WORKING PAPER

FUTURE DEVELOPMENT OF THE
EUROPEAN SOFTWOOD LUMBER INDUSTRY

Sten Nilsson

January 1989
WP-89-11

PUBLICATION NUMBER 82 of the project:
Ecologically Sustainable Development
of the Biosphere

IIASA
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FOREWORD

Within IIASA's Environment Program, the Project on Ecologically Sustainable Development of the Biosphere seeks to clarify the policy implications of long-term, large-scale interactions between the world's economy and its environment. The project conducts its work through a variety of basic research efforts and applied case studies. One such case study, the Forest Study, has been underway since March 1986, and focuses on the forest-decline problem in Europe. Objectives of the Forest Study are:

(a) to gain an objective view of the future development of forest decline attributed to air pollution and of the effects of this decline on the forest sector, international trade, and society in general;

(b) to build a number of alternative and consistent scenarios about the future decline and its effects; and

(c) to identify meaningful policy options, including institutional, technological and research/monitoring responses, that should be pursued to deal with these effects.

As in North America, most of the forests of Europe are dedicated at least partly to timber production for industrial purposes. Thus, wood raw materials are processed into wood and paper products to meet market demands for a wide range of goods. Many decisions that bear on the management of European forests are driven by market forces and industrial development. These forces must be taken into account in any study of the long-term outlook for timber-production forests and the forest-products industry. This paper, one in a series of several Forest-Study background papers, looks into the future possible development of softwood lumber industry in Europe.

B.O. Döös
Leader
Environment Program

ABSTRACT

The development of the softwood lumber industry in Europe is driven mainly by demand for softwood lumber. Therefore, critical analyses are made herein on the future demand for softwood lumber. The conclusion is that the demand is going through a structural change due to changed socio-economic developments. This will likely result in a lower growth rate of demand or declining demand in the future.

Wood supply in Europe is expected to increase in the future, resulting in a higher degree of self sufficiency of softwood lumber in different regions of Europe. The sawmilling industry is facing economic difficulties in general. The only way to improve the economic conditions for the industry is intensified research and development.

CONTENTS

Future Development of the European Softwood Lumber Industry

Sten Nilsson

1. BACKGROUND

Many international investigations have identified that the European sawmilling will face a structural change in the future. The most detailed investigation concerning the future of the European sawmilling industry has been organized and carried out by ECE Timber Committee, Geneva (1). The investigation started during the early 1980s and was presented in 1986. This report has been carefully analyzed and discussed by experts in the sawmilling industry in several European countries. The investigation constitutes the platform in this paper concerning the future long-term development of the softwood sawmilling industry in Europe.

2. ALTERNATIVE MARKET DEVELOPMENTS

The Timber-Committee investigation (1) presents 7 alternative scenarios concerning the demand on softwood lumber in Europe (Table 1).

The different scenarios are based on calculations with an econometric model based mainly on GDP development and different consumption patterns in different end-use sectors. It is a conventional idea that the development of GDP is the strongest driving force for the consumption of lumber (see Baudin (2), Martin _et_ _al_. (3), FAO (4) and Buongiorno (5)).

During recent years it has been recognized that GDP development is not sufficient to explain the demand on lumber. This is a result of the fact that the sawmilling industry has reached a stage of maturity in development (see Lönnstedt _et_ _al_. (6)). Therefore, it is also necessary to work with specific end-use patterns for different end-use sectors in the mathematical demand models, for example, the model developed by the Timber Committee (Table 3). Construction is clearly the most important sector in all of Europe concerning softwood-lumber consumption (Table 3).

The projections generated by the Timber-Committee model have been adjusted after hearings by panels of experts from the sawmilling industry in different countries. This is a common way of building in experts' knowledge to the analysis, knowledge which is impossible to incorporate in an econometric model. Thus, the seven scenarios discussed in this paper are the adjusted ones. One objective with this paper is to make a critical review of the driving forces behind the seven demand scenarios presented by Timber Committee (1).

Table 1. Basic conditions for the different demand scenarios presented in the Timber-Committee report (1).

Scenarios	Average GDP development for Europe in % per year	Residential investments	Other user sectors	Relative price of sawnwood	Trend effects
1. Low	2.6	Constant growth of GDP	Low	Constant	None
2. High	3.3	Constant	High	Constant	None
3. Recession in user sector	2.6	Decline 1.5%/year	Constant	Constant	None
4. Success marketing and product development	2.6	Constant	Low	Constant	0.5%/year
5. Failure marketing	2.6	Constant	Low	Constant	-0.5%/year
6. Price rise	2.6	Constant	Low	+1%/year	None
7. Price fall	2.6	Constant	Low	-1%/year	None

Note - explanations of some of the expressions used here are presented in Table 2.

Table 2. Explanations of some of the expressions used in the different scenarios.

Recession in construction (user) sector

- High real interest rates
- Satisfaction with existing housing stock
- Lack of availability of government funds to subsidize housing

Product development and marketing

Positive trend:
Improve existing products and services provided with the products, or able to develop and promote new types of products

Negative trend:
Substitution

Relative prices

Positive:
Increased demand
Supply problems
Increased wood costs

Negative:
Lower raw-material costs
Technical advances
Efficient transportation and distribution

Table 3. End-use sectors employed in the Timber-Committee analysis (1) and consumption of softwood lumber in the different sectors. Figures are expressed as percentage of total consumption around year 1980.

	End-Use Sector			
Country	Construction	Furniture	Packaging	Other
Finland	65	10	14	11
Norway	73	4	9	14
Sweden	75	5	10	10
France	92	4	12	2
Italy	82	5	10	3
Portugal	92	3	2	3
United Kingdom	70	3	13	14
Switzerland	65	-	-	-
Poland	62	8	8	12

3. DEVELOPMENT OF GDP

There was a strong development of the GDP in Europe during the 1960s and early 1970s. After the oil crisis in 1973, the growth rate of GDP declined (Table 4). Table 4 also shows future GDP growth rates employed on a regional basis (Figure 1) in the Timber-Committee Study (1). The base year for GDP used in the Timber-Committee Study is 1980.

Table 4. Historical development of GDP growth rates and future growth rates employed in the Timber-Committee Study (after Timber Committee (1)). Figures are expressed as annual percentage increases.

	Period			
	1965-1973	1973-1980	1980-2000	
Region			Low	High
Nordic	3.7	3.3	2.8	3.6
EEC (9)	4.5	2.2	2.4	2.9
Central Europe	4.4	1.5	2.2	3.0
Southern Europe	6.5	3.9	3.5	4.3
Eastern Europe	6.5	4.5	3.7	5.1
Europe	4.7	2.6	2.6	3.3

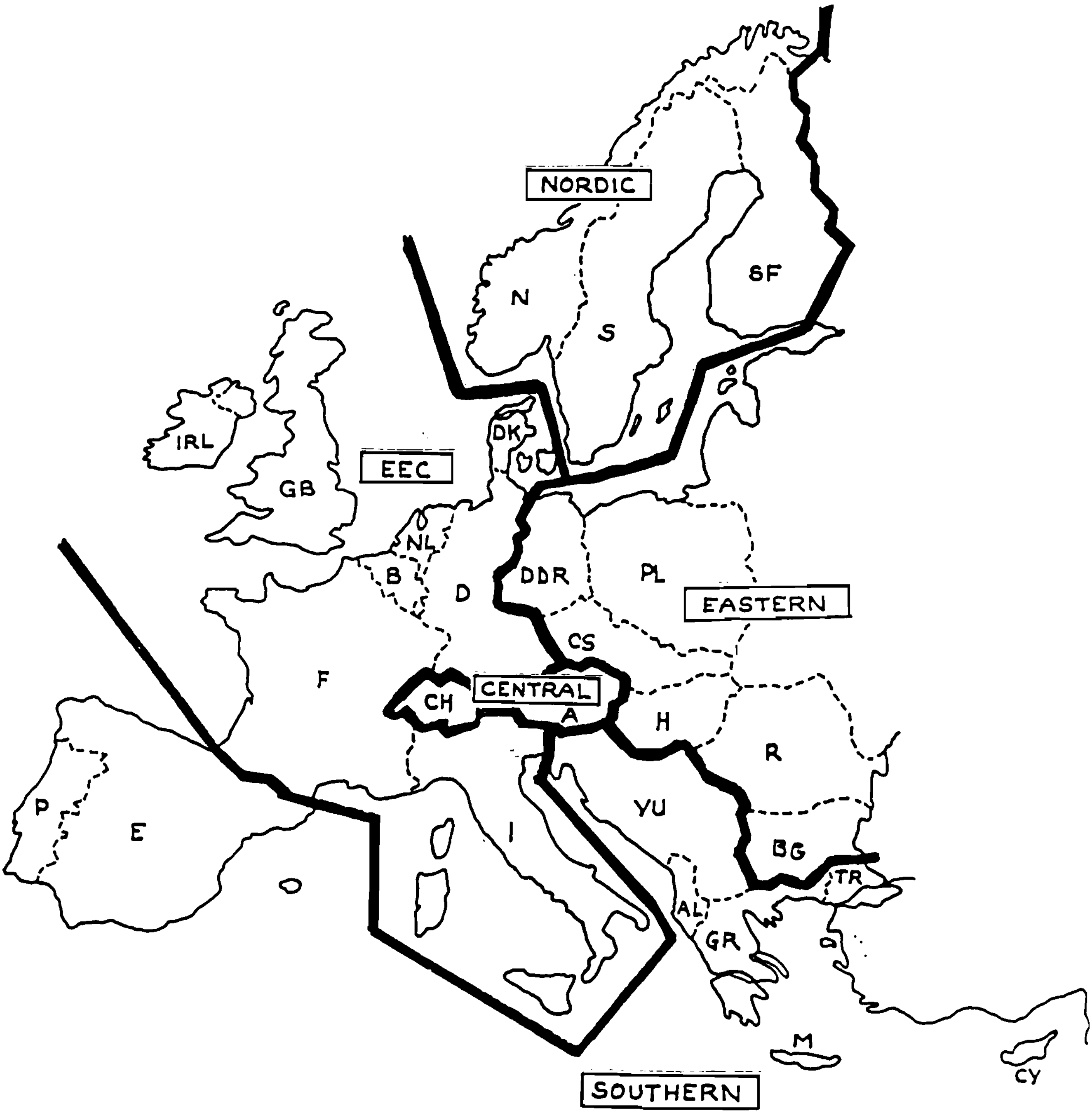

Figure 1. Sub-regions of Europe used in the Timber-Committee Study (1).

The high projection for GDP development used in the Timber-Committee Study (Table 4) is too high and rather unrealistic (compare Tables 4 and 5). There are no indications today that growth of GDP in Europe could reach such levels. The judgement by the panel of experts involved in the Timber- Committee study was also that the high estimate was unrealistic (1). Therefore, the demand scenario based on the high assumption for GDP development should be disregarded.

The development of GDP during the period 1980-1985 (Table 5) indicates that even the low GDP projection is too high. An average GDP growth rate of 2.6% per year for Europe is accepted here as a basis for projections on future demand for softwood lumber in Europe.

Table 5. Average annual growth rate of GDP (percentage) for the period 1980-85. (Source: OECD Main Economic Indicators).

Region	GDP Growth Rate
EEC10	1.3
Nordic	2.4
Central	1.3
Southern	2.1
OECD	2.4
OECD-Europe	1.4
North America	2.9

4. CONSTANT RELATION BETWEEN GDP DEVELOPMENT AND INVESTMENTS IN RESIDENTIAL CONSTRUCTION

As mentioned earlier, investments in residential construction are the major driving force for consumption of softwood lumber. During the period 1965-1980 there was a fairly stable and straight relation between investments in residential constructions and GDP development.

Table 6. Relation between investments in residential construction and GDP for many European countries.[1)]

	Relation Indices		Residential Investment / GDP	
Country	1966/71	1971/76	1976/81	1981/86
Finland	1.04	1.15	1.11	0.91
Sweden	0.97	0.90	0.64	0.62
Norway	1.05	1.31	1.24	1.15
Belgium	0.94	0.62	0.81	0.47
France	1.04	1.34	1.30	1.08
Denmark	1.00	1.08	0.92	0.54
FRG	1.00	0.87	0.68	0.73
Ireland	1.00	1.17	1.33	0.39
Netherlands	1.10	1.11	0.92	0.87
Italy	0.83	0.86	0.68	0.64
United Kingdom	1.05	0.97	0.91	0.65
Austria	1.03	1.09	1.07	0.87
Switzerland	0.88	0.95	0.81	0.88
Greece	1.00	1.07	0.73	0.67
Spain	1.00	0.97	0.88	0.69
Portugal	1.21	0.69	0.58	0.48

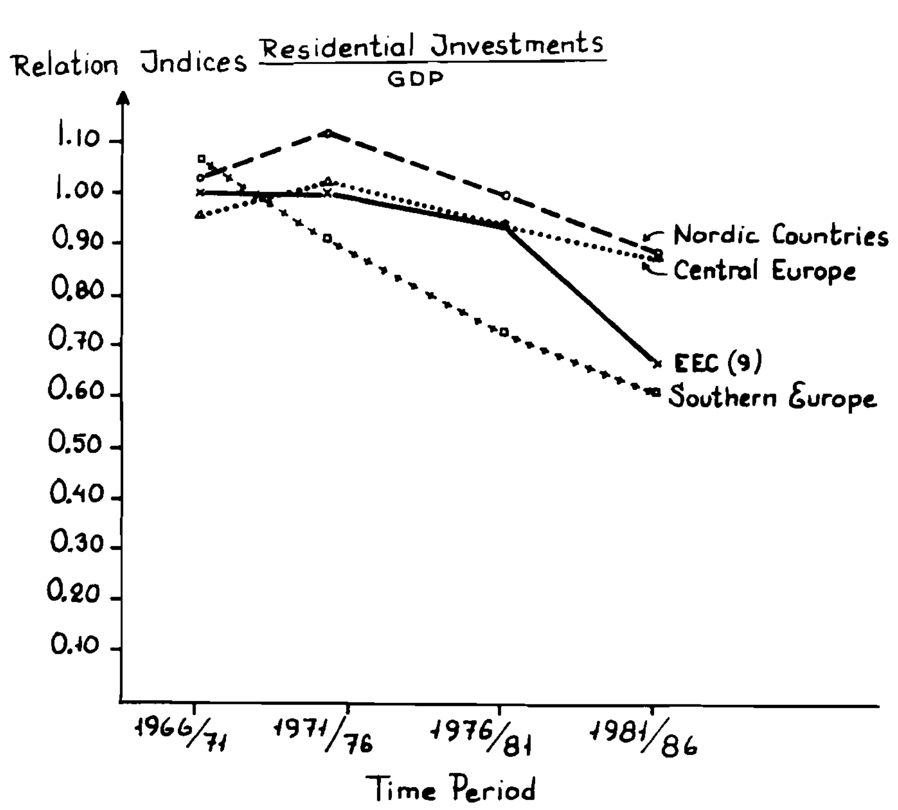

Figure 2. Relation between investments in residential construction and GDP for aggregated regions of Europe.[1)]

1) Relation indices, presented in Table 6 and Figure 2, are calculated by dividing annual percentage increase in residential construction by annual percentage increase in GDP.

In the late 1970s, the straight relation between investments in residential construction and GDP changed (Figure 2 and Table 6). At this time, investments started to decrease in relation to the GDP formation. This development can be explained by demographic factors. During the 1960s and 1970s, a major effort by the societies in Europe was to supply housing for large groups of people after the second world war. This objective was more or less fulfilled during the end of 1970s. After that a larger proportion of the GDP was used for other investments (see Figure 3, for example, for developments in the United Kingdom).

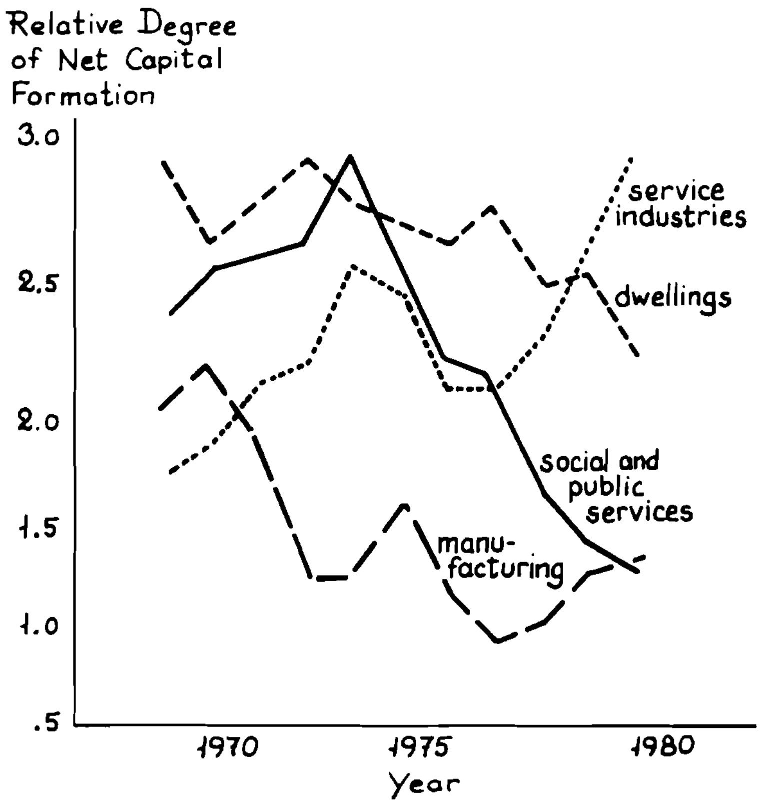

Figure 3. Degree of net capital formation in United Kingdom. After Broadbent and Meegan (7).

The negative trend in the relation between investments in residential construction and GDP-development is assumed to increase in the future. This assumption is based on the future development of socio-demographic factors, which will be discussed below.

The growth rate of the European population is expected to level out or decline during the following 35 years (Table 7). In other studies it has been identified that European countries have a lower fertility than other countries with similar socio-economic standards (8). Thus, European culture seems to have a checking effect on fertility. This is more obvious for the Northwestern part of Europe than for the southern part. Roman Catholics have higher fertility in comparison with Protestant countries. The influence of culture on fertility is expected to increase in the future (8).

Urbanization is expected to increase in the future as well (Table 7), especially in Southern Europe with an increase of urbanization by around 20% from 1985 to 2025.

Another structural change concerning the development of population is the shift in the distribution of age classes (Tables 7 and 8). A strong increase is foreseen in the age classes 45-65 years and older than 65 years.

Rogers (10) demonstrated how GPD is distributed on different activities over age classes in continental Europe (Figure 4). Consumption of housing is clearly concentrated in the age class 30-50 years old (Figure 4). After age 50, consumption is shifted towards social services with special emphasis on health care. With the future age-class distribution, there will be increased demand on smaller and efficient dwellings, special buildings for retired people and, nursing homes. The demand on ordinary single- and multi-family houses will also decrease in the future.

Another factor influencing the demand on dwellings and the size of the dwellings is future family size. Today there is a strong increase of single-person households and two-person households both in continental Europe (Table 9) and in the Nordic countries (e.g., (12)). This development creates an increased demand for more but smaller dwellings.

Table 7. Population development in the regions EEC-9 and Southern Europe. (UN 1986, unpublished material)

EEC-9

Year	Total in thousands	Percentages by Age Group					
		0-19	20-39	40-59	60-79	80+	Urban %
1950	215 399	31	29	26	13	1	69
1955	222 399	31	27	26	14	1	71
1960	232 261	31	28	25	14	2	73
1965	243 956	32	27	24	15	2	75
1970	251 307	32	27	23	16	2	78
1975	258 622	31	28	23	16	2	79
1980	261 185	29	28	24	16	3	80
1985	262 420	27	30	24	16	3	80
1990	263 581	25	30	25	16	3	81
1995	265 198	24	60	26	17	3	82
2000	266 495	24	28	27	18	3	82
2005	266 089	24	26	29	18	3	83
2010	264 862	23	25	29	19	4	83
2015	263 362	23	24	29	20	4	84
2020	261 799	22	24	28	21	4	84
2025	260 119	23	24	26	23	4	85

Southern Europe without Turkey

Year	Total in thousands	0-19	20-39	40-59	60-79	80+	Urban %
1950	62 249	39	30	21	9	1	38
1955	65 743	37	31	22	10	1	41
1960	68 874	37	31	21	10	1	43
1965	72 598	36	30	22	11	1	47
1970	75 486	35	28	22	12	1	52
1975	79 829	34	28	23	13	1	55
1980	84 132	33	28	24	13	2	58
1985	87 089	31	30	23	13	2	61
1990	89 986	30	30	23	14	2	64
1995	92 861	28	30	23	15	2	67
2000	95 572	28	30	24	16	2	69
2005	97 911	28	29	25	16	2	72
2010	99 787	27	28	26	16	3	74
2015	101 338	27	27	27	17	3	76
2020	102 759	26	26	27	18	3	77
2025	104 088	26	26	26	19	3	79

Table 8. Future age-class distribution in the EEC-9. After Commins and Higgins (9).

Age	1985 Millions (%)	2000 Millions (%)	Change 1985-2000 Millions
0 -14	63.6 (19.8)	64.3 (19.4)	+ 0.7
15-44	140.8 (43.8)	138.7 (41.9)	- 2.1
45-64	73.8 (23.6)	78.2 (23.6)	+ 4.4
65+	43.0 (13.4)	49.5 (15.0)	+ 6.5
Total	321.2 (100)	330.7 (100)	+ 9.5

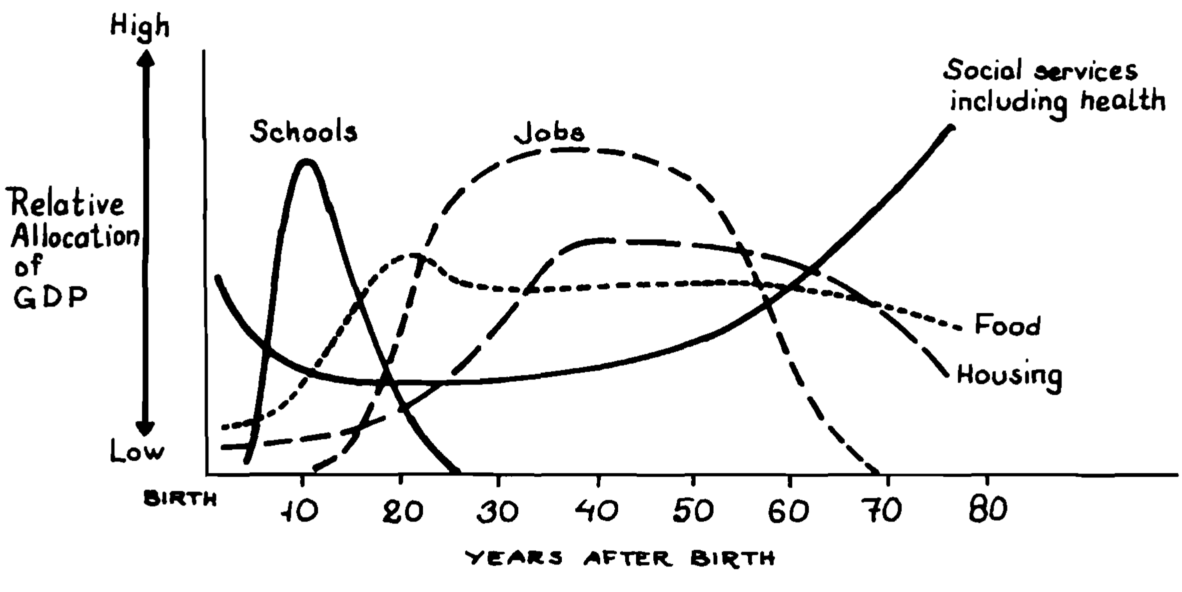

Figure 4. Distribution of GDP on different activities over age classes in continental Europe. After Rogers (10).

Table 9. Distribution of family size in continental Europe during the period 1960-1981. After Presvelou (11).

Family Size	Proportion of Total Population (%)			
	1960	1971	1977	1981
1 person	11.9	17.1	17.6	22.1
2 persons	24.4	25.3	29.9	29.9
3 persons	19.1	18.1	16.9	15.6
4 persons	17.9	19.1	21.1	20.7
5 persons	11.4	10.6	9.1	7.8
6 persons	6.7	5.1	3.3	2.5
7 persons	3.7	2.3	1.4	0.8

Another trend influencing future demand for dwellings is the extent of women gainfully employed. Recent increases in the proportion of women gainfully employed (Table 10) are expected to strengthen in the future (13). The actual trend is explained by increased levels of education. Gainfully employed women require smaller and efficiently designed dwellings.

Table 10. Distribution of gainfully employed women in EEC-10. After Dewson et al. (13).

Country	Percentage of women gainfully employed		
	1968	1977	1983
Belgium	31.7	34.4	36.9
Denmark	35.2	41.8	45.2
France	34.8	37.4	41.9
Germany	36.9	37.8	39.1
Greece	--	--	34.1
Ireland	26.6	28.4	31.1
Italy	27.2	28.7	34.1
Luxembourg	--	28.4	33.4
Netherlands	--	26.9	33.8
U.K.	35.2	39.0	40.4

During the 1960s and 1970s, migration played an important role on the demand on housing. Two kinds of migration are important: migration inside a country and migration between countries. The driving forces for migration within a country in Europe are:

- improvement of economic conditions
- better work
- closeness to work
- better housing
- marriage.

The relative importance of these driving forces change dramatically with age (Figure 5). The age class 20-40 years is the most important from a migration point of view. Earlier it was noted that this age class will decline in the future in Europe and that single-person households will increase.

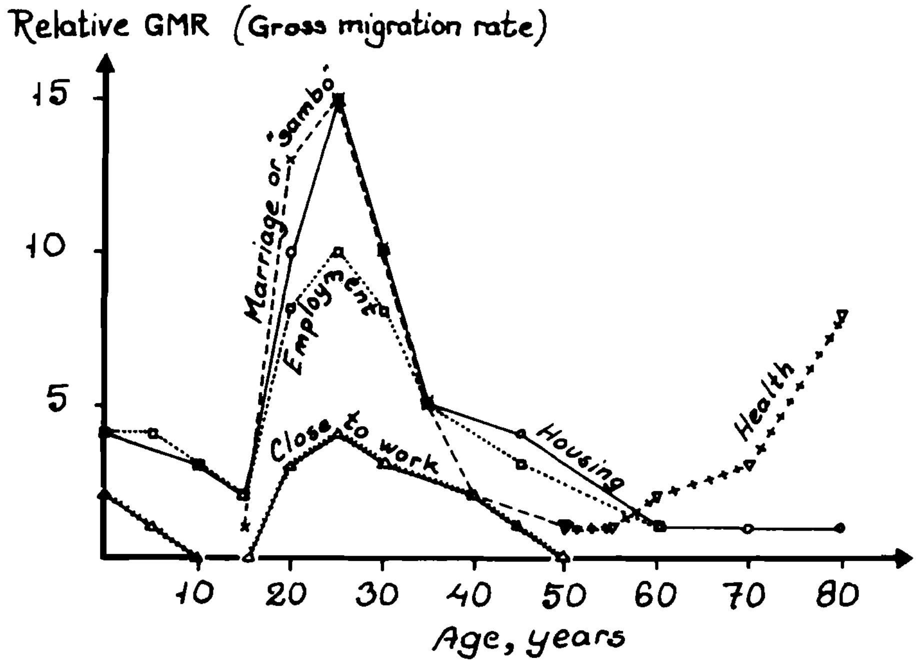

Figure 5. Observed cause-specific migration rates in continental Europe. After Rogers (10).

Migration between countries in Europe is driven mainly by the desire to improve individual socio-economic conditions. This kind of migration takes place mainly in the age class 20-30 years ((14) and Figure 6).

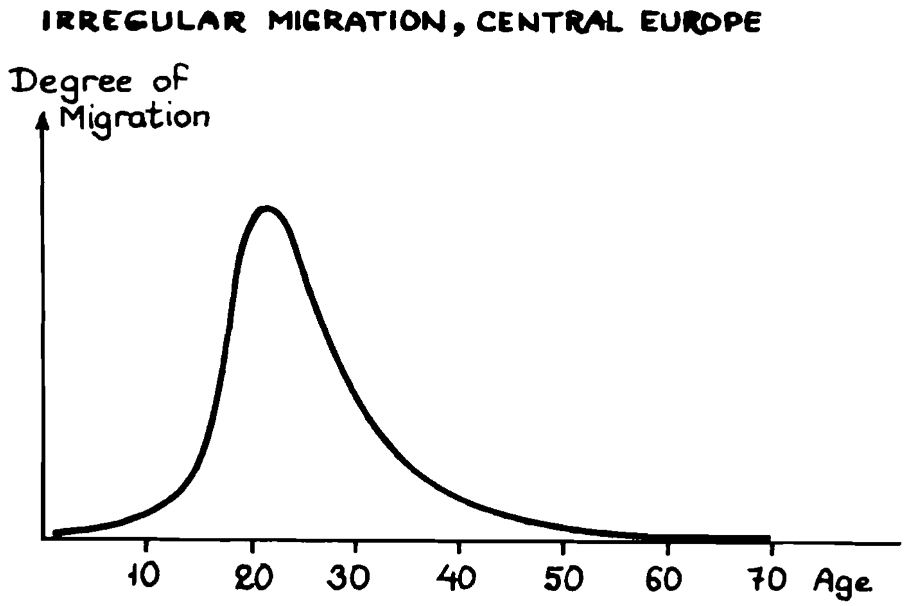

Figure 6. Distribution over age classes of migration between countries in Europe. After Castro and Rogers (14).

Migration between European countries was of big importance during the early 1970s, when 3.5 million individuals migrated to FRG and 2.5 million to France. This trend has now definitely changed (Table 11).

Table 11. Number of immigrants per thousand inhabitants in Europe. After Dewson *et al*. (13).

	Number of Immigrants per Thousand Inhabitants	
Country	1970	1980
Belgium	0.4	0.3
Denmark	2.4	0.1
France	3.5	0.8
FRG	9.2	5.1
Greece	5.3	5.2
Ireland	-1.2	-0.2
Italy	-0.9	0.2
Luxembourg	3.1	3.7
Netherlands	2.6	3.7
U.K.	-0.5	-0.9

The rate of unemployment in Europe has increased recently (Table 12), and is expected to increase in the future (13). About 40% of the reported unemployment is in the age class less than 25 years old. Thus, this age group has limited economic resources for renting dwellings of higher standards.

Table 12. Unemployment rates in Europe. After Dewson *et al*. (13).

	Unemployed as Percentage of Total Employed	
Country	1970	1983
Belgium	2.2	13.7
Denmark	1.0	9.3
France	1.3	9.1
FRG	0.6	6.9
Greece	--	1.5
Ireland	5.3	13.0
Italy	4.4	11.1
Luxembourg	0	1.3
Netherlands	1.0	12.5
U.K.	2.5	11.6

Due to changed demographic factors in the future, purchasing power in the future European society will change. Keyfitz (15) concluded that the financial burden on the young and middle-aged will be so great that it will be difficult to make a living. He also concluded that investments in social services must be reduced in the future.

The future demographic picture should be supplemented with a look at housing costs. Riley (16), discussing current and future housing costs in Europe and the United Kingdom, concluded that the cost spiral for housing has reached such an intensity that first-time buyers are being priced out of the market. He illustrated the situation in the U.K. by saying that purchasers are having to raise (in equity and debt) four times the average earnings per head in order to afford to buy an average house. He concluded that "children who not could enlist the support of parents would not be able to enter the housing market". Similar discussions are held in the media throughout Europe today.

The cost spiral for housing is, among other things, driven by the decreased availability of land for housing in urban centers in Europe. This can be illustrated by the development of London. International estate dealers are leaving London due to the fact that the city hardly can be expanded. The conclusion among dealers is that the future estate market in London will be dominated by renovations (17). Similar trends are identified in other European cities (17). Perhaps this trend is an indication that Europe will face the same housing situation in the future as Japan has today.

In summary, it seem unrealistic to base the demand calculations for softwood lumber on a constant and straight relation between GDP and new residential investments (Table 13). It is more realistic to assume a declining relation between development of GDP and residential investments. Rough calculations indicate that a decline in the actual relation of 1.5% per year is an underestimate of the future situation.

5. SUCCESS OR FAILURE IN MARKETING AND PRODUCT DEVELOPMENT

The ECE Timber Committee (1) analyzed two alternatives concerning product and market development (see Table 1). One alternative deals with the case that the sawmilling industry is successful in improving the lumber products and services which are adapted to the requirements of future markets. If the sawmilling industry is successful in these efforts, the Timber Committee assumes a positive effect on demand for softwood lumber of 0.5% per year. This assumption seems to be reasonable. If the sawmilling industry fails in its efforts in product and market development, the Timber Committee calculates a substitution of softwood lumber by other building materials by 0.5% per year. This means a decreased demand on softwood lumber by 0.5% per year in the future. To get a view of the ongoing process in product and market development, the actual substitution of softwood lumber is examined. A number of studies concerning such substitution exist, e.g., (18) and (19). They show that the sawmilling industry has not been successful in product and market development so far (Tables 14 and 15). The ongoing substitution is about 1% per year of softwood lumber. If this trend is not broken, a future "market failure" (see Table 1) is likely and a future substitution of at least 0.5% per year of softwood lumber is foreseen.

Table 13. Consequences of changed demographic and socio-economic factors on the future development of housing in Europe.

Factor	Consequences on Housing
Level out of population growth rate	General decline of demand on new dwellings
Changed age class distribution - more elderly people - more young people	Less demand on new single-family houses and large flats. Increased demand on small flats and nursing houses. Increased renovation.
Decreased family sizes	Less demand on new single-family houses and large flats. Increased demand on the number on small flats. Increased renovation.
Increased extent of gainfully employed women	Increased demand on smaller efficiently designed and well-equipped flats. Less demand on new single-family houses and large flats.
Less migration	General decline of demand on new dwellings.
Increased unemployment	General decline of demand on new dwellings. Increased renovation.
Increased financial burden for working generations	General decline of demand on new dwellings. Increased demand on cheaper (probably smaller) dwellings. Increased renovation.
Increased cost spiral for housing, less availability of land for housing and increased urbanization	General decline of demand on new dwellings. Increased demand on smaller and cheaper flats. Increased demand on multi-family houses. Increased renovation.

Table 14. Substitution of softwood lumber. Share of wood in relation to other building materials in construction. 10 years average for the period 1974-1984. After Nilsson (19).

	Average Change per Year
Nordic countries	- 0.5%
EEC (9)	- 1.6%
Central Europe	- 2.0%
Southern Europe	- 5.5%
Eastern Europe	- 1.0%
North America	- 1.0%
Japan	- 1.4%

Table 15. Relative usage of sawnwood in construction in U.S. 1970 = 100. After Nilsson (19).

	1970	1985
Single family houses/living area	100	84
Multifamily houses/living area	100	87
Other buildings than family houses/area	100	97
Sawnwood in industrial production	100	80
Wood per living area repair and maintenance	100	94

6. FUTURE PRICE RISE VERSUS PRICE FALL FOR SOFTWOOD LUMBER

In the Timber-Committee report (1), calculations are made on the effects of a price change in real terms on the future demand on softwood lumber. In one alternative, the consequences on future demand of softwood lumber are calculated at a real price increase of 1% per year (see Table 1). This price increase is driven by general increased demand on softwood lumber, limitations in supply of sawlogs, and increased delivered-wood costs. This price increase is assumed to drive the substitution of softwood lumber and to generate a declined demand in the future. The Timber Committee (1) uses a price decrease of 1% per year in real terms if there will be an oversupply of sawlogs, decreased delivered-wood costs, technological breakthroughs in the sawmilling process, and improvement of the efficiency in the long-distance transportation and distribution system to wood-users. Such developments are supposed to hamper the substitution of softwood lumber and act as a driving force for an increased demand on softwood lumber.

Earlier it was indicated that there will be a general decline in the future demand on softwood lumber in residential construction in Europe. Therefore, in this case it is of importance to study the future supply of softwood sawlogs and delivered-wood costs in Europe.

6.1. Future Wood Supply in Europe

6.1.1. Analysis by the ECE Timber Committee

The ECE Timber Committee (1) has analyzed the possible future wood supply in Europe (Table 16). This analysis has to some extent taken into consideration future changes in factors like species distribution and intensity in afforestation.

An increase is foreseen in the wood supply of softwood sawlogs in most regions (Table 16). This development is most obvious in the regions Nordic, EEC-9, and Southern. The increases for the 3 regions during the period 1980-2020 are about 45.55 and 70% respectively.

Thus, the Timber Committee is not indicating any supply problems concerning softwood sawlogs for Europe in the future.

6.1.2. Changed Silviculture Management

Within EEC-12, there is a strong underutilization (underharvest) of the forest resources. Kreysa (20) illustrated that only about 65% of the Net Annual Increment (N.A.I.) in this region is harvested. This is a rather strange situation, since the region EEC-12 imports about 37% of its consumption of forest products (expressed in roundwood equivalents) (21). There are several reasons for the low intensity in harvesting but the major contribution factor is a conservative forest management. Kuusela (22) has studied forest management in continental Europe and argues that compared with the prescribed thinning and rotation regimes, over large areas in continental Europe the density of stands is too high and mature stands are becoming too old. In another study, Kuusela (23) studied this conservative development of management in Bavaria and illustrated that the rotation period has changed dramatically during the last 25 years. In the early 1960s the rotation period was 110-120 years for softwood. But the actual age-class structure today indicates that the average rotation period is nearly 200 years. During this period, fellings have been at least 20% smaller than the net increment of growing stock.

Table 16. Possible wood removals in different regions of Europe (million m^3 under bark). Calculations based on detailed information from Timber Committee (1).

Region (Type of wood)	Base Year 1980	Removals 1990 Low	1990 High	2000 Low	2000 High	2010 Low	2010 High	2020 Low	2020 High
Nordic									
Total removals	103.8	104.3	126.9	109.3	130.1	115.2	135.5	119.4	140.4
Softwood sawlogs	45.5	51.3	54.3	51.6	56.2	54.1	63.4	56.1	66.0
EEC 9									
Total removals	81.1	95.3	102.9	114.7	101.1	106.6	120.1	111.1	129.4
Softwood sawlogs	28.8	31.7	34.8	35.2	40.2	37.3	42.0	38.9	45.3
Central									
Total removals	16.6	19.2	20.4	19.9	21.8	20.0	21.6	20.0	21.3
Softwood sawlogs	9.3	9.8	10.3	10.2	11.1	10.2	11.0	10.2	10.9
Southern									
Total removals	59.6	68.3	71.5	77.1	82.3	84.6	92.1	92.2	98.8
Softwood sawlogs	15.0	17.4	18.0	19.7	20.7	22.0	24.0	24.0	25.7
Eastern									
Total removals	79.5	80.0	83.6	82.8	89.2	85.3	94.7	88.5	100.3
Softwood sawlogs	25.2	23.7	24.9	24.3	26.1	24.7	27.5	25.7	29.1

There is a logical reason for conservative forest management in continental Europe. Huss (24) showed that big sawlogs (large diameter) have been the classic production goal in continental European forestry for a long time. This classic concept as a silviculture objective was driven by the sawmilling industry holding that the bigger the sawlog, the bigger the yield of volume from the sawmill, the bigger the yield of high quality lumber, and the lower the production costs. This resulted in a roundwood pricing system where thick logs are at a premium (Figure 7).

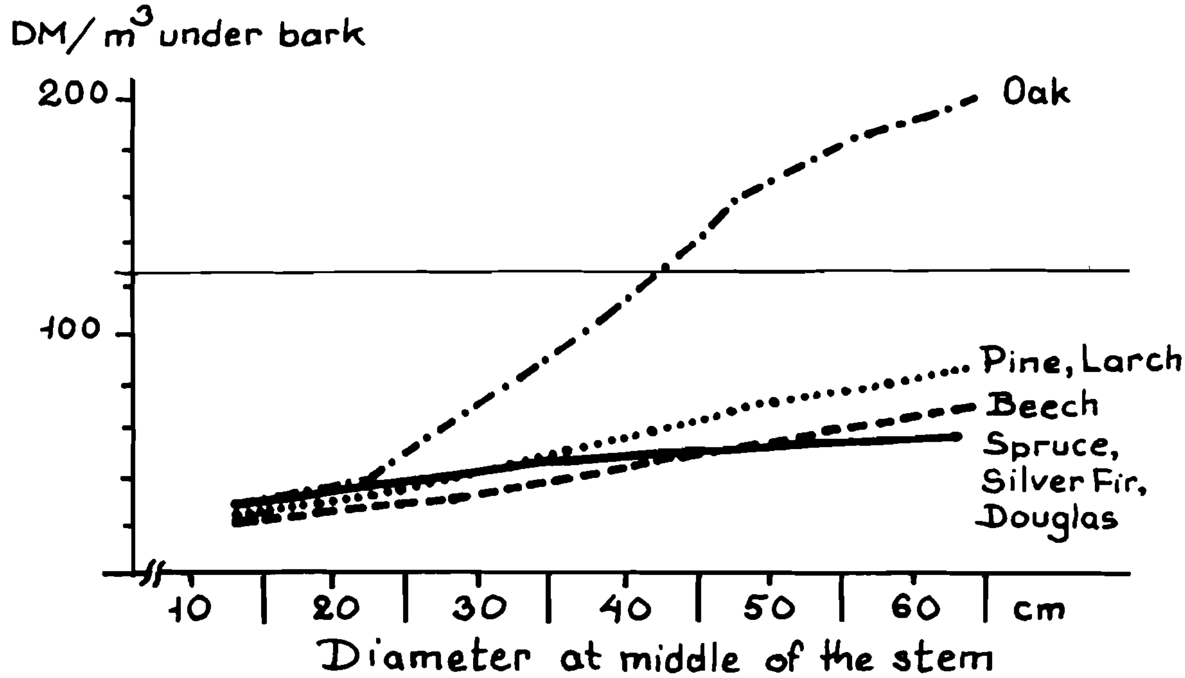

Figure 7. Relation between sawlog prices and diameter size of sawlogs in continental Europe (FRG) during mid-1980s. After Huss (24).

This situation is forcing forest owners to very long rotation periods in maximizing their profit. Based on the conservative forest management in continental Europe, Kuusela (22) made a revision of the future possible wood supply in Europe presented by the Timber Committee (Table 16). Thus, while the Timber Committee has calculated an increase in total growing stock and net annual increment during the period 1950 to 2000 by 45 and 46% respectively, and corresponding increases for the period 1980-2000 of 14 and 11% respectively (Table 17). Kuusela argues that this increase is too low. In combination with the dammed-up requirements on harvests in continental Europe, the estimate for total removals should be at least 70 million m^3 higher for total Europe in comparison with the high estimate of the Timber Committee (Table 17).

Table 17. Comparison between Timber Committee and Kuusela estimates concerning possible removals in Europe in 2000.

Variable	Increase in percentage according to the Timber Committee 1950/2000	1980/2000	High estimate year 2000 by Timber Committee (million m^3)	Estimate year 2000 by Kuusela (million m^3)
Growing stock (total)	45	14		
- coniferous	46	15		
Net annual increment (total)	46	11		
- coniferous	51	13		
Removal (total)	18	18	438	506
- coniferous	34	19		

Kuusela also argues that one of the contributing factors to the extent of forest decline attributed to air pollutants in Europe is the extent of overmature forest: "The combination of high density and old age is the most mortality-prone condition. Trees and stands that lose their vitality because of high density and old age become more and more sensitive to all kinds of diseases as well as to pollutants" (23). Forest managers in continental Europe are now becoming more and more aware of this situation. There are several indications that this condition will generate a more intensive management in continental Europe and an increased wood supply in the future. The forest-decline situation will be discussed further in section 6.1.4.

Another factor which will force continental-European forest management into higher intensity is the changed paying capacity in sawmills. As illustrated (see Figure 7) there has been an increasing price for sawlogs (stems) with increasing diameter. This condition has now changed due to:

- Changed sawmilling technology, resulting in higher productivity in medium-sized sawlogs in comparison with large sawlogs.

- Improved price and market conditions for chips produced at sawmills.

- All lumber dimensions can now be produced from small- and medium-sized logs using finger joints.

- The demands on large dimensions in residential construction is decreasing.

As an example of the changed paying capacity of continental-European sawmills (Figure 8), logs with a length of 4 to 8 meters and with a diameter at the middle of the log of 25 cm has a price advantage of 16 DM per m^3. Similar price changes have also occurred in the Nordic countries. The price for logs with top diameters bigger than 35 cm has been reduced due to changed paying capacity in the sawmills (26). Kreysa's (27) conclusion after an analysis of the forest sector in EEC is: "large dimensions are and will be less valuable than medium dimensions". As another driving force for a more intensive management in continental Europe, this change of the paying capacity in the sawmilling industry has not been taken into consideration in the analysis of the Timber Committee (1).

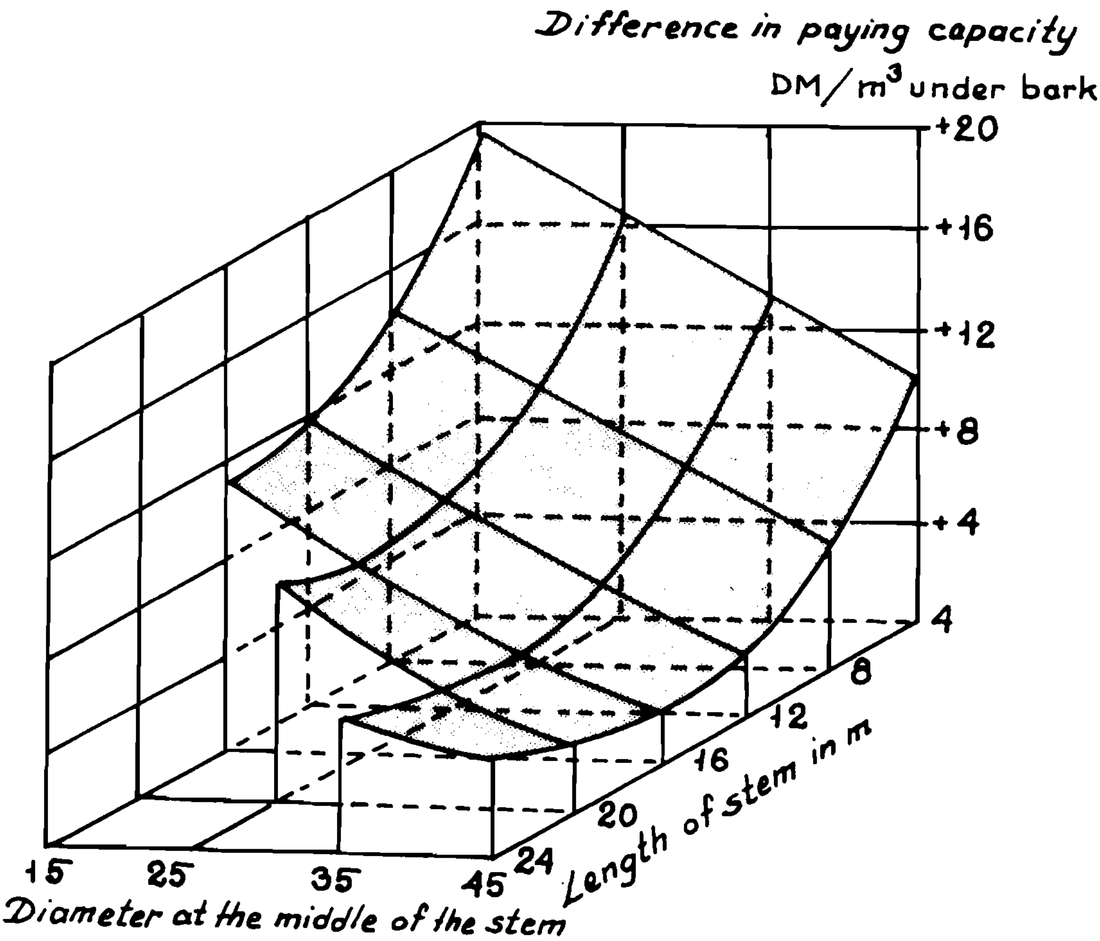

Figure 8. Example on difference in paying capacity in European continental sawmills for different diameters and lengths of stems. After Häber (25).

6.1.3. Possible Conversion of Agricultural Land into Forest Land

Subsidies to direct agriculture production within the EEC is around 12 million USD/year. Overproduction of animal products and feed crops is about 30-40% per year. In spite of high subsidies, it has been impossible to attain the same economic standard for farmers in comparison with other groups in society (9 and 28). Due to effects of new biotechnology, productivity in European agriculture is estimated to increase in the future (Table 18).

Table 18. Increase in productivity in European agriculture (EEC) in the future. After Dewson et al. (13).

Product	Future Annual Growth Rate (percent)
Beef:	
Yield of meat per unit feed	0.2
Calves per year	0.7
Dairy:	
Yield of milk per unit feed	0.2
Milk per cow per year	3.9
Poultry:	
Yield of meat per unit feed	2.0
Eggs per layer per year	0.7
Swine:	
Yield of meat per unit feed	0.6
Pigs per sow per year	1.1
Corn:	
Yield per ha and year	1.2
Yield per hen and year	1.3

Based on information from De Wit et al. (30) and Wong (31) concerning major trends for cereal crops, Stigliani et al. (29) estimated that a total of some 40 million ha of agricultural land in Europe are expected to be taken out of production, corresponding to about 30% of the present land used for growing cereal crops (Table 19). There seems to be a general opinion within the EEC that there is only one realistic alternative usage for most of the abundant agricultural land - some form of forestry (see Kreysa and Last (32)).

Table 19. Plausible agricultural development of Europe for the period 1980-2030 in terms of the amount of land (in million ha), the total production (in million tonnes), as well as yield (in tonnes/ha). After Stigliani et al. (29).

Region	1980			2000			2030		
	Land	Prod.	Yield	Land	Prod.	Yield	Land	Prod.	Yield
Nordic	3	10	3.3	2	9	3.3	2	10	5.0
EEC-9	27	120	4.5	18	98	5.4	13	82	6.3
Central	1	5	4.5	1	6	5.5	1	6	5.8
South	15	42	2.8	14	46	3.3	11	44	4.0
Eastern	84	189	2.3	68	200	3.0	60	216	3.6
Europe	130	366	2.8	103	359	3.5	87	378	4.2

The conversion of agricultural land will influence the future wood supply first in the long term (year 2030-2040). But this process can also facilitate the possibility to harvest earlier in existing forest resources. Within the Forest Study at the International Institute for Applied Systems Analysis (IIASA), we have tried to estimate how much of the abundant agricultural land can be converted to forestry (Duinker et al. (33); Table 20).

Table 20. Possible conversion of agricultural land into forests. Expressed in thousand ha new forest land. After Duinker et al. (33).

Region	Period		
	1990-2000	2000-2010	2010-2020
Nordic	500	500	500
EEC-9	3655	4040	3400
Central	350	550	700
Southern	845	1230	1400
Eastern		1500 (up to year 2010)	

Thus, large areas (about 20 million ha during the period 1990-2020) with high productivity and good infrastructure will probably be available for forest production. One example is Ireland with a total possible conversion of 1.65 million ha and an average production of 14-15 m^3/ha/year of Sitka Spruce and a rotation period of 40-50 years (see Bulfin (34)). In this case, forest development is driven by a sector outside the forest sector, i.e., agriculture.

Kreysa and Last (32) have analyzed the consequences of a changed land use (including conversion of agriculture land) on the future supply of sawlogs within the EEC (Table 21).

Table 21. EEC countries with possibilities to increase future sawlog production. After Kreysa and Last (32).

Kind of Land Use	High probability of significantly increased amounts of sawlogs
A[1)]	Belgium, France, FRG, The Netherlands, Portugal
B	Denmark, Belgium, France, FRG, Greece, Ireland, Italy, The Netherlands, Portugal, Spain, UK
C	Denmark, Belgium, France, FRG, Greece, Ireland, Italy, The Netherlands, Portugal, Spain, UK

1) A. Improvements within existing forests and afforestation of some other land already available to forest authorities.
B. As (A) plus the afforestation of some less productive agricultural land.
C. As (B) plus the afforestation of some more productive agricultural land.

The conditions discussed above were not taken into consideration in the Timber-Committee estimate of future supply of softwood sawlogs (see Table 16).

6.1.4. Forest Decline Attributed to Air Pollutants in Europe

The information on forest decline is uncertain, principally because:

- the classification of forest decline is rather subjective (e.g., crown density);
- monitoring systems vary among countries; and
- the volume estimates are very rough.

The best available information has presented by Nilsson (35) (Table 22).

Table 22. Extent of forest decline attributed to air pollutants in Europe in 1987. Expressed in million m^3. After Nilsson (35).

Region	Probably damaged volume by air pollutants		Risk Group
	Softwood	Hardwood	Softwood
Nordic	400	n.a.[1)]	n.a.
EEC-9	260	570	485
Central	55	125	280
Southern	85	280	150
Eastern	460	100	390

1) n.a. = not available

In total, about 3.5 billion m^3 are affected by air pollutants and other natural stress factors in Europe. However, the Nordic region argues that most of the decline in this region is caused by natural stress factors. Thus, from a wood supply point of view, the EEC-9 and Eastern regions are the worst affected by air pollutants.

So far the extent of damage has not disturbed the international roundwood markets. If the affected volume is increasingly subjected to sanitation harvests, the supply situation in Europe may be strongly changed. The extent of forest decline is concentrated in older and large diameter stands (Table 23).

Table 23. Damaged trees as percentage of the number of investigated trees in FRG. All species and all levels of damage. After Anon. (36).

Year of investigation	Stands of less than 60 years	Stands of more than 60 years
1984	35.0	69.0
1985	34.6	72.9
1986	34.9	73.3
1987	32.8	75.6

A large number of studies have been carried out on the biological and technological properties of wood damaged by air pollutants (for a summary of the study see [Duinker et al. (33)]). The studies carried out are mostly based on laboratory studies and deal with lumber quality. The conclusion from these lab studies is that forest damage caused by air pollutants will not generate any negative consequences on lumber production and lumber yield. However, investigations among sawmills indicate a negative effect of forest decline on the sawmilling industry.

A questionnaire was sent out to sawmillers in Baden-Württemberg, FRG (37), and some of the results from the questionnaire were:

- 20% of the sawlogs delivered to the sawmills were affected by air pollutants.
- About 75% of the sawmills made the statement that the quality is lower in the damaged wood, and a larger volume has to be sorted out in comparison with healthy logs.
- About 75% of the sawmills stated that damaged wood was a contributing factor to lower prices on the lumber market.
- About 45% of the sawmills indicated market problems due to the damaged volume.

Along with an increased wood supply due to sanitation harvests, the situation above indicates that bulk products of lumber will be strongly influenced.

Joukki and Uutela (38) made an analysis of price effects on different forest products in connection with increased wood supply caused by air pollutants (Table 24).

Table 24. Changed cost competitive structure due to increased sanitation harvest caused by air pollutants. After Joukki and Uutela (38).

	Changes in Cost Competitiveness (%)					
	Cost Decrease without Subsidies		Relative Benefit of	Cost Decrease with Subsidies		Relative Benefit of
	CE[1)]	Nordic	CE	CE	Nordic	CE
Spruce sawnwood	-10-12	--	+10-12	-20-24	-5-6	+15-18
BL. softwood pulp	-5	--	+5	-15	-5	+10
LWC-paper	-1	--	+1	-3	-1	+2
F. Boxboard	-1	--	+1	-3	-1	+2

1) CE = Continental Europe

They concluded that it is mainly the cost competitive structure of the sawmilling industry which will be influenced by an increased sanitation harvest due to air pollution.

A central question at this point is how to handle the situation with a tremendous volume of old forests affected by air pollutants, declining prices for large dimensions, and a general decline in the growth of demand on softwood lumber.

6.1.5. Conclusions Concerning Future Wood Supply

The analysis carried out by the Timber Committee (Table 16) indicates a rather strong increase in the future supply of softwood sawlogs. Changed management, conversion of agricultural land and sanitation harvests due to air pollution, discussed above, will generate an even greater wood supply in the future in comparison with the Timber-Committee estimate. The increased wood supply will press the prices of sawlogs downwards, which will be a contributing factor for increased demand on softwood lumber. But it also means that the importing countries will reach a higher degree of self-sufficiency in the future, as discussed below.

6.2. Prices and Technological Development

Real prices of softwood lumber have had a flat or slightly declining development since 1970 in Europe (See Lönner (39)). According to Jaakko Pöyry (40), a continued slight decline in real prices is foreseen in the future. This is necessary to avoid increased substitution of softwood lumber. High quality softwood lumber may have a slight increase or flat development in real terms in the future.

Prices for softwood sawlogs in most countries showed a sharp rise around 1973-74 after a less eventful period (1). The price rise was followed by an abrupt decline and brought prices around 1980 to the same level, in real terms, as in the mid-1960s. During the rest of the 1980s the prices more or less stayed at this level. Without any disturbances in the market this real price level is estimated to continue in the future.

In the Timber-Committee report (1) it was also stressed that technological breakthroughs and strong improvements in distribution systems may influence the future prices on softwood lumber. Today, no revolutionary breakthroughs in technology and distribution are foreseen. Of course, breakthroughs are by nature very difficult to predict but they are international commodities. This means that the effects of eventual technological breakthroughs will be roughly the same in all regions of Europe, implying no change in competitive structure between regions in Europe.

Based on the discussion so far, there are no reasons for assuming any real price changes for softwood lumber in the future except in situations with a large extent of sanitation harvests and conversion of agricultural land. It also means that, in the analysis of future demand scenarios presented by Timber Committee (1), no real price changes should be taken into account. Thus, the conclusion is that the Timber-Committee scenarios "Price rise" and "Price fall" are only valid under extreme conditions.

7. DEMAND IN OTHER END-USE SECTORS THAN RESIDENTIAL CONSTRUCTION

So far, the discussion on future demand has concentrated on the end-use sector residential construction. This sector is the most important sector concerning demanded lumber volume. There are no separate estimates presented in the Timber-Committee report (1) concerning the development of the individual end-use sectors. Therefore, the following discussion is based on a special investigation into the development of the sawmilling sector in continental Europe (Anon., (41)) and papers by Nilsson (42) and Politi (43) (Table 25).

Table 25. Estimated consumption of lumber in other end-use sectors than residential construction in continental Europe[1]. After Anon. (41).

End-use sector	Consumption in 1000 m^3 1986	2000	Increase in percentage per year 1986-2000
Building carpentry	1 800	1 935	0.50
Furniture	1 050	1 140	0.57
Residential construction	16 800	18 050	0.49
Do-it-yourself	3 700	4 515	1.47
Packaging	4 500	4 830	0.49
Others	1 250	1 080	-0.91

1) Continental Europe is represented by FRG, France, the Netherlands and United Kingdom.

In the following some comments are made on the individual end-use sectors with exception for Residential construction.

Building carpentry

The usage of wood in building carpentry is characterized by high qualities, like Nordic and North-American softwood and tropical hardwoods. The future growth rate in demand will be rather modest.

Furniture

The usage of solid softwood in furniture is rather small. Tropical hardwoods have a stronger market position in comparison with European softwood. Pine is used to a rather high extent in some countries. The estimated growth rate on demand is modest.

Do-it-yourself

The do-it-yourself sector is estimated to have a good development in the future. The requirements on quality are high (however, less expressed in comparison with building carpentry). The most important products are planed lumber, panels and ledges.

Packaging

A limited expansion is expected in the future for the packaging sector. The requirements on quality are very low. Therefore, this product will be domestically produced in the future.

Thus, it can be concluded that other use sectors than residential construction will account for a rather small amount of the future demanded volume of softwood lumber.

8. QUANTIFICATION OF FUTURE DEMAND ON SOFTWOOD LUMBER IN EUROPE

Based on the above discussions, I have made a validation of the scenarios presented by the Timber Committee (see Table 1) for future softwood lumber supply in Europe (Table 26). There have been no possibilities to generate 7 consistent scenarios for all regions (Table 26). Concerning the demand development in the Eastern region, there are a number of signs indicating an increased residential construction and a general increased demand on softwood lumber (See Anon. (41)). Therefore, the alternative High Trend is assumed to be realistic for this region.

Table 26. Timber-Committee scenarios for future softwood lumber consumption considered here to be invalid, as indicated by a line through the invalid alternatives. Wood volumes are expressed in million m^3.

Region with Recent Annual Consumption	Scenario for Year 2000: Annual Consumption	Basis
West-Central 1979/83		
33.73	37.45	End-use low GDP 2.6%
	~~44.10~~	~~End-use high GDP 3.3%~~
	29.60	User sector recession
	~~41.20~~	~~Success marketing~~
	34.00	Failure marketing
	~~33.50~~	~~Rise Prices~~
	~~41.70~~	~~Fall Prices~~
South 1979/83		
14.93	19.43	End-use low GDP 2.6%
	~~24.93~~	~~End-use high GDP 3.3%~~
	13.10	User sector recession
	~~21.40~~	~~Success marketing~~
	17.70	Failure marketing
	--	Rise Prices
	--	Fall Prices
Exporters 1979/83		
12.07	12.96	End-use low GDP 2.6%
	~~14.32~~	~~End-use high GDP 3.3%~~
	11.30	User sector recession
	~~14.30~~	~~Success marketing~~
	11.80	Failure marketing
	--	Rise Prices
	--	Fall Prices
Eastern Europe 1979/81		
15.52	~~16.54~~	~~Trend low~~
	18.66	Trend high
	~~24.70~~	~~GDP Base 2.6%~~

The division of regions of Europe for these 7 scenarios is different and not consistent with the division used in earlier discussions concerning the Timber-Committee report. The division of Europe into regions in the is the following:

West-Central:	Denmark, Belgium, France, Federal Republic of Germany, Ireland, Luxembourg, Netherlands, Switzerland and United Kingdom.
South:	Greece, Italy, Portugal, Spain, Turkey and Yugoslavia.
Exporters:	Austria, Finland, Norway and Sweden.
Eastern:	The same as earlier.

In summary, it seems realistic to assume a future demand on softwood lumber in the range of "End-use, low GDP 2.6%" and "Failure marketing" to "User sector recession". This means a modest growth or decline in volume in comparison with the situation in the early 1980s.

Based on the original regional division of Europe (see Section 2), there are possibilities to present quantifications for the two scenarios "GDP low, 2.6%" and "GDP high, 3.3%" (Table 27). For these regions the Timber Committee (1) has also produced a scenario for consumption up to year 2025. This scenario is, however, based on per-capita consumption. The estimate here is that the per-capita consumption will be the same year 2025 as year 2000. This scenario deals with total consumption of lumber (both soft- and hardwood lumber).

Again based on discussions above, I consider several of these scenarios to be unrealistic (Table 27). The remaining valid scenarios (Table 27) suggest that total consumption will decline between year 2000 and 2025 for all regions except Southern and Eastern. Growth in softwood lumber consumption is expected in the regions EEC-9, Southern and Eastern.

9. DEGREE OF POSSIBLE SELF-SUFFICIENCY OF SOFTWOOD LUMBER IN EUROPE

By combining the information in Tables 16, 26, and 27 with conversion factors for softwood sawlogs to softwood lumber (presented in Table 28) it is possible to estimate the future degree of possible self-sufficiency of softwood lumber in Europe (Table 29). These estimates are based only on possible future availability of softwood sawlogs; no analysis is made of the economic feasibility to increase the sawmilling industry. Clearly, the Nordic, EEC-9, and Central regions have the possibility to increase the degree of self-sufficiency in softwood lumber, but the Southern and Eastern regions do not (Table 29).

The rather big difference in the conversion factors between the Nordic region and the other regions can be explained by the different sawmilling technologies and the sizes of sawlogs. In the Nordic region the sawlogs are smaller than in other regions. Smaller logs give less yield of lumber in comparison with large sawlogs. In the Nordic region the sawmills are also trying to optimize the economic yield and not the yield of volume. The chip price is also rather high in the Nordic regions. Therefore, by optimizing the economic result in the Nordic sawmills the lumber yield/m^3 sawlogs is less in comparison with other regions.

Table 27. Alternative demand scenarios generated by Timber Committee (1). Expressed in million m^3.

Region	Year 1979/81	2000	2025	Scenario
Nordic	10.32	10.34		GDP low 2.6%
		~~11.40~~		~~GDP high 3.3%~~
	10.80	11.0	10.0	Per capita low[1)]
		~~12.2~~	~~12.0~~	~~Per capita high[1)]~~
EEC-9	37.66	41.47		GDP low 2.6%
		~~48.78~~		~~GDP high 3.3%~~
	50.50	58.60	57.0	Per capita low[1)]
		~~69.30~~	~~68.0~~	~~Per capita high[1)]~~
Central	4.34	4.77		GDP low 2.6%
		~~5.44~~		~~GDP high 3.3%~~
	5.00	5.70	5.0	Per capita low[1)]
		~~6.60~~	~~6.0~~	~~Per capita high[1)]~~
Southern	10.42	13.80		GDP low 2.6%
		~~18.19~~		~~GDP high 3.3%~~
	14.30	20.80	26.0	Per capita low[1)]
		~~26.80~~	~~34.0~~	~~Per capita high[1)]~~
Eastern	15.52	~~16.54~~		~~Trend low~~
		18.66		Trend high
	21.70	23.00	25.00	Per capita low[1)]
		~~25.90~~	~~28.00~~	~~Per capita high[1)]~~

1) Total consumption of softwood and hardwood lumber.

Table 28. Raw-material/Product conversion factor. Softwood lumber (m^3/m^3). Recalculated from Timber Committee (1).

Region	Conversion Factor
Nordic	1.90
EEC-9	1.70
Central	1.44
Southern	1.71
Eastern	1.57

Table 29. Softwood lumber production (million m^3) and degree of self-sufficiency (percentage) in Europe.

Region	Lumber Production and Degree of Self-Sufficiency		
	1979/81	2000	2020/25
Nordic			
Lumber production	24.0	27.2-29.6	29.5-34.7
Self sufficiency	233	259-325	281-386
EEC-9			
Lumber production	16.9	20.7-23.7	22.9-26.7
Self sufficiency	45	50-62	55-72
Central			
Lumber production	6.5	7.1-7.7	7.1-7.6
Self sufficiency	130	148-179	148-190
Southern			
Lumber production	8.8	11.5-12.1	14.0-15.0
Self sufficiency	84	83-96	58-81
Eastern			
Lumber production	16.1	15.5-16.6	16.4-18.5
Self sufficiency	104	83-89	80.0-88

Thus, there is a tendency to a slight improvement in the total balance situation of softwood lumber for total Europe in the future (Table 30). This situation is valid, however, under conditions with no change in silviculture, no expansion of sanitation harvest due to air pollutants, and no dramatic conversion of agricultural land in the future.

Table 30. Possible total balance for softwood lumber in Europe. Expressed in million m^3.

Year 1979/81	2000	2020/25
-6.6	+ - 0 to + 7.0	- 7.2 to + 13.3

10. COST-COMPETITIVE STRUCTURE OF THE SAWMILLING INDUSTRY IN EUROPE

The major factors influencing the cost-competitive structure of the sawmilling industry are delivered-wood cost, personnel costs, other production costs, prices on sold chips, prices on sold sawdust, and profitability. The Nordic region is the highest-cost producer in relation to the other regions (Table 31). The price of lumber is about the same in all regions (41). The dominating cost factor is, as underlined earlier, the wood cost as a share of total production cost. This means that changed wood cost in the future will drive changes in the competitive structure of the sawmilling industry in Europe.

11. OTHER COMPETITIVE FACTORS CONCERNING THE SAWMILLING INDUSTRY IN EUROPE

In a similar report concerning the pulp industry in Europe, I have discussed other competitive factors concerning the forest industry (See Nilsson (44)). Some of these factors, like risk-taking capital for investments, closeness to market, entrepreneurship, workforce and general investment conditions (Table 32), also have a bearing on the sawmilling industry. Other competitive factors include future competition from the sawmilling industry in North America and USSR. It is reasonable to expect that the North American producers will concentrate on the residential- construction and building-carpentry sectors in the continental European market (41), and the mills in USSR will concentrate on the residential-construction sector in continental Europe.

12. FUTURE CHALLENGES

Research and development (R&D) in the sawmilling industry is far behind in comparison with other sectors (See Timber Committee (1), Lönnstedt et al. (6) and Lönner (39)). The amount invested in R&D is only 0.5 to 1% of the total production value. There are possibilities to change the not very gloomy picture for the sawmilling industry presented so far in this report by increased investments in R&D. The increases should be directed mainly towards the building industry, where some interesting trends are developing (45). The following discussion is based largely on Kroner (45).

Single-use buildings

As discussed earlier the land availability for housing is decreasing in many areas and costs for housing are in a cost spiral. The critical question is, can we afford to continue suburban sprawl and single-use buildings in the future? If this situation changes, how will it influence the quality and choice of housing options?

Table 31. Cost competitive structure of the sawmilling industry in Western Europe during mid-1980s. Expressed in relative figures where the Nordic region = 100.

Region	Production cost	Wood cost as share total of production cost (in %)	Wood cost	Personnel	Other production costs	Prices on chips	Prices on sawdust	Profitability
Nordic	100	74	100	100	100	100	100	0 to negative
EEC-9	80-90	75-80	85-90	80-95	65-70	60-100	80-120	0 to negative
Central	90	80	95	75	70	70	80-100	0 to negative
South	75-80	70-75	80	80	60	n.a.	n.a.	0 to positive

Table 32. Other competitive factors concerning the sawmilling industry. After Nilsson (44).

Region	Closeness to markets	Risk-taking capital	Entrepreneurship	Work force	Investment environment
Nordic	+[1)]	+	+	+++	+
EEC-9	+++	+++	++	++	+++
Central	+(+)	+	++	++	++
Southern	+++	+++	+++	+(+)	+++
Eastern	+	+			(+)

1) The more +, the better the competitive position.

Resource constraints

The energy- and water-supply situation is becoming critical in many European countries (27, 33, 44; see Table 33). Under such conditions of shortage, different quality, design and material in the buildings are required. Above it was shown that the requirements on efficiency and design will increase due to changes in socio-demographic factors. So far, the design and construction of dwellings were based on "average family", "average person" and "average worker". Such foundations for residential construction will not be valid in the future.

Table 33. Water availability in selected countries in Europe. Expressed in 1000 m^3 per head per year. After Kreysa (27) and Duinker _et al_. (33).

Country	Water Availability 1971	2000	2020
Belgium and Luxembourg	0.9	0.8	0.7
Denmark	3.0	2.7	2.4
France	4.6	3.8	3.2
F.R.G.	1.4	1.3	1.2
Greece	7.4	6.4	5.4
Ireland	13.7	11.1	10.0
Italy	3.0	2.4	1.8
Netherlands	0.8	0.6	0.4
Portugal	2.8	2.5	2.2
Spain	3.9	2.8	1.8
United Kingdom	2.7	2.0	1.3

Building diagnostics

The maintenance costs of buildings are increasing dramatically. In the future a continuous monitoring of the behavior and performance of buildings is required to identify degradation of material and equipment. This will lead to changed design, material and construction technologies.

Changed work and living patterns

In the future there will be decreases in the number of working hours per day. The separation between work and living will also decrease. These developments require a changed design of the buildings. Typical housing developments and office buildings may be redefined as work/living environments. Changes in transportation may increase the integrated work/living combination.

Robotics

The use of robotics will change our living and working conditions and also building construction. Fibre optics, composite materials and super-conductors will generate quite new concepts for construction.

Industrial light-weight building modules

In the future, dwellings will have the possibility to expand or decline depending on demand caused by weather, guests and required environment.

Buildings within buildings

Instead of having individual functions for each building, a development is foreseen in which one major building provides for some functions, and buildings within the major building providing other functions.

Intelligent buildings

An intelligent building is monitoring changing conditions both inside and outside. The building modifies its physical characteristics and properties in response. One example is rotating buildings.

Invisible wealth potentials

Today the societal emphasis is on visible wealth and human resources. Invisible wealth refers to spiritual and creative potential. Increased attention to invisible wealth will change the nature of buildings and the building environment. Buildings may have an interface between the natural environment and the indoor environment.

Conclusions concerning future challenges

These are some of the ongoing discussions and trends in the development of buildings and building systems. The overall question is if the sawmilling industry, with its current low profile in R&D, has the resources and the capability at all to accept these challenges, and if the existing management in the industry has the proper background and education for these challenges. The answer is probably no. One possibility to increase the capabilities in accepting the challenges is that the construction industry should take an active part in the development of the sawmilling industry (33). Based on the discussion in Section 9 above, and the discussion in Nilsson (44) concerning the future development of the pulp and paper industry, the conclusion must be that increased acceptance to challenges in the sawmilling industry is required. Otherwise the sawmilling industry will lose competitive position to the pulp industry concerning supply of raw material. However, a consolation for the sawmilling industry can be Guillard's findings (46) that about 50% of the forest products existing on the market today were not known at all 20 years ago.

13. STRUCTURE AND RANKING OF COMPETITIVE FACTORS IN DIFFERENT REGIONS OF EUROPE FOR THE SOFTWOOD LUMBER INDUSTRY

Based on the materials presented above, it is possible to make a rough ranking of competitive factors in different regions of Europe concerning the softwood lumber industry (Table 34). Based on these rankings (Table 34), it is possible to identify a number of different strategies for the sawmilling industry in different regions of Europe.

The major conclusions to be drawn about the future of the softwood lumber industry in Europe, as based on the materials presented above, are:

- The general demand for softwood lumber will increase only in the southern and eastern regions of Europe.

- Demand for repair and restoration, and for smaller and more efficient dwellings, will increase in most regions of Europe. This demand for lumber has different requirements in comparison with traditional construction lumber.

- The demand for high quality wood will increase.

- In Europe there will be no problems with the supply of softwood and sawlogs to the sawmilling industry in the near future.

- The degree of self-sufficiency of softwood lumber will increase in most regions of Europe. In the future, there will be fewer export possibilities, and the domestic markets will be of major importance for the sawmilling industry.

- Profitability will be rather low in the sawmilling industry. This also means that the pulp industry will have a better paying capacity for the wood in comparison with the sawmilling industry.
- In general, the sawmilling industry has to increase substantially the investments in advanced R&D for survival.

Table 34. Rough ranking of competitive factors for the softwood lumber industry. The more +, the better the position, and the more -, the less attractive the position.

Region	Development of general demand (volume)	Demand on new buildings	Demand on smaller and more efficient dwellings
Nordic			+
EEC-9	+		++
Central			++
Southern	++	++	
Eastern	+	+++	

Region	Demand on repair and restoration	Demand on high quality wood for carpentry and DIY	Competition from N. America and USSR
Nordic	+(+)	+	
EEC-9	++	++	++
Central	++	++	
Southern	++		++
Eastern	+++		

Region	Possible supply of sawlogs and lumber according to Timber Committee	Possibilities of supply of high quality wood	Possible degree of increased self-sufficiency of softwood lumber according to Timber Committee
Nordic	++	++	+++
EEC-9	++	+	+
Central	+	+	++
Southern	+++		--
Eastern	+	+	--

Region	Actual competitive cost structure	Competition with pulp-and-paper industry	Increased wood supply by sanitation harvests
Nordic		--	+
EEC-9	+	-	+++
Central	+	-	+++
Southern	++	--	+
Eastern			+++

Table 34 continued.

Region	Increased wood supply by changed silviculture	Increased wood supply by conversion of agricultural land	Increased degree of self-sufficiency by changed silvi-culture, sanitation harvests and conversion of agricultural land
Nordic	+	+	
EEC-9	+++	+++	+++
Central	+++	+	+++
Southern		+++	++
Eastern	++	+	+++

	Changed competitive cost structure due to changed silviculture, conversion of land and sanitation harvests	Changed export possibilities (volume)	Importance of domestic market for survival
Nordic	-	--	+++
ECE-9	++		+++
Central	++	-	+++
Southern	++		+++
Eastern		--	+++

	R&D activities	Future challenges	Closeness to markets
Nordic	--	+++	+
EEC-9	--	+++	+++
Central	--	+++	+(+)
Southern	--	+++	+++
Eastern	---	+++	+

	Risk-taking capital	Entrepreneurship	Work force
Nordic	+	+	+++
EEC-9	+++	++	++
Central	+	++	++
Southern	+++	+++	+(+)
Eastern	+		

	Investment environment
Nordic	+
EEC-9	+++
Central	++
Southern	+++
Eastern	(+)

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