 2-2. Reprinted with the permission of Free Press of Simon & Schuster, Inc., from *The Competitive Advantage of Nations* by Michael E. Porter. © 1990, 1998 by Michael E. Porter. All rights reserved.

in recreational services when forest companies develop products and services that capture demand from nearby city dwellers. Highly skilled artisans who do custom work and small and medium-sized industries that offer a variety of product assortments and quality standards also concentrate on focal points and occupy other niches.

Focusing strategy on diversity management: Diversity management has become an important aspect in strategy development and implementation because of the increasingly international character of business and trade relations (Schulz 2009: 176–229). Within companies, diversity means multinational or multicultural staffs who bring new ideas and experiences, different cognitive and cultural viewpoints and different country and family backgrounds. In the external business environment, diversity management focuses on the relations between companies, society and the natural environment. For multinational companies, both internal and external diversity strategies are important for competition and innovation. For companies operating at the national and local levels, employees from different cultural backgrounds contribute as well to the internationalisation of expertise, technology and supply chains. A company achieves diversity through well-defined strategies involving personnel management and organisational business policies.

8.2 Controlling

8.2.1 Tasks and organisation

The purpose of controlling is to ascertain whether an enterprise is making a profit and operating successfully in economic terms. Controllers analyse the consistency among business goals, strategic planning processes and operational implementation. (Czenskowsky *et al.* 2004; Deyhle 1997; Jöbstl 2004; Peters and Pfaff 2012; Scholz 2001). Business controlling as a general management concept has extensive relationships with all managerial activities. It forms a bracket around the fundamental aspects of business tasks and all processes taking place within a company. The systematic use of business controlling tools makes it possible to demonstrate to what extent business management activities are carried out in a rational way that ensures performance and avoids major risks and mistakes.

Controlling as an important instrument in analysing the economic rationality of business activities – regarded as the shaping, guidance and development of socio-economic systems – operates at several levels (Weber and Schäffer 2000: 191):

- Controlling is concerned with the facts and figures that underlie implementation and problem-solving management processes. A major part of controlling is providing managers with information and the methods to use and interpret it.
- Rational management demands that company goals be systematically elaborated based on well-thought-out plans making use of reliable information, both internal and external. Monitoring then facilitates adjustments to changes in the company's business environment.

– In a dynamic environment, it is necessary to coordinate planning, information exchange and monitoring. Coordination of the activity areas of the company increases rationality in management and is an important controlling task.
– A new task for controlling in forestry and wood processing today is ensuring the sustained use of renewable resources and reducing the effects of economic production and consumption on environment and biodiversity.

The activity of controlling may be undertaken by individuals, offices or organisational units. To ensure that managers responsible for strategic and operational entrepreneurial decisions act on a rational and coherent basis, the controllers or controlling units are independent. They give managers an opportunity to reflect on their behaviour, actions and accomplishments, and they provide critical feedback and positive stimuli concerning the results.

The tasks performed by controlling staff depend on the particular requirements in a company. They may range from routine and regular checking of financial performance to complex strategic and operational issues. The tasks and responsibilities assigned to controlling units often arise from a need to eliminate deficiencies in company management. If these involve weaknesses in information management, the task of the controlling department is to improve the information base of decision makers. If there are deficiencies in the area of rational decision making, the controller supports management by ensuring that its decisions are more consistently aligned with the company's goals.

Three types of controlling settings can be distinguished (Weber and Schäffer 2006: 10–11, 36–7):

– Controlling is oriented towards the past and focuses on the financial business area. These controllers are often in charge of accounting systems.
– Controlling is oriented towards the future, supporting and checking managers' arguments and decisions.
– Controlling focuses on goal setting, production and marketing of outputs, performance levels and organisational systems; it takes an active part in management steering and problem-solving processes.

The origins of controlling are institutional and lie in the field of government administration (Weber and Schäffer 2006: 2–3). Records of income and expenditure at the royal court in England were kept by an official called a countroller. Beginning in 1778 in the United States, a comptroller was entrusted with monitoring the balance of the country's budget and expenditure. State institutions, such as the Federal Audit Office in Germany, carry out similar tasks today. The historical roots of controlling indicate two core areas that persist today: the private and public budgeting and accounting system and the regular, mostly annual, monitoring function.

The first positions for controllers in private business were created in the United States during the 1880s. The number of such jobs greatly increased in the period after the First World War because of a growing need for communication and coordination in companies, along with declining entrepreneurial flexibility as a result of higher fixed costs for increasingly expensive production plants. New management tools were developed to help companies deal with the economic turbulence of the times. The controller's range of responsibilities expanded, from checking past transactions to becoming involved in company planning and decision-making processes. Accounting systems advanced from the bookkeeping level, and controllers were entrusted with responsibility for designing company planning systems and developing planning instruments to supplement monitoring tools. Controlling rose in importance during the second half of the twentieth century, especially in the United States. In Germany and France, appreciable numbers of controller jobs emerged from the 1970s onward (Weber and Schäffer 2006: 14–15).

Controlling has become a highly demanding task. Depending on the business context, it may cover every area of management but always requires outstanding analytical skills, comprehensive methodological expertise and communication skills. Controlling expertise is now necessary for evaluation and advisory consultancies, and controllers have acquired substantial influence in corporations.

Controlling tasks can be carried out internally, by company employees, or externally, by specialists. In practice, combinations of internal and external controlling processes are quite usual. The common element is that the success of the work depends on the competence and sensitivity of the employees and external experts entrusted with it. Controlling tasks are based on the accounting system and on the findings that emerge from information generated by the accounts.

Standard software packages can assist some analyses. Programmes have been developed for internal controlling procedures allowing systematic monitoring at distinct management levels. This approach to controlling procedure is not labour intensive, it uses internal plausibility tests, and it prevents over-interpretation. A disadvantage is that it does not provide external expertise or fresh ideas from an outside perspective for the company's managers; the analysis is limited to processes that have already taken place and based on internal data only.

External consultants with experience and a certain amount of creativity have advantages. They can interpret the data from the accounting system and develop scenarios for the future, and they may conduct research outside the company to obtain additional information and standards for comparison. The role of controllers in this type of people-based model is a highly sensitive one. They have opportunities to make business investigations and comparisons that individual entrepreneurs and plant managers do not necessarily have. External controllers and employees working in specialised internal controlling units need extensive managerial and methodological knowledge for interpreting background information.

As an important part of company management, controlling can provide validation and motivation for employees by reporting problems as well as positive feedback about their work. The central tasks are monitoring, serving as a safety barrier and testing performance. To ensure that results and circumstances are communicated to managers and employees in a suitable form, an internal controlling department is best attached as a consultative staff office.

Controlling tools are designed to collect and process information that affects various parts and activities of a company. Figures that illuminate the main internal and external information systems about the business play an important role (Weber and Schäffer 2006: 167–8, 192–3). These figures are derived from the financial accounting system – the balance sheet, the profit and loss account and the cash flow system. Data on important internal operational processes – for instance, production, inventory, marketing and productivity assessment – are provided by the managerial accounting system. Other information that needs to be analysed relates to organisational processes, the factors that determine procurement and demand, employees' level of motivation and the company's culture and communication with its external stakeholders.

The validity of the figures and importance for company decisions must be critically evaluated. Using figures out of context may lead to false or at best imprecise conclusions. It is the combination of many pieces of information and a coherent examination of their meaning in a given context that provides a balanced picture of the performance of a company. For areas that cannot be captured using figures, qualitative information needs to be gathered and compared with findings from competitors, market segments or stakeholders.

8.2.2 Deviation and internal value-adding analysis

Deviation analysis: Analysing deviations between plans and actual achievements and identifying their causes is important in business controlling. Because of unforeseeable circumstances in planning processes as well as new opportunities and risks during the implementation phase, deviations between goals and attainments tend to be the rule rather than the exception. Changes in turnover, purchasing conditions, operational performance or staff sometimes have direct and unpredictable effects on the level and structure of costs and profits. Managers need to know how and why results diverge from expectations for each business area, product and service and determine the scope available for correction. Since plans and their fulfilment are used to evaluate employees, deviation analyses need to clarify to what extent employees' performance, good or bad, has directly influenced business results.

The procedure of a deviation analysis is illustrated by the example of profit deviation (Seiler 2008a: 379–80). Quantitative aspects play a major role here, and the causes of profit deviations usually lie in several business areas of a company. Parameters to be examined include the cost structure and changes in cost centres associated with production. Figure 8.13 illustrates potential causes of profit deviations. Detailed familiarity with the accounting system and the connections between financial and managerial accounting is a necessity for this type of analysis.

Deviations between projected and actual profit may be caused by sales trends or changes in the cost structure. Differences in sales quantities or the contribution margin may result when prices differ from the predicted values (price deviation), from unforeseen diminished production quantities or from a slowdown in sales

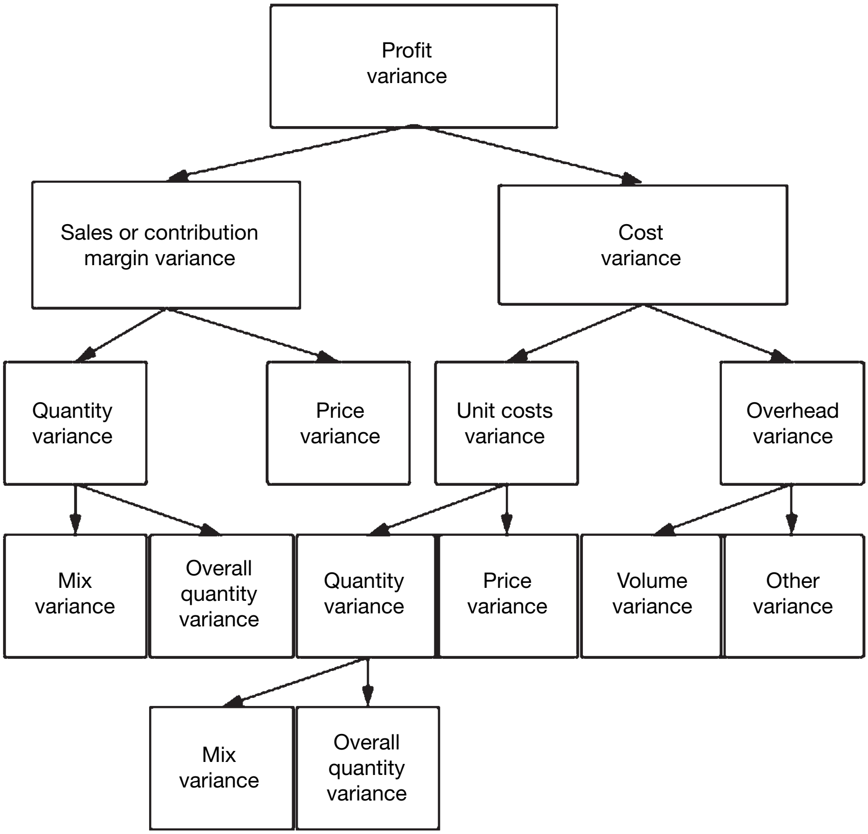

Figure 8.13 Possible causes of profit deviations

Source: Seiler 2008a: 380. © 2008 Orell Füssli Verlag AG, Zurich.

(quantity deviation). When price and quantity deviations are calculated, it is necessary to ensure that the total corresponds to the deviation in sales amounts. This is done by using planned prices as the base for assessing quantity deviations and using actual quantities as the base for assessing price deviations.

An examination of the effects of quantity deviations on the contribution margin provides information about the influence of sales and marketing on profit. When sales quantities change, variable costs change as well. The profit increases by the difference between the increased turnover and the variable costs. Sales of multiple products should be treated separately to show the effect of a different product mix. Deviations in total quantities due to changes in quantities of particular products sold need to be added up in a meaningful manner. Deviations in sales figures may also occur for such reasons as temporary shortages of raw material or labour, changes in the quality of products, breakdown of machinery or difficulties in logistics.

Deviations on the cost side require detailed analysis. Prices and production factors (materials, labour and energy) have direct effects on itemised costs and may be the cause of itemised cost deviation. Quantity deviations are mainly influenced by the employees involved in the production process, which means that work standards need to be used to determine whether production efficiency targets have been met. The causes of price deviation may be complex. A company's purchasing department usually has a considerable influence on the level of price deviation. Analyses of deviations in unit costs are based on production quantities actually achieved. Deviations in overhead costs are another important element that needs to be analysed, since such costs have a major influence on the cost level in cost centres. They tend to develop unnoticed because they are not directly connected with production quantities.

The controller must also distinguish costs that can and cannot be influenced by management during the period of analysis. Overheads usually contain a large proportion of fixed costs, which are independent of the quantity produced. Fixed unit costs may differ from the planned values because the use of a production plant was higher or lower than anticipated. This deviation, known as volume variance, is not capable of being influenced by the manager of a cost centre (see Figure 8.14). Only the variable overheads that remain can be used to evaluate the cost centre's performance. In this type of assessment, few costs can be regarded as fixed in the long-term view.

Internal value-adding analysis: The managerial accounting system is the source of data for the analysis of internal business activities that support the production of

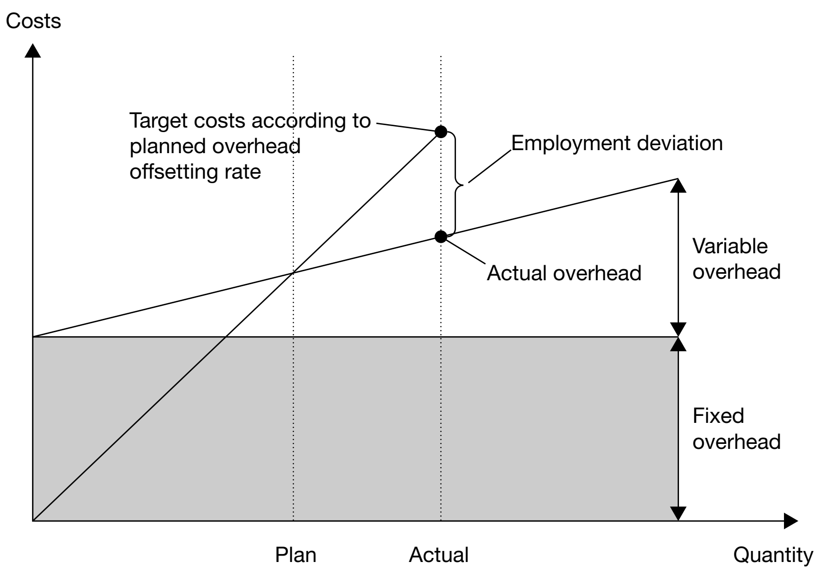

Figure 8.14 Volume variance in overhead analysis

Source: adapted from Reichmann *et al*. 2006: 366

goods and services. It thus provides guidance for improving the efficiency and effectiveness of operations. Although large companies extend their internal information systems by adding analysis modules, the necessary information is not always available in a usable form. In small and medium-sized enterprises, data on employees, production processes and above all sales markets and customer segments are often not gathered regularly or systematically.

The purpose of this kind of analysis is to provide quantitative and qualitative information for improved decision making. There may be several reasons for conducting this type of analysis:

- Valuation in connection with mergers or the purchase or sale of a business or its parts (Helbling 1995; Koller *et al.* 2005), based on profit and loss statements and additional controlling procedures to check the book values of various positions;
- Assessments of potential synergies in collaboration between companies, a circumstance for which routinely available data may not provide the information needed directly, promptly or in a suitable form;
- Special evaluations in critical company conditions to reveal previously unidentified shortcomings and risks; and
- Strategic reorientation in an altered business environment that requires a detailed operations review.

There is no generally valid scheme for the procedure to be used. The characteristics of the company being examined and the purpose of the analysis undertaken determine the content and format for a particular case. Operations reviews are useful and indicate the points to be covered (Tschandl 1999); they are available, for example, for the evaluation of technical and functional contexts and for business management in general.

Elements of an operations review that supports management in the forestry and wood industry include the following:

- Production and value-creation processes;
- Finances and controlling procedures;
- Strategic and operational planning;
- Sales, marketing and communication organisation;
- Purchasing, logistics and warehousing;
- Recruitment policies, staff evaluation and social services; and
- Research and development activities.

8.2.3 Benchmarking

The term *benchmarking* means using reference values to compare and evaluate performance of companies and business units. The method was developed by the Xerox Company in the late 1970s, then spread to Europe during the 1980s and 1990s and attracted considerable attention in academic circles (Sabisch and

Tintelnot 1997: 11–12), generating an extensive specialised literature (Lamla 1995; Meyer 2002; Töpfer 1997). Benchmarking is of considerable importance in private industry, and it is increasingly used for improving performance and efficiency in government and public administration. Although the usual form of operations analysis compares the major performance indicators for an industry, benchmarking identifies competitive advantages along with other management methods and indicates practicable ways of achieving improvements and cost savings. The procedure involves defining the benchmarking object, the reference point that serves as a measure of comparison (the reference object), the criteria to be used for a comparative evaluation and the specific evaluation methods (see Figure 8.15).

Benchmarking stimulates operative and strategic performance processes by distilling lessons from enterprises and agencies that are more efficient and effective in managing their activities and attaining their objectives (Peters and Pfaff 2012: 207–9). It seeks to improve management and production processes by detecting ways to increase quality and quantity outputs and avoid shortcomings, complicated procedures and unnecessary steps. Seeing the success of others is a powerful motivation for managers and staff to look at established habits and practices that are amenable to improvement. Internal benchmarking within a company, public agency or nongovernmental organisation (NGO) has the advantage that access to comparative information can be obtained relatively easily and performance gaps between units can be closed. It is suitable for internal comparisons but does not offer a bench for comparisons with high-performing reference objects outside the company or business unit.

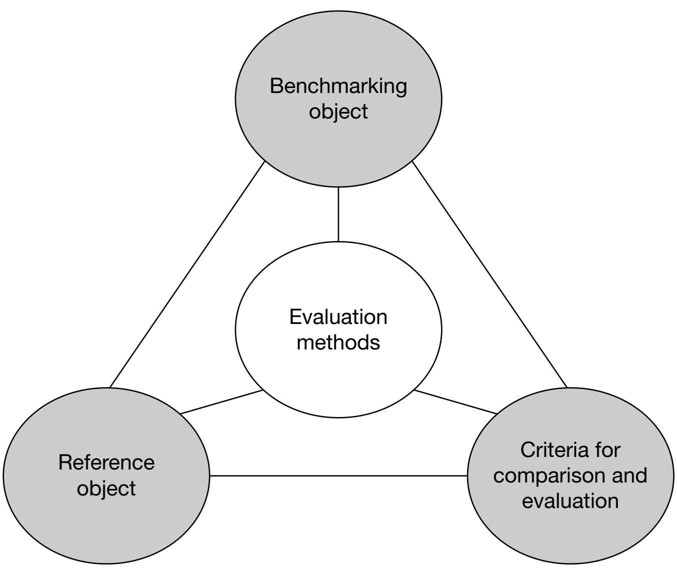

Figure 8.15 Basic elements of benchmarking

Source: Sabisch and Tintelnot 1997: 21

External benchmarking involves assessment of practices in a company's own sector or in other sectors. Analysis of benchmarking objects within a sector can reveal competitive standards or innovative 'best solutions'. Carefully conducted comparisons between individual companies or groups of companies can provide a great deal of information for the development of a competitive strategy. The selection of objects for comparative analysis is thus an important control factor and determines the validity and quality of the findings. Indicators for the selection can be obtained by referring to the critical structural characteristics of the enterprises being compared. Comparisons with strong competitors are promising because they offer information about potential sector-specific performance standards ('best practices') and entrepreneurial innovations.

A major advantage of the benchmarking method over traditional business comparisons is thus that the analysis can be extended to reference objects in other sectors (see Table 8.2). Problems related to processing sequences are not necessarily limited to one's own sector. Benchmarking investigations may thus be undertaken at various levels of activities, objects and targets in business as well as at the performance level of tasks that are accomplished in public governance and administration. Benchmarking objects include both products (goods and services) and processes (logistics, production, strategy development or administration procedures). Usually, certain subordinate parts of business or particularly important products are included in the analysis.

In sector benchmarking in forestry, it is mainly summary data from official statistics that are used. These indicate average values for large groups of companies or for the sector as a whole and are suitable for general classification and assessment of one's own company's strengths and weaknesses. By contrast, it is not useful to orient one's own entrepreneurial goals towards average values for the sector: these performance indicators provide hardly any information about

Table 8.2 Reference classes in benchmarking

Reference class	*Reference object*	*Goals*	*Remarks*
Internal benchmarking	Corporate branches and business areas	Improved corporate performance	Requires favourable conditions for comparison; has limited potential for improvement
Sector-related benchmarking	Competitors, other companies in sector	Competitive advantages, market leadership in sector	Is closely related to competition analysis; requires constant analysis of developments in sector
Intersector benchmarking	Company with best solutions for specific issue	Competitive advantages, best solutions	Identifies analogies, specific adjustments for companies; has extensive potential for improvement

Source: Sabisch and Tintelnot 1997: 25

future potential and instead represent averages for past developments (Weber and Schäffer 2006: 62, 337–8). In addition to official statistics, data for business comparisons come from industry associations, the Central Office for Market and Price Reporting in Germany, state forestry administrations and the test business network run by the Forestry Experimental and Research Institute in Germany (Brandl *et al*. 1999).

Qualitative and quantitative evaluation procedures may be used (see Figure 8.16). Qualitative assessments may involve personal judgements or yes-no decisions recorded using questionnaires and interviews. Quantitative assessments can use utility analysis, specific pre-investment analysis procedures or defined technical and economic performance parameters. Specific evaluation methods should be chosen with an eye to the purpose of the benchmarking.

Time series and business comparisons provide information and aids for the classification of business results. They are based mainly on quantitative data, but qualitative elements may be added. In forestry, time series usually focus on comparisons of costs and productivity for wood harvesting, stand planting, cultivation and forest road maintenance. Management of forests is increasingly subject to analysis that provides indicators for assessing ecological sustainability, biodiversity and landscape conservation in certification schemes used at country or sub-national levels. The validity of time series in the wood-processing industry depends on whether a sufficiently large number of companies in the sector are willing to provide figures in accordance with agreed instructions and allow them to be analysed. Because of rapid concentration in the wood industry, business

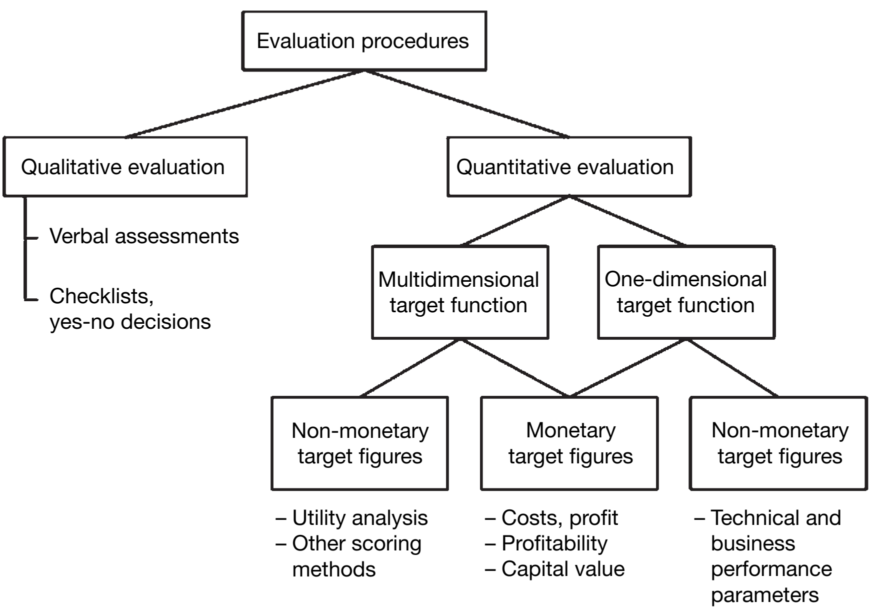

Figure 8.16 Qualitative and quantitative evaluation procedures

comparisons now need to be carried out at the international level. Industry associations, and occasionally consultancy companies and research institutes, often conduct this type of research, which requires gaining the confidence and trust of the companies to be included in the study.

Difficulties in comparing test enterprises arise if the structural characteristics of the units examined are not sufficiently homogeneous (Jöbstl 2000; Sekot 1998; Sekot and Rothleitner 1999, 2009). In forestry, this may be the case when management units focusing on wood production are compared with forestry units whose management goals are primarily protection and recreation forests. Difficulties also arise in international comparisons if the reference values are collected in different ways and influenced by factors that are not adequately described. Assigning businesses to a specific sector or investigation unit can be difficult when comparing horizontally integrated companies with companies in the wood industry that are vertically integrated over several production steps.

8.2.4 Balanced scorecard

The balanced scorecard approach offers an interesting example for developing and structuring a comprehensive business strategy. In 1996, Robert Kaplan and David Norton published *The Balanced Scorecard: Translating Strategy into Action*, a book based on their 1992 journal article (Kaplan and Norton 1996, 2001, 2005). This book and publications that followed have become the leading source for the balanced scorecard (BSC) concept, a complex and consistent strategic orientation in business management. The authors assert that traditional financial measures are inadequate for guiding and evaluating companies that need to create future value through investments in customers, suppliers, employees, management processes, technology and innovation. Their alternative approach takes a broader perspective to designing, implementing and controlling business strategies in different types of organisations, in both the private and public sectors. It provides support for integrating strategic planning with operational management decisions and uses performance indicators in accordance with the principle that ‘if you can’t measure it, you can’t manage it’.

The BSC framework links four key performance indicators (KPIs) – financials, customers, learning and growth, internal business processes – in order to identify and describe the company’s vision and strategy (Kaplan and Norton 2005: 24–5):

- Financials: The financial figures are a critical summary of the performance of management and the board of directors.
- Customers: The focus is on strategically important market segments. Both interdepartmental and departmental achievements are important for customer satisfaction, customer loyalty, customer relations management and share of profit in individual market areas.
- Learning and growth: Changes in the business environment require changes in employees’ qualifications, skills and attitudes. Learning and development secure the potential for long-term entrepreneurial success.

– Internal business: Critical business processes for companies include those that are already underway as well as new projects that are important for the company's success. These may be short-term production or long-term innovation processes.

Figure 8.17 shows the four key indicators and the specific objectives, measures, targets and initiatives that may determine and characterise the company's vision and selected strategy.

The BSC framework translates strategies into a standard set of operational terms, which include objectives, measures, targets and initiatives and can be used consistently in strategy development and implementation. Figure 8.18 shows the framework for implementing the envisaged strategy. The first stage is clarifying and building consensus on the vision and strategy. The second stage combines communication, education and training, goal setting and performance measuring. Planning, setting targets, determining strategies, allocating resources and establishing milestones are a third stage in a systematic implementation. Fourth is sharing the learning experiences of management and staff; this provides feedback for revising the strategy and making any necessary midcourse corrections and innovations. In reality, the four modules are not discrete or even sequential; implementation is more a mosaic of activities.

Identifying performance-driving factors and incorporating them into the BSC framework ensure that improvements in the operating field show the positive effects on the company's overall goals and strategies. At the operational level of management, these factors provide integrative information on effective and efficient goal attainment. In this way, company strategy becomes a collection of hypotheses regarding the causes and effects of the various states of affairs reflected in it. These hypotheses are represented by using the key performance indicators (KPIs) and make accessible the systematic use of regular controlling procedures.

Basing the method on financial KPIs has both advantages and limitations (Bea and Haas 2005; Kaplan and Norton 2005: 355–6; Lombriser and Abplanalp 2005: 38–9):

– Financial KPIs document the results of operational entrepreneurial activities and are based on actual, verifiable performance achievements, but the information is not immediately available.
– Changes in strategically relevant internal and external states of affairs can be detected, but the changes affect companies' financial figures after a time delay.
– A systematic and regular controlling of the factors that determine the financial results allows critical developments to be recognised at a comparatively early stage. This makes it possible to respond to change more quickly which is particularly important for competitiveness in a dynamic business environment.

Communication between various business units and specialists responsible for the planning system as a whole promotes a shared understanding of the company

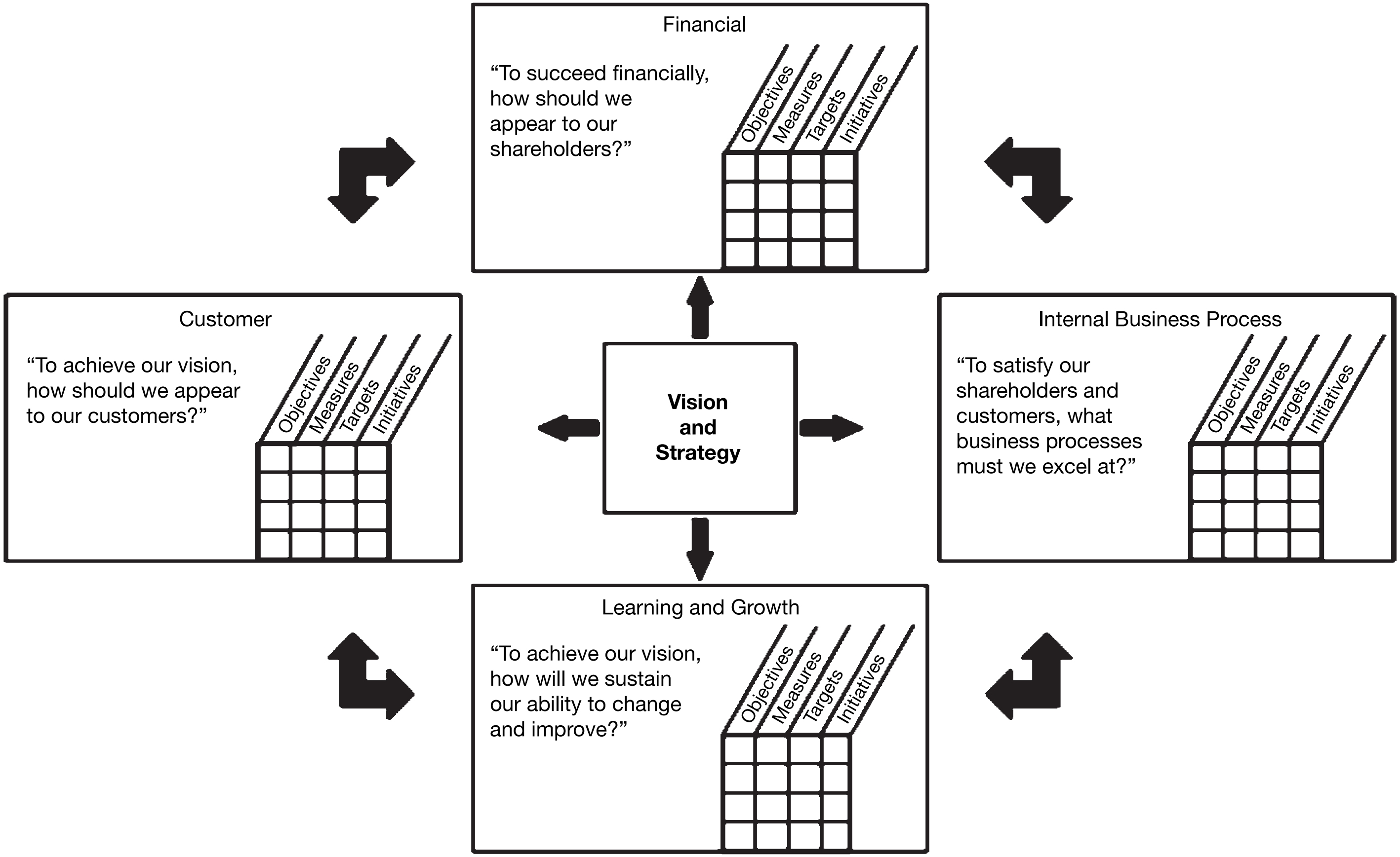

Figure 8.17 The Balanced Scorecard translating a strategy into operational terms

Source: Kaplan and Norton 1996: 9. Originally adapted from ‘Using the Balanced Scorecard as a Strategic Management System’ by Kaplan, R.S. and Norton, D.P. Harvard Business Review, Jan/Feb 1996.

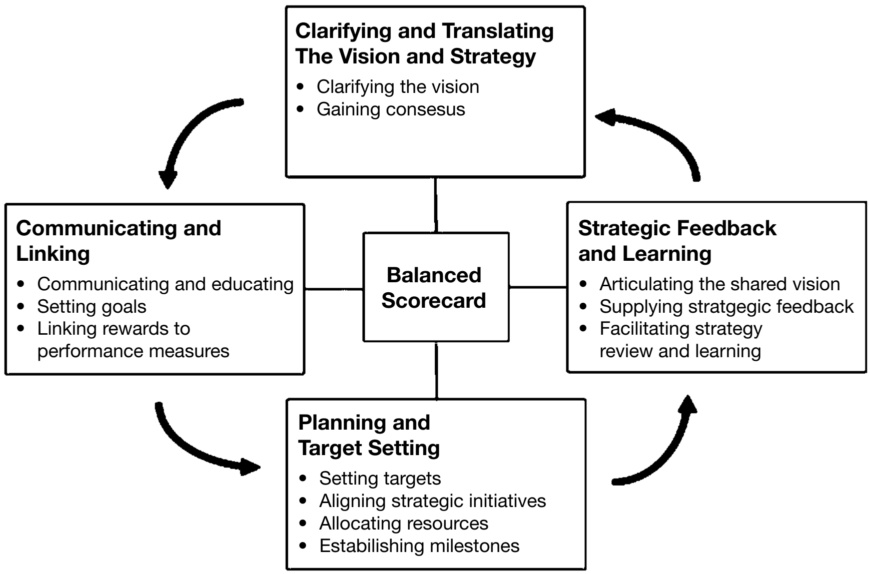

Figure 8.18 The Balanced Scorecard as a strategic framework for action

Source: Kaplan and Norton 1996: 11. Originally adapted from 'Using the Balanced Scorecard as a Strategic Management System' by Kaplan, R.S. and Norton, D.P. Harvard Business Review, Jan/Feb 1996.

strategy that has been adopted. Discussion of indicators, performance-driving factors and financial figures leads to a convergence of the different interpretations often seen in different management teams. The underlying approach of BSC thus overcomes the disadvantages of planning instruments that do not sufficiently take into account the connections among driving factors. However, the difficulty of translating strategies into figures and identifying cause and effect should not be underestimated.

The constant monitoring of important factors and how they are represented by KPIs makes the BSC a document that conveys a large amount of information. The structured visualisation is a good way of giving employees an overview of the company's current situation. It provides constant guidance regarding the business strategy, the factors involved in making it successful and the state of its implementation. The BSC tool can be used as well by nonprofit organisations (Kaplan and Norton 2005: 144–5), where interest focuses on the expectations of members or stakeholders.

The BSC approach draws attention to critical management processes and, looking ahead, provides support for solving problems that arise. It contributes to the following (Bea and Haas 2005):

– clarifying and making operational the company's visions and strategies;

- linking strategic goals with specific measures and activities;
- enhancing communication between levels of management;
- planning specific goals and coordinating strategic initiatives; and
- improving strategic feedback and promoting learning processes.

The construction of a BSC framework is a primary task of management; it cannot be delegated to controlling units (Peters and Pfaff 2012: 186–9). To setup the framework, the first step is determining strategic goals and defining the criteria that will indicate their attainment. The second step could be defining those operational actions that will contribute to reaching the goals. In a third step, one determines operating figures for assessing to what extent individual actions and personal performance are contributing to goal attainment.

8.3 External factors affecting wood-based sector strategies

8.3.1 Multifunctional and sustainable forestry development

Strategy in forestry development and wood processing as important sector activities requires knowledge of the economic, social and political demands in society, combined with a clear perception of the changing business opportunities and risks in the wood-based sector. It also needs an understanding of the current state and potential of forest ecosystems – both within a country or region and worldwide – and the role of forests as a multifunctional renewable natural resource. The shifts to sustainable development, a green economy and renewable energy resources are altering the frame conditions of both the private and the public sectors. Entrepreneurs in the wood-based sector need to identify the likely external factors of change and anticipate possible consequences so that they can develop innovative strategies and adapt to new demands, opportunities and risks. They have to be familiar with the European and international political agendas that relate to forests and wood utilisation and reflect the changing attitudes of citizens and decision makers worldwide.

Sustainable forest management starts as a fundamental approach in using a renewable natural resource from the principle that the present level of consumption and its effects on the environment must respect an equilibrium that allows for future options. It requires investments in forest productivity and a long-term view on wood production, and needs to harmonise present interests with future potentials. Sustainable utilisation is linked to concrete economic and technical conditions yet depends on lasting human perspectives and social norms. Sustainability does not express itself as a mere intention for the use of resources or represents only a means of production. Rather, it results from decisions to recognise a full range of forest social functions, economic uses and cultural values.

Sustainable forestry practices in Europe have evolved over several centuries. The central idea, developed and implemented by forest professionals, forest-land managers and scientists, has remained the same. But the context – the forest environment and the socioeconomic conditions of each country – is changing, and the strategies to achieve sustainability are changing with it. The following aspects are of relevance in assessing trends in European forestry development.

- Over the past two centuries, forest management has made progress, thanks to the efforts of landowners, professionals and scientists. Step by step, it has integrated societal demands into current management practices. Multi-functional objectives and close-to-nature practices are pursued in many forests. The patient work of foresters has led to productive forests and diversified landscapes.
- Wood production remains a major source of income in forestry. It creates economic opportunities, provides employment and is a traditional factor of development, particularly in rural areas. Rational and economically feasible wood production is allowing the wood-processing sector to expand. Thanks to considerable investments in new production technologies, the sector's competitiveness in world markets increases.
- Over their life cycle, wood production and the use of wood products are largely carbon neutral, making the forest and wood products sector a viable option for mitigating climate change. Accumulating additional biomass through good forestry practices and afforestation contribute to meeting the Kyoto Protocol targets for reducing greenhouse gas emissions.
- Private enterprise and public policies, as much as private and public investment, need to be coordinated for more efficient use of natural resources on a landscape scale.
- Combining land uses at the local and regional levels – for example, providing accessible recreational areas while also conserving the forest genetic pool – maintains the capacity of forest ecosystems to adapt to changing environmental conditions. Consensus-based strategies are increasingly developed and implemented.
- Integration between environmental requirements and efficient economic production processes has become the benchmark for modern forestry practices. Legal and economic instruments balancing rights and responsibilities in private and public land management are indispensable for generating an optimal combination of benefits from sustainable forest management. Marketable products and services can be financed from market proceeds. Public goods and services for which no markets exist (at least not at present) have to be financed by those who use or benefit from them, or through public investment.
- Agreement on the principles for individual and collective decision-making processes, with equal consideration of economic, social and environmental goals, is essential in determining the framework for forest protection and forestry development. This requires democratic decision making that engages both private and public stakeholders. It also needs an explicit agreement on the goals of individual as well as societal progress.

In the European experience, forestry can be multifunctional only if political conflicts between divergent economic and social demands are resolved. This presupposes democratic processes, legal security of ownership and use rights, active involvement of forest owners, engagement of the private industrial wood-processing sector and large private and public investments. And it needs a reliable political framework that allows negotiation among actors representing often contradictory economic, social and cultural goals, so that stakeholders can find solutions appropriate to the country and ecosystem.

One lesson is that sustainable forest management practices require strategies that are supported by local, regional and national efforts to protect the potential and resilience of forests, fulfil the needs of both rural and urban dwellers, generate economic value from wood and nonwood forest products and provide environmental and social benefits. The law of locality for making decisions, formulated in forestry as early as the nineteenth century, cannot be circumvented: strategies to achieve the goal often vary, with different combinations of private and public sector efforts to protect the public values of trees and forests.

Another lesson involves the varying time scales for multifunctional forestry. For instance, long rotation cycles allow flexibility for adjusting forest management to changing economic, social and environmental conditions and give managers options for achieving multifunctional forest uses. Old-growth forests, long-term management cycles and extended rotations for new plantations contribute to maintaining naturalness and biodiversity. Institutional rules, processes and instruments for policy and decision making are prerequisites for protecting the capital stock of forest resources and ensuring a balance between private and public needs and demands. Knowing how to engage the stakeholders in forest ecosystem management and assess the trade-offs between today's and tomorrow's benefits is indispensable.

The success of economic activities has traditionally been measured by calculating the value and quantity of outputs, with little consideration for harm to nonrenewable and renewable resources and the environment. A new and more comprehensive approach to the economic meaning of sustainability in natural resources use is necessary (FAO 2012a: 26–30). For instance, forestry, agriculture, power, transport, construction and other industries demand a fundamental technological overhaul for contributing to global sustainability (Sachs 2011). In order to determine progress in sustainable development, the total wealth from production of goods and services, considering the costs of resource use as well as benefits, needs to be assessed and quantified.

The total wealth of a country comprises: natural capital such as minerals, cropland, timber assets and protected areas; produced capital such as the built infrastructure; and foremost, human and intellectual resources (World Bank 2011a). Using a system of shadow pricing, a 2012 inclusive wealth report published by UN agencies has taken up the immense challenge of putting figures on the multiple economic links and trade-offs in a worldwide and country perspective. This report assesses and quantifies relative gains and losses in resource use and tracks progress in creating a more sustainable world (UNU-IHDP and UNEP 2012).

Precautionary and long-term measures and careful treatment of the available natural resources potential are a fundamental element of behaviour and an independent value in our culture. Production and consumption cannot be separated from people's responsibility for their effects and consequences. The present economic value of benefits compared with the envisaged future costs resulting from forest destruction, overuse and loss of biodiversity cannot be systematically reduced to the yardstick of the present day.

The Economics of Ecosystem and Biodiversity study (TEEB 2008, 2009) provides useful information for valuing and measuring the economic benefits of ecosystem services and improving the distribution of costs and benefits in managing natural capital. Proposed solutions include devising payments and markets for ecosystem services, eliminating incentives for environmentally harmful practices, reducing losses through regulation and pricing, adding value through protected areas and investing in ecological infrastructure. Both governments and the private sector have essential roles (TEEB 2010): assessing the effects and interactions of entrepreneurial activities on biodiversity and ecosystem services, exploring new business opportunities and new markets and broadening commercial strategies with wider corporate social responsibility initiatives.

The Brundtland report 'Our Common Future' signalled a change of paradigm in how nations would address the trade-offs between development and the natural environment. Its definition of sustainability is concise and subtle (World Commission on Environment and Development 1987: 43): 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' Two fundamental statements underlie this concept. Needs, as used in the report, mean foremost the basic needs of people living in poverty – the part of the world's population that lacks the economic resources, technology and social and political institutions to improve their living conditions. Sustainable development refers to all regions of the world and demands fundamental changes in economic relationships to achieve social justice and a more balanced equilibrium between the interests of rich and poor countries.

The report expands the meaning of sustainability (*Nachhaltigkeit*) from an energy and material resources capital problem, as defined in Germany by Hans Carl von Carlowitz in 1713 for the forestry sector (Grober 2012; Schmithüsen 2013), to the global challenge of finding ways to satisfy human needs in a stable and liveable environment. It insists on justice and intra-generational equity in our present world as much as it advocates care and opportunities for the coming generation. It raises inter-generational equity to the level of a comprehensive principle for guiding human behaviour and activities. Three hundred years ago, von Carlowitz foresaw the course of action that would ensure a lasting supply of wood. Now the Brundtland report challenges each generation to determine what sustainable development means in a particular context. Sustainable development thus aspires to address every sector of the economy, each stage of development and all the prevailing social demands and cultural values expressed in a particular society.

Contributions to identifying international political problems, fostering international debate and proposing possible solutions have been made by a large number of NGOs, scientists, researchers, specialists and experts engaged in north-south cooperation. UN agencies such as the United Nations Environmental Programme (UNEP), the Food and Agriculture Organisation (FAO) and the World Bank have been instrumental in the process. Worldwide and regional scientific networks, such as the Intergovernmental Panel on Climate Change (IPCC), now the International Climate Council, have been established.

8.3.2 Factors of change in the wood-based sector

Michael Porter (1990: 69–130) has analysed determinants that play a decisive role in national competitive advantage. His findings can also be considered in an international context when discussing future perspectives, strategic trends and foreseeable developments, whether for economic sectors and industrial branches or for individual companies competing at national and international levels. Relevant determinants that have been identified are factor conditions, such as skilled labour and infrastructure, the nature of demand for the industry's products or services, the presence or absence of competitive supplier and services industries and the public framework governing the conditions of business strategy, structure and rivalry. Figure 8.19 shows how the four determining forces are interconnected. Government, public policies and law are influenced by the four business determinants as much as they have significant effects on business activities. Note the factor chance, important because it creates discontinuities allowing shifts in competitive positions at either national or international scale.

The business environment of the wood-processing industry is determined by economic growth, trade liberalisation, changes in energy costs and worldwide market competition. The dismantling of trade barriers within the framework of the World Trade Organization (WTO) has accelerated regional and global market integration, international technological transfers and the emergence of company structures that operate worldwide. Direct investment is promoted in countries that offer political stability, good infrastructure, high educational standards and innovative research institutions (IIASA 2007). Economic integration in the EU has led to new market dimensions and a concentration of production structures combining forestry and wood processing. In the countries of Central and Eastern Europe, the transition to a market economy, privatisation of industry and restoration of private and municipal property provide new opportunities for entrepreneurial initiatives.

International trade and globalisation of trade are major trends in the wood-based forest sector that have many implications for strategic planning – for technological options, strategies to secure roundwood resources, professional education and research and silvicultural and forest management in both the medium and long term. In the international wood-based trade, the relative importance of the main wood product groups is changing. Between 1963 and 2011, the share of import values for roundwood and sawnwood declined by almost 50 per cent, import values of wood-based panels increased by 80 per cent, wood pulp

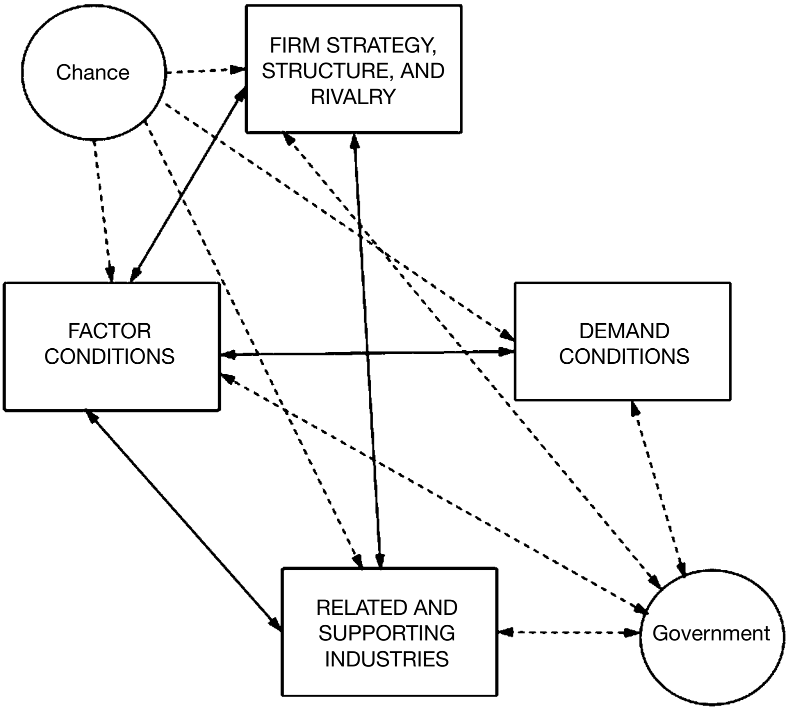

Figure 8.19 Determinants of national competitive advantage – the complete system

Source: Porter 1990: 127, Figure 3-5. Reprinted with the permission of Free Press of Simon & Schuster, Inc., from *The Competitive Advantage of Nations* by Michael E. Porter.

import value remained rather stable and the value of pulp and paper grew by 50 per cent (see Chapter 1, Section 1.3.7).

Regional patterns in forest product markets are also being affected by globalisation. High-cost producers are challenged by competitors with more favourable wood-growing conditions, low labour costs, innovative technology and efficient supply chain systems. The countries of the Economic Commission for Europe (ECE) – with its three sub-regions, North America and Western and Eastern Europe, which includes Russia – are major suppliers of forest products to other regions of the world (UNECE/FAO 2013: 19–20). Countries like Canada, Russia and the Nordic and Baltic countries have traditionally been wood products exporters, but structural changes have occurred since the mid-1990s as Germany and other countries strengthened their export capacities. At present, all three ECE sub-regions are net exporters of total forest products both in cubic-metre roundwood equivalents and in value.

Overall, *trade balances* in the wood-based sector vary by product and over time but show a remarkable division between world regions that have a concentration of sizeable production and export capacities and those that are net importers of roundwood and wood products. Based on figures for 2009 and 2010, the following aspects are of interest (UNECE/FAO 2013: 21–2):

- The ECE region dominates world trade in forest products, and 40 per cent of world trade in forest products takes place between European countries. Non-ECE countries account for 25 per cent of world exports and 36 per cent of world imports, with rapid growth in both imports and exports from China.
- Two-thirds of the world's industrial roundwood is exported to Asia, with 40 per cent going to China alone. Important roundwood exporters are Russia, the United States, New Zealand, Malaysia and Myanmar.
- Canada is the world's largest exporter of sawn softwood, followed by Sweden, Russia, Finland, Austria and Germany – all ECE countries, which between them account for 75 per cent of world trade. For sawn hardwood trade, however, non-ECE country exports and imports are about 50 per cent of world trade. Europe accounts for 48 per cent of world exports of wood-based panels and 52 per cent of world imports.
- Two-thirds of world exports of pulp come from five countries: Canada (20 per cent), Brazil (18 per cent), the United States (15 per cent), Sweden (8 per cent) and Chile (7 per cent). China accounts for a quarter of world pulp imports.
- Half of the world's forest products trade, by value, is in paper and paperboard, dominated by European exporters, with around 60 per cent. Germany (12 per cent), Finland (11 per cent) and Sweden (10 per cent) have leading positions. Germany is also the biggest importer of paper and paperboard (10 per cent), followed by the United States (9 per cent) and Canada (8 per cent).

The world's population is projected to increase from 6.4 billion in 2005 to 7.5 billion in 2020 and 8.2 billion in 2030. Global GDP increased from about US$16 trillion in 1970 to US$47 trillion in 2005 (at 2005 prices and exchange rates) and is projected to grow to almost US$100 trillion by 2030 (FAO 2009: 62–70). Following demographic changes and economic growth, industrial roundwood production – derived from demand for sawnwood, wood-based panels, and paper and paperboard – is projected to rise by more than a quarter from around 1.8 billion m^3 to close to 2.5 billion m^3. Major shifts will occur, particularly in Asia, which has 60 per cent of the world's population but only 15 per cent of the world's forest area. Global paper and paperboard production should rise by more than 70 per cent, from around 400 million tonnes to 700 million tonnes. Because of new energy policies, wood used for bioenergy is expected to rise globally from 2.6 billion m^3 to 3.8 billion m^3 in 2030.

Major factors *on the demand side* for roundwood and processed wood products are population trends in developing and developed countries, per capita income trends and price developments. The degree of urbanisation, size and number of households and age structure of the population are also significant. According to World Bank data for 2010, the largest population increases during the next two decades will occur in Africa (+235 million) and in Asia and the Pacific (+255 million), increasing their share of the global population to 18 per cent and 53 per cent, respectively. Global economic growth is expected to shift to the east and the south, with Asia and the Pacific increasing its part from 28 per cent in 2010 to 34 per cent in 2030 (FAO 2011a: 31–3).

Five issues determine the overall business environment of the wood-based sector (Mery *et al.* 2010). (1) Demand from intermediate and end consumers, (2) present and future raw material potentials and (3) competition between wood and other structural materials are major concerns in sustainable forest management. (4) Changing needs and values in resource use create alternative combinations in demand for processed forest products, nonwood goods and environmental services, and (5) global environmental and socioeconomic changes and international and national policies and institutional arrangements influence business activities and entrepreneurial initiatives.

Business strategy *on the market side* is influenced by globalisation, which favours the homogenisation of markets, expansion of international trade and competition for raw materials and energy, leading to more specialisation in production, communication systems and worldwide transport facilities. At the same time, competitive advantages arise through local market knowledge, product differentiation and the development of local market niches. Other factors are wood's utility as a renewable structural material and energy resource, the availability of wood products at competitive market prices for intermediate and end consumers and the dynamic development of international markets in wood products. Because energy prices have a strong effect on production costs, new technologies that offer more benefits to clients and use the full value of the raw material are important.

Business strategy *on the procurement side* is principally determined by the future availability of the renewable wood resource, which in turn depends on forest area, resilience of forest cover and productivity of forest soils. The annual growth rate of forest stands, the percentage of accessible production forests and restrictions on harvesting practices will all affect procurement. Important factors include the following:

- the actual possibilities of maintaining and protecting forest resources;
- effects of climate change on tree species, wood resources and site productivity;
- progress in silviculture and management planning techniques;
- the rate of reforestation and rehabilitation of secondary forests;
- short- and long-term investments by the private and public sector in silviculture, reforestation and new forest plantations with appropriate tree species;
- public sector investment in conservation of forests as an economic resource as well as a social and environmental resource; and
- the spatial distribution of wood production forests, forests protected for social and cultural values and forest areas preserved for biodiversity and landscape protection.

There is *another group of factors* that affect both market trends and procurement potentials. Current and future investment rates and infrastructural conditions determine whether the wood-based sector can expand its markets and acquire additional raw material. Innovation, research and technology decide to a large extent whether wood as a raw material remains competitive with other raw materials and production technologies. High-level and diversified forest product research is a prerequisite for using wood resources more efficiently, exploiting the physical properties of wood, making products with special qualities (e.g. resistance to fire or fungi), reducing manufacturing costs and recovering wood residues. Science education, high-level teaching and regular on-the-job training are needed to ensure that qualified technical and managerial employees are available.

Progress in the forest products industry comes sometimes from subtle, evolutionary, gradual changes to well-established processes, and sometimes from revolutionary innovations creating new products and production processes (FAO 2012a: 34–5). Composite and engineered wood products are an example of the latter: glulam beams, laminated veneer lumber, parallel-strand lumber, I-beams with oriented-strand board webs and edge-glued solid wood panels support new construction techniques in high-rise wood building. Wood fibre is mixed with other materials to make composite boards with better utility. Wood-polymer composites provide more durability and easier product use. Cross-laminated wood products offer superior strength and dimensional stability. Such new products are of particular interest because a large proportion of the world's population will live in large cities and urban landscapes, imposing new demands on land-use planning and architecture.

Researchers have identified trends in Europe's forestry and wood-based sector (Niskanen 2006; Niskanen *et al.* 2007b; Rametsteiner *et al.* 2005; Weiss *et al.* 2011) and characterised recent innovation processes. Points that emerge are: the importance of innovation and entrepreneurship in forestry and wood processing; the need to strengthen such activities in small and medium-sized enterprises; the potential contributions of well-designed forest- and wood-based industry clusters, whether at local, national or European regional levels; the expanding range of activities of entrepreneurial interest in wood production and nonwood forest products; expanding commercial opportunities for environmental and social services; and the need to support innovation through closer cooperation among actors in industry and commerce, multifunctional forestry practises, agriculture and landscape management.

Important factors of change are induced by cross-sector policy domains, particularly by energy and environmental policies (Dubé and Schmithüsen 2007). Entrepreneurial challenges result from the complex framework of national regulations and policies that address forestry and wood production (Schmithüsen *et al.* 2000a). Both Europe and North America have used public policy and legislation to promote the sustainable use of renewable natural resources by restricting harvests on certain categories of forestland for environmental and nature conservation reasons – with notable effects on the roundwood procurement side.

Several *international and national studies* offer strategic indications based on present trends and expert assessments. Although the forecasts cannot be taken as a certainty, forest sector studies suggest the possible future developments and driving factors of change that can be used to develop alternative scenarios and strategic plans.

The European Forest Sector Outlook Study 2005 (EFSOS) is a comprehensive and informative document that traces the development of the wood-based sector between 1960 and 2000, analyses trends and current status of roundwood production and processed wood products, identifies driving forces in the sector and previews developments up to 2020 (UNECE/FAO 2005). The study builds on the work of timber trend studies dating to the 1950s but has a broader perspective that includes exogenous factors, changes in demand and policy and market frameworks. The outlook to 2020 offers three scenarios (baseline, conservation and integration). It presents production and consumption estimates for processed wood products and pulp and paper and offers country data and aggregated data for Western and Eastern Europe, the Commonwealth of Independent States subgroup and Europe as a whole.

EFSOS II provides projections from 2010 to 2030 (UNECE/FAO 2010b). It focuses on seven major challenges that could have significant consequences for forestry and wood processing: mitigating climate change, supplying renewable energy, adapting to climate change and protecting forests, protecting and enhancing biodiversity, supplying renewable and competitive forest products, achieving and demonstrating sustainability and developing appropriate policies and institutions. EFSOS II presents a reference scenario and four policy scenarios covering forest resources (area, increment, harvest and silviculture) and forest products (consumption, production, trade); the four policy scenarios are as follows:

- maximising biomass carbon – exploring how much carbon could be stored in European forests under different silvicultural methods but unchanged harvest levels;
- giving priority to biodiversity – exploring the consequences if decision makers emphasise biodiversity protection;
- promoting wood energy – exploring how wood could contribute to achieving renewable energy targets; and
- fostering innovation and competitiveness – exploring the consequences for the sector of a successful strategy of innovation (this scenario is not quantified).

The overall results of the analysis anticipated for 2030 show a fairly balanced relationship between supply and demand of different output aggregates for the reference, carbon and wood energy scenarios, moving in a range between 1.2 billion m^3 and 1.4 billion m^3 roundwood equivalent (RWE) units. For the biodiversity scenario, supply would be about 200 million m^3 RWE lower than demand.

The EUwood study calculates a wood resource balance, bringing together all components of supply and demand for wood in the 27 countries of the EU (Mantau *et al.* 2010a, 2010b). The forecast compares the potential for wood supply, from both forests and nonforest sources, with the demand from industry for wood raw material and energy. It provides historical balances for 2005 and 2007 and projected balances for 2010, 2020 and 2030.

In 2010, the total supply of all wood resources in the EU-27 was about 1 billion m^3, of which 70 per cent came from forests and 30 per cent from nonforest woody biomass (residues, recovered wood and landscaping trimmings). Looking ahead, the analysis shows that with medium mobilisation, the expected demand is likely to exceed the potential supply before 2020, driven chiefly by strong demand for wood energy, itself driven by policy targets for renewable energy. In the high mobilisation scenario, demand may be met, with difficulty, in 2020 but would outstrip supply by 2030. The EU-27's forests are not just suppliers of wood but have many other equally important functions and ecosystem services, and wood supply cannot trump other aspects of sustainable forest management. Because the need for wood must be balanced with maintaining sustainability, country- and region-specific solutions, adapted to local and national priorities and compatible with the prevailing forest ecosystems, will have to be developed.

The Russian Federation Forest Sector Outlook to 2030 points to different opportunities, problems and priorities. In this country, with its immense forest area – more than four times that of Western Europe – the long-term potential wood supply is considerable. However, many accessible areas, mostly in the European part of the country, have been overlogged and now need more intensive silvicultural treatment. Annual increment on forestland available for harvest between 2010 and 2030 has been estimated at 845 million to 860 million m^3. Estimated variations in annual allowable cut move between 650 million m^3 and 700 million m^3.

The substantial rise in demand for forest products has been estimated in five-year steps between 2010 and 2030, by major product group and under scenarios for slow, moderate and innovative growth. The slow-growth scenario projects what would happen without dynamic moves to achieve the potential of the Russian forest sector. The gap between the slow-growth and innovative scenarios quantifies the opportunity cost of not adopting strong expansion policies. Wood for construction is in particularly high demand, with a projected rise from less than 10 million m^2 of construction surface per year to 70 million m^2. Manufacture of sawnwood, plywood, particle board, fibreboard, pulp, paper and paperboard is projected to rise one-and-a-half to three times by 2030.

The above studies focus mostly on the raw material supply side. There are also comprehensive projections, based on econometric modelling, of processed wood products demand, supply and trade in European countries (Jonsson 2012). These projections are the basis for the demand side estimates in both EUwood and EFSOS II. Jonsson (2012) works with two baseline references and gives data in five-year steps to 2030 for coniferous and nonconiferous sawnwood, plywood and veneers, particle board and fibreboard, newsprint, printing and writing paper, other paper and paperboard, recovered paper and mechanical, chemical and semi-chemical wood pulp. The study calculates supply and demand elasticity for each product group and country as well as projected annual product prices and production costs under the two scenarios. Projections are given for individual products and countries.

The nature of Europe's forests, forest management and wood-processing industry becomes clearer in comparisons with the situation on other continents. It is useful, for instance, to consult the North American Forest Sector Outlook Study 2006–2030 (UNECE/FAO 2012a), which makes projections for the United States and Canada to 2030, using a global model to account for concurrent changes in other countries. Its three scenarios are based on information developed by the Intergovernmental Panel on Climate Change. Two assume rapid growth in wood-based energy, and the third assumes steady growth, as in the past. The scenarios take account of trends in population, income and land use, assessments of emerging technology and predicted changes in consumption patterns for wood products and bioenergy. Projections suggest a decline in the use of paper for media but strong demand for other paper and paperboard for packaging

A different situation is arising in the Asia-Pacific region (FAO 2010d). By 2020, this region will have an estimated population of 4.2 billion people – an increase of 600 million since 2005 – accounting for about 60 per cent of the world's population. Economic growth rates will bring major changes in production, consumption and trade of forest products and services, with regional GDP expected to double between 2006 and 2020. During the past two decades, the Asia-Pacific region, led by China and Vietnam, has become a major producer and exporter of wooden furniture. The region's share of global furniture exports between 1990 and 2007 increased from 9 per cent to 33 per cent. The rapid growth in paper and paperboard production is expected to continue. The wood-processing industry is growing rapidly in several countries, notably China, to meet both domestic and export demand, but producers must often import raw material (logs, chips and recovered paper) from Southeast Asia, Russia, Australia, New Zealand and North America. With 0.2 ha of forest per person and an uneven distribution among countries, Asia-Pacific is the world's least forested region. South Asia, for instance, with 23 per cent of the world's population, has only 2 per cent of the world's forests. Deforestation continues in many countries, forest degradation remains a problem and forest ownership rights are often contested. A positive trend is the increased area of forest plantations and land managed under agroforestry systems.

8.3.3 The European agenda

The Ministerial Conference on the Protection of Forests in Europe, involving more than 40 countries, the EU, international institutions and numerous NGOs, has been the political platform for addressing forests and forestry development on a continental scale. The conferences, supported by highly efficient secretariats, have helped the wood-based sector throughout Europe build capacity for sustainable forest management. The issues addressed by conference declarations and the resolutions signed by the signatory states show the complex political dimensions of European forests. As a signatory to the Ministerial Conference, the EU is directly involved in the follow-up and implementation of the resolutions.

The first resolutions, in Strasbourg 1990, focused on forest degradation from industrial emissions and appropriate protection measures to maintain the resilience of forest stands. The 1993 Ministerial Conference held in Helsinki adopted a resolution that provides a modern definition of sustainable forest management; it establishes guidelines for forest management and biodiversity maintenance in all European forests. The principle of sustainability, as agreed upon in Helsinki, is based on a comprehensive approach towards forests and forestry practices:

> Sustainable management means the stewardship and use of forests and forest lands in a way and at a rate that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems.

The Helsinki definition has become the joint pan-European commitment to practising sustainable forest management. It covers the central theme of enduring and wise use of forests, building on the legacy of the past and providing opportunities for the future. It encourages an integrative approach in coordinating individual decisions, markets and economic value creation and social and political demands. It emphasises the overall goal of protecting the environment and improving the quality of life for present and future generations. It urges more meaningful and comprehensive research to capture the interactions among humans, the natural resource base and the physical and biotic environment.

The 1998 Lisbon conference adopted six criteria for sustainable forest management, with detailed quantitative indicators, for judging the state of forests: forest resources and their contribution to global carbon cycles, forest ecosystem health and vitality, productive functions of forests, biological diversity in forest ecosystems, protective functions in forest management and other socioeconomic functions and conditions; there are also qualitative indicators for policies and institutions. Pan-European operational level guidelines for assessment were formulated and accepted and served as the basis for the Programme for the Endorsement of Forest Certification. The Vienna resolutions of 2003 addressed cross-sectoral cooperation, national forest programmes, economic viability of forest management and social and cultural dimensions of forestry and revised the pan-European criteria and indicators.

At the Fifth Ministerial Conference for the Protection of Forests in Europe, held in Warsaw in November 2007, the signatory states committed themselves to enhancing the role of the forest sector through the use of wood biomass and investment in the production and distribution of bioenergy. Warsaw Resolution 1, 'Forests, Wood and Energy', refers specifically to the need for partnerships among public and private forest owners, forest-based industries and energy producers to develop new markets for bioenergy. A second resolution dealt with forests and water. The Warsaw conference also encouraged the removal of barriers to the sustainable use of additional wood resources by, for example, promoting forest owners' associations and adequate infrastructure to improve access to forestland.

In 2011, the ministers met in Oslo and adopted the name Ministerial Conference of Forest Europe – a change that reflects the expanding role for the conference process and the larger responsibilities and commitments of the signatory members. The issues that prompted the initial conferences in the 1980s and 1990s were pollution with subsequent deterioration of forest conditions, followed by growing concerns of biodiversity losses and climate change effects. The agenda has since expanded to encompass economic, social and environmental political issues related to forests and biodiversity. New issues that are now addressed are the wood-based sector using a renewable natural resource producing materials and energy in a green economy and the need to arrive at a common and more integrative understanding of the meaning of sustainable and multifunctional forest management. An important complementary event of the 2011 conference was the decision to negotiate a legally binding agreement on European forests.

The 2011 comprehensive conference document, published by the Liaison Unit Oslo, identifies four major challenges and opportunities in maintaining and increasing the forest resource potential in Europe (FOREST EUROPE, UNECE and FAO 2011: 11):

- the forest sector's major role in climate change mitigation through carbon sequestration and substitution for nonrenewable energy and materials, with the challenge of finding the optimum balance among forest functions in the context of a changing climate and dynamic societal needs;
- the ambitious targets for renewable energy throughout Europe, resulting in more use of wood for energy, with the challenge of reconciling this mobilisation with the other dimensions of sustainable forest management;
- the progress made in conservation of forest biodiversity, with the challenge of balancing conservation with the intensive forest management necessary to meet expected demand for wood, including wood for renewable energy; and
- the 'green' characteristics of the forest sector, with the challenge of developing a green economy by promoting sustainable production and consumption patterns, supporting green building and green jobs, supplying renewable energy and developing payment systems for ecosystem services.

European forestry has clear strengths and opportunities compared with other regions (FOREST EUROPE, UNECE and FAO 2011). It is geared to long-term production periods, and its goals are based on local conditions, the potential of domestic tree species and silvicultural treatments that can increase the productivity of existing forest stands. European forestry's practices are largely based on multifunctional semi-natural management, taking into account the needs and requirements of different user groups. Progressive management models integrate private and public interests. Forest owners respond flexibly to social changes. Multifunctional forest management generally meets the requirements for sustainable development, is resilient to shocks, such as those from climate change, and is well accepted by society. In short, European forestry has major long-term advantages over its international competitors.

The review of policies, institutions and instruments for sustainable forest management presented in the secretariat's report suggests several trends affecting forestry development in the European region (FOREST EUROPE, UNECE and FAO 2011: 145–66):

- The long-term development of the available forest area for wood production is difficult to assess, but short- and medium-term prospects for increasing the forest resource base are good.
- Assuming a further increase in the establishment of fully preserved forests and areas with limited forest uses, the extension of forestland available for wood production will remain basically stable.
- Public demands for close-to-nature silviculture and certified sustainable forest practices are reaching high levels in European countries.
- International instruments addressing climate change, biodiversity, and nature and landscape protection have a growing influence on sustainable forest management, close-to-nature silvicultural practices, utilisation of wood as a source of high-quality material and renewable energy, and national environmental and energy policies.
- The trend towards a rising net increment of wood can be expected to continue in the foreseeable future, and existing forest stands represent an important carbon sink. Harvesting and replanting, however, produce substantial carbon dioxide emissions, at least immediately.
- Production of roundwood depends primarily on the ratio between forestry and wood-processing production costs and the prices of semi-finished and end-user wood products. The demand for renewable energy and energy prices will play a role in determining price developments for roundwood assortments and processed wood products.
- The demand for nontimber forest products, recreational uses and infrastructural services is increasing and must be accommodated in multifunctional forest management practices.

The European Union (EU) offers an interesting example of a supra-national policy framework that has considerable momentum and importance for policy making both in the member countries and within the United Nations. The supra-national framework operates through the EU-level regulations, directives and decisions. *Regulations* are legal acts that have general application, are binding and directly applicable in all member states. A regulation becomes applicable in its entirety and with the same text in the legal systems of all EU countries, and it gives precise and detailed rules for a policy for which the EU has an agreed competence. *Directives* are legal acts of the European Community that require member states to achieve certain aims but leave to the national authorities the form, procedure and instrument of implementation. Member countries are under a legal obligation to adopt national legislation that conforms to the directive within a determined time limit. *Decisions* are legal acts addressed to a specific entity concerning a determined issue, generally of an administrative nature.

At the international level, the EU is a signatory to multilateral and bilateral treaties and a member of many international organisations; it negotiates substantive arrangements within its competencies and is engaged in extensive international, multilateral and bilateral programme activities and country programmes. It contributes to a more coherent economic and social regime and supports sustainable development – for instance, through its environmental and climate change policies, material and land-use policies, promotion of a green economy and protection of natural ecosystems and biodiversity.

Not having specific competencies in forestry matters, the EU has adopted numerous measures in other policy domains that have immediate or indirect effects on forests and forest management. As a consequence, the EU's forest conservation and forestry goals rely largely on cross-sector targets and measures (Cirelli and Schmithüsen 2000). EU policy targets deal, for instance, with renewable energy, biomass use, biodiversity, environmental regulations and mobilisation of wood resources in accordance with the principle of sustainability. In the wood-processing sector, relevant EU policies address national and international trade relations, market access and timber regulations, the competitive position of the European industry, and research, technology and innovation programmes and networks. Within the European Commission, Directorates General (DGs) are dealing with EU competencies that relate to forests and the wood-processing industry: for example, the DGs for Agriculture and Rural Development, Environment, Enterprise, Research, Climate Action, Regional Policy and Development. Forest-related bodies at the EU level are the Council's working party on forests, the European Commission's standing forestry committee, the advisory group on forestry and cork and the advisory committee on forest-based industries.

The *European Agricultural Fund for Rural Development* has become the second pillar of the Common Agricultural Policy and one of the main instruments for implementing the EU Forestry Strategy and the EU Forest Action Plan. It offers eight measures supporting forestry, with emphasis on sustainable forest management. The European Commission has presented a draft regulation for 2014–2020 as part of its proposal to reform the Common Agricultural Policy. The *Sixth Environment Action Programme*, adopted in 2002, established a ten-year framework for Community action focusing on four thematic areas: climate change, nature and biodiversity, environment and health and natural resources and waste. Priority actions were set out for forestry as an important sub-area for achieving objectives related to nature, biodiversity and climate change.

The *EU Regional Policy* supports an integrated approach to using natural assets to ensure complementarities between urban and rural areas. The European Regional Development Fund provides financial support for implementing specific actions indicated in the EU Forest Action Plan. Cross-border, transnational and interregional projects on forests and forestry are undertaken. Natural risk reduction, in particular the prevention of forest fires, has been a priority, especially in the Mediterranean region. Protection from fire relies on a funding scheme for regular monitoring and information campaigns based on yearly data submitted to the Commission. Member states classify their territory according to the degree of forest fire risks. In high- and medium-risk areas, plans to reduce fire risk and extinguish forest fires are prepared. Funding is also available for a uniform system of monitoring and reporting.

A major contribution to nature conservation and forest biodiversity is Council Directive (EEC) 92/43, on the conservation of natural and semi-natural habitats and wild flora and fauna (Habitats Directive). The objective is the creation of a European network of protected areas (Natura 2000) in member countries. A new EU Biodiversity Strategy, adopted in 2011, sets out five targets: conserving and restoring species and habitats; maintaining and enhancing ecosystems and their services; ensuring the sustainability of agriculture, forestry and fisheries; combating invasive alien species; and stepping up the EU's contribution to global biodiversity. A sixth target is specific to forestry: having forest management plans in place for publicly owned forests and forest holdings that receive funding under EU rural development policy. The programme dedicated to funding environmental and climate action (LIFE) is relevant in this context.

To cut emissions and mitigate climate change, the *Commission Biomass Action Plan* was adopted in 2005. The *Renewable Energy Directive (2009)* sets out a strategy to increase security of energy supply and reduce greenhouse gas emissions. The EU's and member countries' positions on the Kyoto Protocol carry weight in international negotiations and implementation processes. The same is true for the recent roadmap for moving to a competitive low-carbon economy, part of the Europe 2020 Strategy. It emphasises the effect of forestry practices on the capacity of the energy sector.

The *EU Communication on Innovative and Sustainable Forest-Based Industries* is part of industrial policy. It stresses the importance of this economic sector for the EU's growth and jobs strategy and its challenges, including access to raw materials, reductions in greenhouse gas emissions and innovation and trade in forest-based products. Trade negotiations with third countries include multilateral commitments for reinforcing sustainability and compliance with EU commitments. Wood industry issues include illegal logging and illegal timber imports into member countries (European Timber Regulation EUTR 995/2010). EU plant health and propagating material regulations affect the forest sector and the timber trade directly and indirectly. Within the framework of trade policy, Community regulations address the processing and marketing of forestry products (Council Regulation EEC No. 867/90), the classification of roundwood (Council Directive EEC No. 68/89) and the marketing of forest reproductive material (Council Directive EEC No. 66/404).

The *Seventh Framework Programme (FP7)* was the main instrument for funding research at the EU level during 2007–2013. This funding extended to a wide range of topics, including biotechnology, energy, materials and production technologies. There are five groups of European technology platforms supporting industry-led research: technological cooperation and innovation in energy, information and communications technology, bio-based economy, production and processes and transport. The *forest-based industry technology platform*, part of the bio-based economy group, is run by the European confederations of the forest and wood-based sector.

The *EU Forestry Strategy*, adopted in 1998, stresses the multifunctional role of forests and states that forest policy lies in the competence of the member states, with the EU contributing to the implementation of sustainable forest management through common policies based on the principle of subsidiarity and shared responsibility. It emphasises the implementation of international commitments, principles and recommendations through national or sub-national forest programmes, and it calls for coordination, communication and cooperation in policy areas that affect the forest sector. The strategy confirms the importance of promoting wood as an environmentally friendly product in line with the rules of the open market, the contribution of forestry and forest-based industries to income, employment and other elements affecting the quality of life and the need for better integration of forests and sustainably derived forest products in EU policy.

The *EU Forest Action Plan*, adopted in 2006, builds on the EU Forestry Strategy and provides a complementary framework of interaction between member states and the European Commission in the realm of forest production, wood processing and environmental protection. It has four main objectives: (1) to improve long-term competitiveness; (2) to improve and protect the environment; (3) to contribute to the quality of life; and (4) to foster coordination and communication. Eighteen actions identified by the European Commission were to be implemented jointly with the member states between 2007 and 2011. Key Action 4 of the Forest Action Plan calls for an assessment of using small-dimension and low-value wood and harvesting residues for energy production; dissemination of good utilisation practices for processing such material; assessment of the feasibility of using forest residues and tree biomass for energy in the context of sustainable forest management and possible environmental limits; and ways to help private forest owners – in particular, small owners – establish and manage cooperatives for supplying biomass to energy-generating units.

Key Action 5 of the Forest Action Plan focuses on fostering cooperation between forest owners and enhancing education and training in forestry. The goal is to find innovative solutions to problems that arise from changing ownership structures. The increasing share of forests that belong to owners with little experience or skill in managing their land sustainably is one problem; fragmentation of private forest holdings is another. Key Action 5 calls for a well-trained and adaptable work force in forestry and wood processing and recommends formal and vocational training and education in technology and natural science disciplines. To strengthen the competitiveness and economic viability of forestry, and in the framework of their priorities, it encourages the member states to promote cooperation among forest owners, industry and third parties. New products, processes, technologies and investments need to be fostered to increase the economic value of wood products, nonwood products and environmental services.

The interests of forest owners in EU countries are represented by the Confederation of European Forest Owners (CEPF) and the European State Forest Association (EUSTAFOR). The European Confederation of Woodworking Industries (CEI-Bois) and the Confederation of European Paper Industries articulate the positions of the wood-processing industry.

The *Confederation of European Private Forest Owners* sees potential for the private forestry sector to mobilise additional market supply and increase sustainable wood production over the long term. Criteria and indicators for forest certification can help promote responsible forest management and sustainable wood production. Private forest owners, who control 60 per cent of forests in the countries of Western, Central and Eastern Europe, excluding the Russian Federation, play a major role in maintaining and developing forest cover. A large proportion of these private forest holdings are small – between 1 and 5 ha. Because of restitution and privatisation, as well as afforestation of marginal farmland, the area of private forest holdings has increased considerably during the past 15 years. Information from the 2006 UNECE/FAO enquiry highlights significant differences among European regions in resource potential and utilisation, economic indicators of forest production and the demographics of forest owners. There are both common issues to be addressed at the European level and specific opportunities and challenges at the national and local levels, such as ownership structure, forest cooperatives and ageing of owners.

8.3.4 The world agenda

International negotiations and agreements on sustainable development began at the United Nations Conference on the Environment in 1972 and were followed by the Brundtland report (1987) and the Conference on Environment and Development (UNCED, the 'Earth Summit', 1992) in Rio de Janeiro. Significant stages of the Rio process are the 2002 World Summit on Sustainable Development in Johannesburg and the Rio de Janeiro Declaration in June 2012, which have promoted the move to a green economy and a new understanding of the role of governance in national and international affairs.

The term *sustainable development* gained currency at UNCED 1992, which applied the concept not just at the world level but also to local, national and regional levels. The conference adopted Agenda 21, which describes a vast work programme for the twenty-first century. This far-sighted document sets goals for implementing sustainable development, using natural resources sustainably and improving management activities. The global issues to be addressed are as pressing today as when the text was presented to the UN delegates in 1992.

Among Agenda 21's social and economic issues are combating poverty, changing consumption patterns, protecting and promoting human health, improving the sustainability of human settlements and creating development strategies that integrate social and environmental policies. Referring to natural resources conservation and environmental management, Agenda 21 addresses agricultural practices; deforestation, desertification, and drought; agriculture and rural development in mountainous regions; biological diversity and management of biotechnology; freshwater and marine resources; and toxic substances, solid waste and sewage. Agenda 21 calls for the commitment and involvement of all social groups in determining and implementing governmental policies and programmes, and it highlights the need to mobilise and empower NGOs. To implement the recommendations, the agenda refers to financial partnerships; technology transfer; science and research; education, teaching and training; capacity building for sustainable development; organisation and institution building; adaptation of national and international law; and information systems for decision making.

Agenda 21 of UNCED 1992 asks national governments and the international community to focus on *cross-sectoral effects and policy linkages*. It advocates a comprehensive approach integrating economic, social and environmental policy objectives and more consistent *public policy frameworks for sustainable development* (Agenda 21, Chapter 8, Integrating environment and development in decision-making). The need for more coordination between sectors relevant to forestry development and forest resources conservation is underlined in Chapter 11, Section 31 (e), on combating deforestation, and again in Section 9 of the 'Non-legally binding authoritative statement of principles for a global consensus on the management and sustainable development of all types of forests'.

The Intergovernmental Panel on Forests, subsequently renamed the Intergovernmental Forum on Forests and, later, the United Nations Forum on Forests, calls for intersectoral approaches and coordinating mechanisms for programmes and projects affecting forests and thus also land use, poverty, food security, energy needs and environmental protection. Enhancing policy coordination and fostering cross-sector cooperation are core elements in the mandate of the UN Forum on Forests. The Food and Agricultural Organization (FAO) has launched several programmes in agriculture, water management and forestry that examine the benefits and drawbacks of policies and legislation on the integrated use of natural resources. Other United Nations agencies, such as the Environment and the Development Programmes (UNEP, UNDP), are committed to more effective inter-agency coordination and support of member countries to foster a more consistent approach in addressing sustainable management. The World Bank and the regional development banks play a catalysing role in integrating different public policies within the overall framework of sustainable development.

With Agenda 21 and the Declaration on Environment and Development, UNCED 1992 filled out the definition of sustainable development. The two documents establish the principles of foresight, justice and balance between divergent interests as indispensable conditions for maintaining a liveable human environment. They are a standard for global, national and local development that meets the needs of both present and future generations.

The World Summit on Sustainable Development, held in South Africa in 2002, furthered the global vision of sustainable development by focusing on pressing social and human problems to be addressed immediately by the international community. It defined eight Millennium Development Goals:

- eradicating extreme poverty and hunger;
- achieving universal primary education;
- promoting gender equality and empowering women;
- reducing child mortality rates;
- improving maternal health;
- combating HIV/AIDS, malaria and other major diseases;
- ensuring environmental sustainability; and
- developing a global partnership for development.

The last goal is of particular relevance: a global partnership for development is an indispensable condition for reaching the other seven goals. Results to be achieved by 2015 were specified, the implementation process is being monitored at regular intervals, performance rates are assessed and implementation strategies are revised as necessary.

The World Summit placed forests in the context of sustainable development as a natural renewable resource base for economic and social advancement. It acknowledged the multiple and varying functions of forests for poverty alleviation, raw material and energy sources and natural habitats and environment. The implementation plan highlights the role of forests in several policy domains, such as natural resources management, agriculture, desertification, mountains and sustainable development for Africa. Forests and forestry are closely linked to the decisions and measures that address climate change, biodiversity and the overall institutional framework of sustainable development. This implies, for instance, that *international climate change and biodiversity conventions* should systematically consider the need for forest protection and improvements in the forest sector. And in the same manner, forest policy should promote measures that make significant, concrete contributions to preserving biodiversity and mitigating human-induced climate change effects.

The World Summit implementation plan contains specific provisions for forests, focusing on sustainable management of both natural and planted forests and the sustainable production of wood and nonwood forest products – considered essential for economic and social progress. The plan stresses forest protection and management as critical means to eradicate poverty, reduce deforestation, halt the loss of forestland biodiversity and limit degradation of renewable natural resources. The role of forest cover in improving food security, providing safe drinking water and supplying affordable firewood and wood energy in rural areas is specifically mentioned.

In 2012, the *UN Conference on Sustainable Development*, also called the Rio+20 Summit, met in Rio de Janeiro again and issued ‘The Future We Want’. This document lays out a comprehensive international development agenda and the basis for determining Sustainable Development Goals, to follow the Millennium Development Goals. Two major concerns on the agenda were the shift to a green economy and the strengthening of international environmental governance.

‘The Future We Want’ reconfirms the important social, economic and environmental benefits of forests and acknowledged the contributions of sustainable forest management, including reforestation, restoration and afforestation, to international objectives. It calls for efforts to slow, halt and reverse deforestation and forest degradation in developing countries and to promote international trade in legally harvested forest products. The conference recognised, for the first time, the importance of integrating sustainable forest management objectives and practices into mainstream economic policy and decision making.

Another cornerstone of sustainable development at a global scale is the move to a green economy. The concept, developed by UNEP, has been readily taken up by other UN agencies and the international community. This contribution to the ongoing Rio+20 process focuses on economic and social factors that help reduce poverty in all regions, rational and interlinked use of energy and natural resources and effective actions to protect the environment and deal with climate change risks. UNEP explains *green economy* as a system that improves human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP 2009, 2011).

It is an economy that is low in carbon intensity, efficient in its use of resources and acceptable and beneficial to society. Achieving these economic and social goals requires substantial private and public investments in reducing carbon emissions and pollution; enhancing energy and resource efficiency; providing social, cultural and ecosystem services; and preventing the loss of biodiversity. A green economy makes a systematic contribution to maintaining, enhancing and if necessary rebuilding natural renewable capital as a critical economic asset and source of public and private benefits. Involving all economic actors and social groups, the transition to a green economy will be a long-term process. Progress can be accelerated by, for example, changing consumption patterns and introducing sustainable investment projects based on new technologies. Moving from a wasteful and costly 'brown economy' requires changes and adaptation in public regulations, policies and financial measures as much as progressive initiatives and decisions throughout the private sector. As in the management of other renewable natural resources, the challenge is to engage private and public economic actors in creating additional value, developing new technologies and generating environmental and social benefits while preserving natural capital.

A *green economy action plan* was prepared in 2012 under the auspices of the Timber Committee of the United Nations Economic Commission for Europe (UNECE) and the Forestry Commission of FAO. The plan provides a strategic concept and medium-term work programme combining country activities all over Europe and describes how the forest sector in the UNECE region could lead the way towards a global green economy. It defines how significant progress is to be monitored and promotes measures for sharing and implementing best practices and suitable policies for the forest sector (UNECE/FAO 2012b: 2–5).

The Action Plan for the European region is based on the following vision:

> In a green economy, the forest sector makes a maximum contribution to human well-being through the supply of marketed and un-marketed forest goods and services, and the creation of revenue and livelihood, while

> maintaining and developing forest ecosystem services on a sustainable basis within the context of a changing climate.
>
> In a green economy, the forest sector protects the welfare of all stakeholders, including forest dependent indigenous peoples and the forestry workforce, uses all resources wisely and economically, and contributes to the mitigation of climate change through both sequestration and substitution.
>
> In a green economy, forest sector governance systems take into full account all of the ecosystem services provided by the forest, compensating suppliers for providing them whenever feasible. Progress is monitored in a transparent way, and policies adjusted to reach the goals which will be agreed at the national, regional or local levels. The forest sector learns from other parts of the emerging green economy and shares its own experience with them, to mutual benefit.

The plan comprises five pillars, each with measures and activities for which detailed goals and tasks have been determined. The pillars are sustainable production and consumption of forest products, a low-carbon forest sector, decent green jobs in the forest sector, valuation of and payment for forest ecosystem services and monitoring and governance of the forest sector.

Reduction of Emissions from Deforestation and Forest Degradation (REDD and REDD+) is a multifunctional forest-related international programme that involves specialised organisations of the United Nations and bilateral and multilateral cooperation among countries, NGOs and individual initiatives. The network started its initiatives in 2005, following the 11th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). At its 16th session, in 2010 in Cancún, Mexico, the Conference of the Parties encouraged developing countries to contribute, within their respective capabilities, to reducing forest-related carbon emissions, conserving forest carbon stocks, fostering sustainable forest management and supporting the enhancement of forest carbon stocks (Parrota *et al*. 2012: 14–16).

The decisions taken in 2010 stipulate that protection of forest cover, conservation of forest carbon stocks and sustainable forestry practices are major issues to be addressed under UNFCCC. REDD+ activities should be country-driven options available to the parties of UNFCCC. They need to be consistent with the objective of environmental integrity and take into account the multiple functions of forests and other ecosystems. And they should be implemented in a context of sustainable development, contributing to poverty reduction while mitigating climate change and meeting the needs of the country.

Strengthening international forest sector governance has become an issue in international, bilateral and multilateral relations and is on the agenda of the United Nations. Governance describes how people organise their way of living together in society and how the power in managing a country's social and economic resources for development is exercised. Governance can have good or bad effects on people's lives, depending on how public officials and political institutions acquire and exercise authority to shape public policy, manage public affairs and provide public goods and services. Good governance demands that citizens and NGOs be able to articulate their interests and exercise their legal rights and obligations. Growing understanding of the complexity of achieving sustainable development has given rise to a new vision of the interaction between humans and the natural environment. Principle 10 of the Rio Declaration 1992 on Environment and Development underlines this important insight:

> Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Good governance is thus essential to effective decision making and implementation. It represents a shift from a hierarchic and top-down system to a more participatory and self-organising approach to public affairs. It is characterised by constitutionally defined rights and an open and democratic relationship between the state and civil society, including citizens, stakeholders and private institutions, such as associations, corporations and social communities. Process steering and communication among interest groups, private enterprises and industry representatives are essential elements in developing workable solutions.

Political institutions and processes that contribute to good governance in the public and private sector have several characteristics:

- cooperation between the state and specific target groups;
- participation of citizens and NGOs in policy making and implementation;
- coordination, inclusiveness and integration of sector policies;
- multilevel transactions between private and public organisations;
- decentralisation and transfer of public authority and responsibilities to local and federal governments, in accordance with the principle of subsidiarity;
- elaboration of policy programmes based on agreed-upon objectives, performance monitoring and evaluation of results; and
- setting of effective and efficient management standards in public administration and NGOs.

Governance in forest management requires constitutional rules, laws, regulations and governmental action that allow bottom-up decision-making processes in which stakeholders and citizens can freely interact. It becomes operational through commercial market transactions, contractual arrangements for the delivery of goods and services, other societal initiatives and negotiations, conflict resolution and agreement on criteria, indicators and performance standards. Effective governance processes are based on functioning political, economic and social networks, and their effects on forest management and utilisation practices need to be assessed and monitored (FOREST EUROPE, UNECE and FAO 2011; Kishor and Rosenbaum 2012).

The implementation of forest-related governance reforms at country, regional and international levels implies institutional, economic and policy measures that address decentralised forest management practices, reforms of forest institutions, modernisation and coordination of laws and regulations; strengthening of fiscal systems in the forest sector; and remedies for illegal logging and other forest offences (World Bank 2008: 151–201). An analytical policy framework for governance reforms that can ensure tangible results has been presented by the World Bank with the following five principles (World Bank 2009): transparency, accountability and public participation; stability of forest institutions and conflict management; quality of forest administration; coherence of forest legislation and rule of law; and economic efficiency, equity and incentives.

The consequences from natural resources overuse and loss cannot be justified by the economic benefits derived today. Production and consumption cannot be separated from responsibility for their implications. Despite the controversy and complexity of the international agenda, progress has been made over the past 20 years in addressing environmental, energy and renewable natural resources management. The principle of sustainable development has become a point of reference in understanding the meaning and validity of human actions.

8.4 Further reading

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