WORKING PAPER

FACTORS AFFECTING FUTURE INVESTMENTS IN PULP CAPACITY

Sten Nilsson

September 1988
WP-88-75

PUBLICATION NUMBER 79 of the project:
Ecologically Sustainable Development of the Biosphere

IIASA
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for Applied Systems Analysis

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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 is focusing 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 potential possibilities for investments in the pulp industry in Europe. A draft version of the paper was presented at the Market Pulp Symposium "Tomorrow – A New Yesterday" organized by Finncell in Nice, France, April 21–22, 1988.

R.E. Munn
Leader
Environment Program

ABSTRACT

This report deals with factors affecting future investments in the pulp industry in Europe. The factors taken into consideration are those influencing the long-term cost-competitive position for the pulp industry in different regions of Europe. They include:

- market development
- forest resources
- energy
- knowledge
- capital
- workforce
- environmental aspects
- general investment conditions.

After analyzing the above factors, one can identify the many challenges and current strategic options available for the European pulp producers.

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FACTORS AFFECTING FUTURE INVESTMENTS IN PULP CAPACITY

Sten Nilsson

1. BACKGROUND

Factors affecting future investments in pulp capacity are continuously analyzed quite carefully by hundreds of consulting companies, FAO, World Bank, Asian Development Bank, ASEAN, EEC, ECE, different aid organizations, industrial organizations in individual countries, governments, individual companies, and so on. From an intellectual point of view, this situation made the task of analyzing such factors rather simple. I only had to collect and compile the most updated and relevant studies carried out during the past year about these factors. Although this may sound simple, it was rather tough to read through 98.6 kg of reports. However, it was very interesting reading. It was fascinating to see the conformity in problem identification and the resolutions in the different reports. It was also very convincing to see how stable the problems are in the context of factors affecting future investments in pulp capacity. In several cases, I found that the titles of the reports were quite different but the same texts were used over and over again. It would only have been necessary to change the cover picture.

This tremendous conformity in the different reports will, of course, result in a short and concise presentation in this paper. The conclusions are presented below. (Summary and quotations from different reports).

Brazil

"Large uncommitted plantations for new industries. Great potential to increase fiber production by genetic improvement. Afforestation has slowed down due to cuts in funding and less attractive tax incentives. Growing negative public opinion to plantation forestry in general and eucalyptus in particular. There are also other environmental constraints".

"Very high investment costs in the pulp industry combined with general economic situation, huge foreign debts and social problems limit further expansions. No major greenfield mills are expected, only new mills at established sites."

Chile

"Chile has good prospects for pulp production. The ownership structure is sound for industry expansions. Conditions for economic growth good and the forestry exports important for the economy of the country. Chile must be regarded as a major cost-competitive supplier of long-fiber pulp in the future. There are risks involved in building new green field mills."

New Zealand

"Large plantation areas of *Pinus radiata*. In the 1990s there will be considerable potential to increase pulp capacity."

Australia

"In the 1990s, the supply of wood from plantations will increase rapidly, creating a potential to increase pulp capacity."

South Africa

"During the 1990s there will be a balance between wood supply and industrial capacity."

Portugal and Spain

"In these two countries pulpwood is in short supply. Government policies on forestry are weak. Public resistance to forest plantations, particularly eucalyptus. Strong interest in EEC in forest plantations relying on EEC subsidies."

France

"France is in a good position to expand its pulp industry using its own wood resources if the costly investments can be financed."

Nordic

"The Nordic countries still have untapped wood supplies. But, the Nordic countries would invest in integrated mills instead of commodity pulp."

Rest of Western Europe

"Slight increases in the wood supply are possible but no new mills are foreseen. Acid rain?"

Eastern Europe and USSR

"Difficult to predict any changes. Over-harvesting in the Western part of USSR has taken place for many years. Eventual changes will not influence the Western industry. Acid rain?"

North America

"Investments are possible in U.S. South and Western Canada (especially for an increased usage of hardwoods)".

Native tropical hardwood areas

"Abundant wood supply. Harvesting is fairly expensive and the locations not attractive for building new mills."

Other general conclusions

- "Further pulp capacity expansions are not restricted by lack of wood;
- investment cost in the pulp industry is extremely high and the industry often has low self-financing capacities;
- difficult to find risk capital for new investments;
- demand for chemical pulp will grow modestly and from already planned projects no shortage of any kind of chemical pulp seems likely;
- this situation generates low profitability, constituting a major obstacle to pulp mill expansions;
- trend to substitute softwood long fibers by hardwood short fibers and fillers."

A pervasive feature of the analyses studied is wood availability (the possibility to mine forest resources) and cost-competitive structure or position. The latter are analyzed with respect to primary cost factors such as capital, raw material, and energy costs, in new greenfield mills in different countries. If the total level of primary cost factors is low in one country in comparison with others, its investment potential is regarded as good, and vice versa. A typical cost calculation for investment potentials is presented in Figure 1.

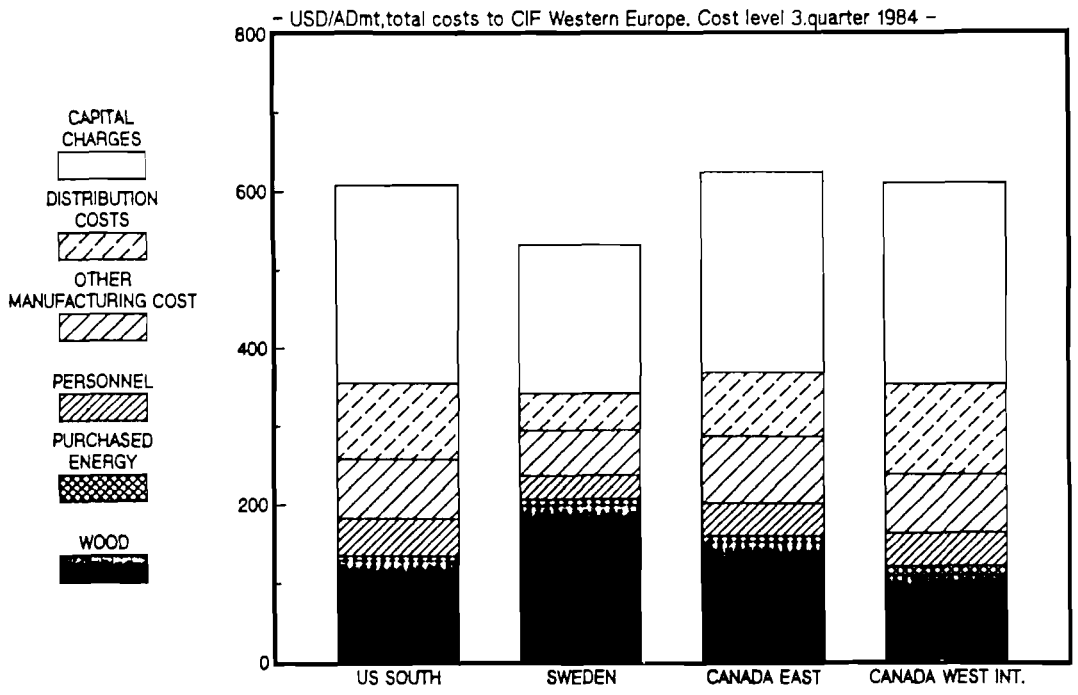

Figure 1. Cost comparison for hypothetical new softwood pulp mills [From Jaakko Pöyry (1)].

In my opinion there exist too many cost-competitive-structure calculations on the market of the kind pictured in Figure 1. These calculations are misleading, conserving actual structure and impeding sound, strategic long-term investments in the forest industry. Wibe (2) made a critical review of these kinds of calculations made by consultant companies. He found that the calculations are more or less worthless from both theoretical and empirical points of view concerning investments. The reasons are the following:

- in the calculations, the costs for marginal capacity (new mills) are studied. By definition, the costs for marginal mills in different countries will be rather small and the differences or similarities in the costs are not reflecting any competitive power or structure in different countries. Instead the calculations reflect the market conditions;
- the insecurity in the individual components in the calculations is often twice as high as the reported total cost differences between countries; and
- the calculations describe the situation at a specific point of time and do not take change into consideration. Very dramatic changes have taken place during the last 10 years if we study individual cost items.

Thus, by construction, the calculations argue for a conservation of the existing structure of the industry due to the fact that the real competitive structure factors are not taken into consideration. These real structural factors are referred to by some authors as secondary cost factors, which relate to the culture of the industry and investment climate [see Anon (3)]. Wibe (2) stressed that the real competitive factors are technology, knowledge and natural conditions based on the theory established by Heckscher and Ohlin [see Löfgren (4)].

In further discussion I will try to illustrate these real long-term competitive factors by using the "European case", as illustrated in Figure 2. It should also be stressed that the competitive factors are strongly linked to each other and in many cases should not be considered separately.

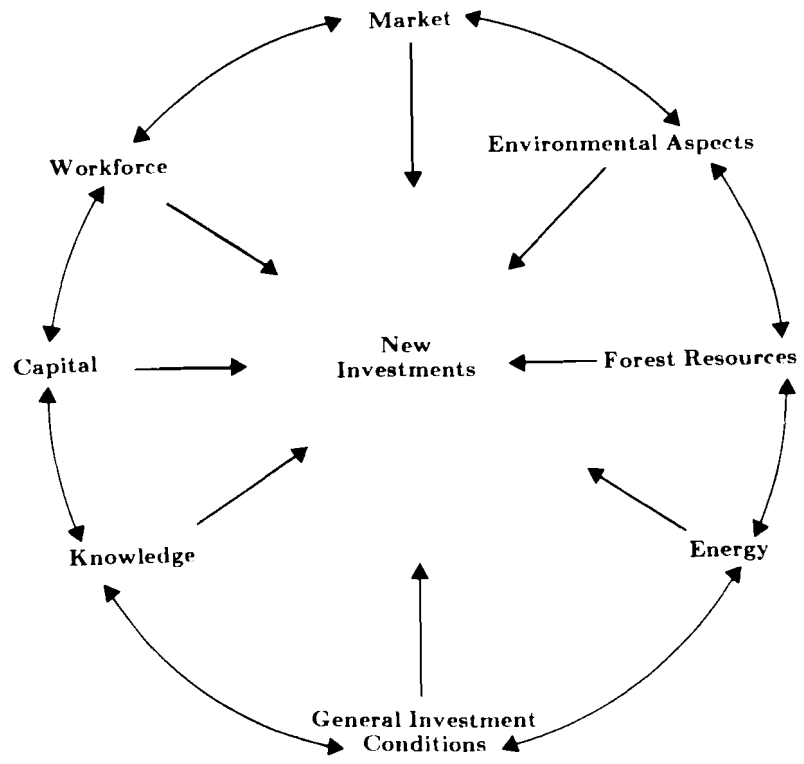

Figure 2. Factors affecting future investments in pulp capacity.

2. THE EUROPEAN CASE

Before describing the status of the European region, it must be underlined that in the documents studied, the general opinion is that continental Europe is not very interesting from the point of view of investment in new pulping capacity. Another general opinion is that investments are considered to be too risky a venture in continental Europe.

2.1. Structure of the European Forest Pulp and Paper Industry

In the following discussion, I have divided Europe into 5 regions, namely: Nordic, EEC-9, Central Europe, Southern Europe and Eastern Europe (Figure 3).

Table 1 illustrates the pulping capacities in the mid-1980s and the degree of self-sufficiency in total pulp production (5).

Table 1. Pulping capacities during the mid-1980s and degree of self-sufficiency (million tons).

Region	Mechanical pulping	Chemical pulping	Dissolving + other	Degree of self-sufficiency for total pulping (%)
Nordic	7.4	12.9	0.6	140
EEC-9	3.1	2.8	0.8	40
Central	0.5	1.2	0.1	90
Southern	0.9	3.2	0.5	100
Eastern	0.9	3.5	0.7	80

Table 2 shows the existing capacities and degrees of self-sufficiency for major paper grades during the mid-1980s (5) in the different regions of Europe.

Table 2. Capacities for papermaking and degree of self-sufficiency during the mid-1980s (million tons, and percentages).

Region	Newsprint	Printing & writing	Other paper & board
Nordic	4.6/765	4.8/480	7.1/375
EEC-9	1.8/38	10.0/100	15.7/85
Central	0.5/125	1.1/220	1.5/135
Southern	0.5/100	1.7/120	4.5/115
Eastern	0.5/100	1.2/130	4.7/105

From the two tables above, it can be seen that EEC-9 has a huge deficit of pulp. Even the Eastern European countries have a pulp deficit. Concerning the paper grades, EEC-9 is the only region with a deficit [Anon (5)].

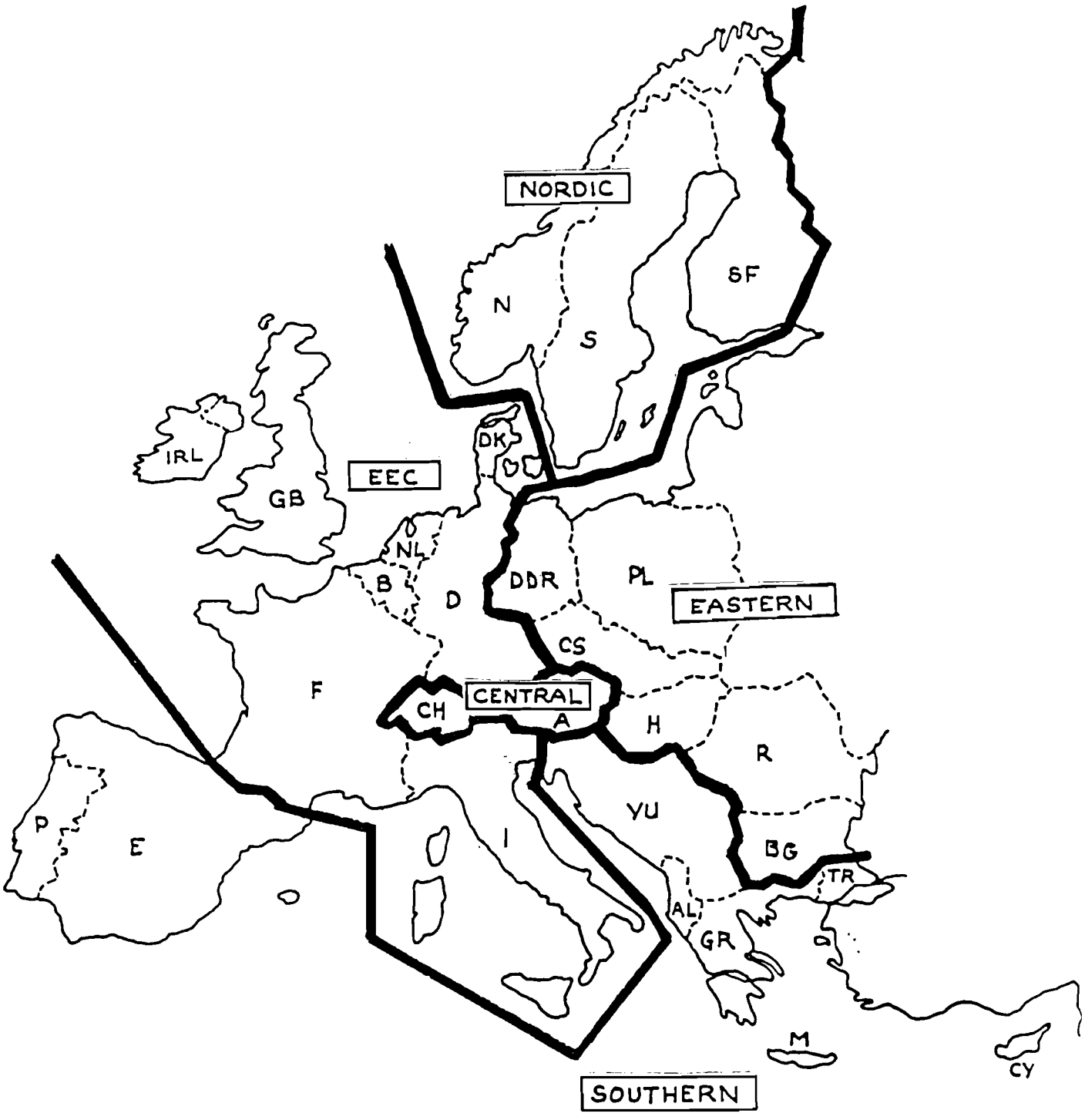

Figure 3. Division of Europe into subregions.

2.2. Relationship Between Net Annual Increment and Annual Removals

It also may be of interest to illustrate the relation between Net Annual Increment (NAI) on exploitable closed forest and annual removals during the early 1980s (5) (Table 3). It is clear that there are no restrictions due to lack of wood for increased industrial production in any region. Thus, in this respect the reports mentioned previously have reached the correct conclusion. It can also be underlined that only about 65% of NAI in EEC-12 is harvested. The total import (expressed in roundwood equivalents) to the EEC-12 is about 38% of the total NAI in the region [Florio (6)].

Table 3. Relationship between NAI and Removals (percentage).

Region	(NAI/Removals) * 100
Nordic	128
EEC-9	143
Central	135
Southern	149
Eastern	128

3. FUTURE DEMAND FOR PAPER AND PAPERBOARD

A dramatic market increase in paper and paperboard is expected to take place in EEC-9 and Southern Europe (Table 4). The increase will be 15–36 million tons up to year 2000, meaning an increase of about 35–150% in these two regions. This increase in paper demand will of course drive the demand for pulp. This means that the EEC-9 and Southern European regions are of extremely high interest for pulp producers in the future.

Table 4. Future demand for paper and paperboard in Europe, expressed in million tons. [Source: Timber Committee (5)].

Region	1980	2000		2025	
		Low	High	Low	High
Nordic	3.3	4.8	6.5	5	6
EEC-9	32.8	44.1	60.8	43	60
Central Europe	1.9	2.5	3.3	2	3
Southern Europe	5.4	9.2	13.6	11	17
Eastern Europe	5.7	6.7	7.9	7	9

3.1. Requirements for Market Pulp and Structural Changes in the Pulp Market

As seen in the previous section, paper consumption will increase rather dramatically in the future in some of the regions of Europe. However, the demand for wood fiber will not increase to the same degree as that for paper. The reason is that there will be a strong substitution of wood fibers by waste paper and fillers. The demand on wood fiber is estimated to grow by only 1% per year up to the year 2000 worldwide, corresponding to 8 million m^3/year [Häggblom (7)].

A structural change in the fiber furnish will also take place which will be driven by end-use characteristics of the different paper grades. These future end-use characteristics are difficult to identify although some trends are already evident (Table 5).

Table 5. Furnish trends of various paper products [after Whitman (8)].

Grade	More	Less
Diaper	Super-absorbent	Softwood
Sanitary	Eucalyptus	Sulfite
	CTMP	Hardwood/Softwood
	Hardwood	Softwood
	Secondary fiber	Hardwood/Softwood
Linerboard	Secondary fiber	Softwood
	Hardwood	Softwood
	Coating	Softwood
Bleached board	Hardwood	Softwood
	CTMP	Hardwood/Softwood
Newsprint	TMP/CTMP	Sulfite/Softwood
Uncoated mechanical	Mechanical pulp	Softwood
	Filler	Softwood
Uncoated woodfree	Hardwood	Softwood
	Fillers	Hardwood/Softwood
	CTMP	Hardwood/Softwood
Coated mechanical	TMP/CTMP	Groundwood
	Softwood	Groundwood
	Hardwood	Softwood
Coated woodfree	Hardwood	Softwood
	CTMP	Hardwood/Softwood

These developments are driven, as mentioned earlier, by the end-use characteristics of future paper, and also by economic conditions. Lindahl (9) stated that it is cheaper to produce a printing and writing paper with nearly the same characteristics by substitution of softwood kraft by mechanical pulp (Table 6).

There is also a changing grade structure among the printing and writing papers taking place. Traditionally, grades with less than 10% mechanical pulp are considered as woodfree. But mechanical grades (10–40% mechanical pulp) have entered the woodfree markets in both the uncoated and coated sectors (10).

3.2. Closeness to the Market

Earlier, we have seen that there will be a strong increase in paper consumption in the regions of EEC-9 and Southern Europe. The right price and quality segmentation and effective distribution will be key success factors for producers in the future. Companies that can best coordinate their international activities and control the whole chain from pulp-making to paper end-users will be tomorrow's winners.

Table 6. Relative production costs by different furnish [after Lindahl (9)].

Furnish	Relative Production Cost
100% softwood kraftpulp	100
10% bleached groundwood 90% softwood kraft	90
50% bleached groundwood 50% softwood kraft	84

This situation will be stressed by the establishment of the Inner Market in the EEC in 1992. The Inner Market includes a number of dramatic changes which will stress the necessity to have the production located inside the Inner Market or to be in one way or another strongly associated with it. Hamilton (11) discussed these important changes, perhaps the most important of which is Non-Tariff Barriers (NTBs). Non-tariff measures include a wide range of regulations. Such measures may be broadly classified under titles like: government participation in trade and restrictive practices tolerated by governments, customs and administrative entry procedures, technical barriers, testing, licensing, credit restrictions, compensation trade, export stimulation, pricing policies.

These NTBs will disappear within the Inner Market but will be valid for producers outside. This means free trade of goods and real closeness to the Inner Market for members of the market. There will also be a coordinated transportation policy inside the Inner Market. Crossing the borders within it will be simpler, more efficient and cheaper in comparison with the situation for producers outside it (12). This situation will also determine how close a producer is to the interesting markets.

There will also be a coordinated public purchase within the Inner Market. The policy of *perestroyka* in the Eastern region is to establish a strong economic link between the Inner Market and the East. This means that the Inner Market may be a window for the Eastern market as well. A rough ranking of the regions from the market perspective is given in Table 7.

Table 7. Ranking of regions from the market perspective.

Region	Demand aspects	Closeness to growing markets in Europe
Nordic	+[1)]	+(+)
EEC-9	+++	+++
Central	+	+(+)
Southern	+++	+++
Eastern	+	+

[1)]The more +, the better the investment possibility. This is also valid for the following tables.

4. CAPITAL

Investment in a new kraft pulp mill is tremendous. The cost, excluding financial charges, working capital, cost of land, etc., is about 380–400 million USD today in Europe (13). This depends on the scale of economy. To get an economically optimal mill, the size must be about 350–400' ADT/year.

The investment costs are now so high that few greenfield kraft pulp mills can be foreseen in Europe in the near future. This also means that the investment costs have reached such a height that they are a ***limitation in themselves for structural change of the existing pulp industry in Europe today.***

4.1. Risk Capital for Investments in New Kraft Capacity

Even if the investment costs for new mills are very high, it is not as much a question of availability of capital as one of risk-taking capacity. It is in the risk-taking capacity that we face a vicious circle (Figure 4). Let us examine items 5 and 7 in Figure 4 in some detail. Due to the fact that the pulp industry is a mature industry with low profitability, it is difficult to recruit entrepreneurs to it, since other industries offer more excitement. However, industry in itself is also a major contributor to the actual recruitment situation, being very conservative and mainly recruiting top management from its own circles which results in a kind of farm-bailiffship in the top-management echelon. The examples are too numerous to list here. This can simply be illustrated by a citation from Hay-Roe (14). "The new ventures into market pulps in B.C. – ***none*** has been initiated by a pulp company".

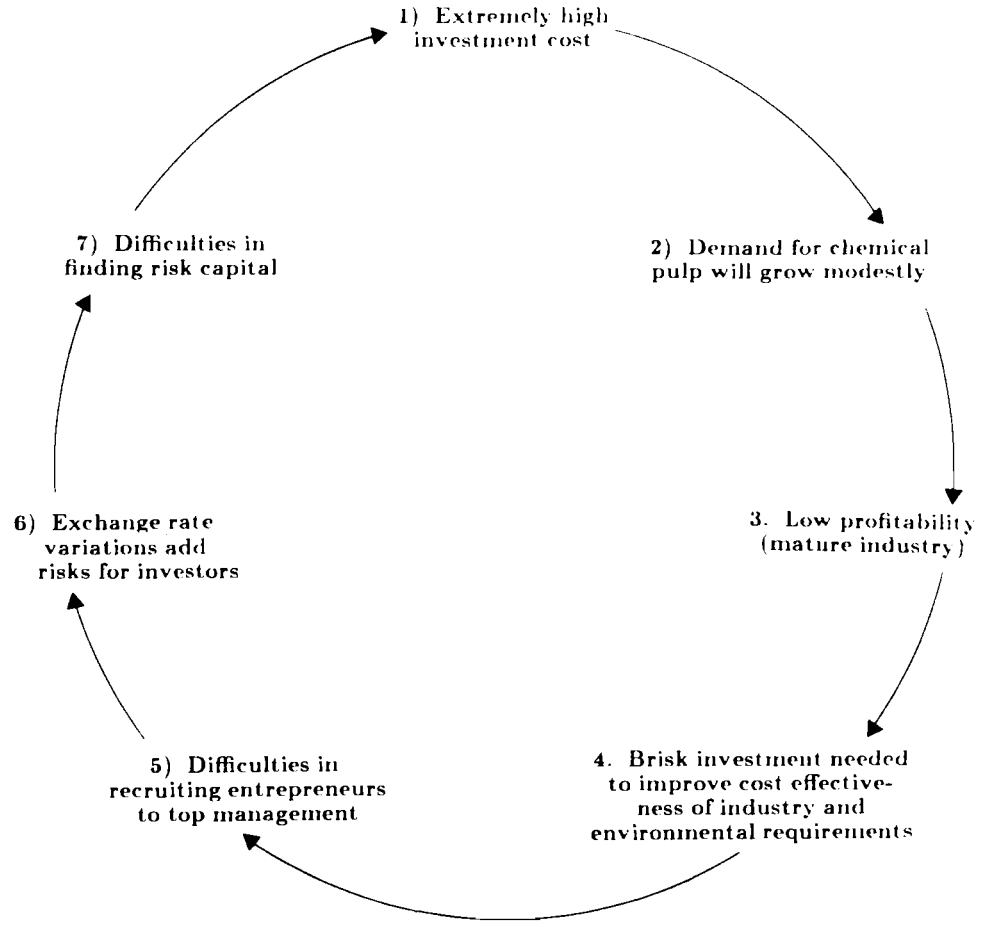

Figure 4. The vicious circle.

Moreover, with high investments, low profitability and no entrepreneurs involved, there is very little chance of attracting risk capital for new investments, and the vicious circle is very difficult to break.

However, we now find that there are ways to reduce the requirements on investment capital in the pulp industry. I stated above that softwood pulp in the future will be substituted by hardwood pulp and pulp from Chemi-Thermo-Mechanical Pulping (CTMP) (and similar methods). The investment costs are lower for these methods (Table 8).

Table 8. Investment costs for economically optimal pulping methods. Expressed in relative dollars per ton.

Pulping Method	Relative investment cost per ton
Softwood kraftpulp	100
Hardwood kraftpulp	≈ 80
CTMP	≈ 50–60

Another way of reducing the investment costs is to go into mill expansion, merger, and acquisitions (Table 9). Take-overs will not generate new capacity directly. But profitability normally increases after a take-over and reconstruction in the pulp industry (unpublished study by SIMS, Swedish University of Agricultural Sciences). The increased profitability will then result in new investments. The general opinion is that new pulp capacity in Europe will be dominated by mill expansions in the future [Diesen (15)].

Table 9. Relationship among investments in new pulp capacity. Expressed in relative terms based on cost per ton.

Kind of Investment	Relative Size
New investments	100
Mill expansions	65
Take-over	45

The Inner Market discussed above will probably also influence the vicious circle in generating risk-taking capital for new investments in the pulp industry. Inside the Inner Market there will be:

- a common company legislation;
- free movements of people and capital;
- establishment of special investment companies for large-scale development projects;
- establishment of special insurance institutes for covering losses in large-scale development projects;
- establishment of banks which can handle large investments;
- EC funds for regional and infrastructure development;
- further development of the European Monetary System (EMS). This system was introduced already in 1979, and the experiences are so far very positive (Table 10).

Table 10. Variability of exchange rates [from Hamilton (11)]; variability expressed in standard deviation.

EMS affiliation	Nominal exchange rate		Real exchange rate	
	1974–78	1979–85	1974–78	1979–85
Average EMS-member	11.8	5.7	13.1	7.2
Average Non EMS-member	14.2	17.1	14.9	18.1

The EMS-system is generating a fixed exchange rate for each country and is generating a large area with exchange rates which are stable against each other. The forest industry is very sensitive to exchange rates. Stable exchange rates mean more stable profitability and less risks in new investments.

Due to the factors mentioned above, the vicious circle for new investments can be replaced due to the Inner Market as follows:

- risk-taking capital will be available;
- more stable exchange rates;
- better profitability;
- less risks in investments;
- possibilities to recruit entrepreneurs to top-management; and
- free movement of top executives.

These conditions are not available outside the Inner Market. From this background a rough ranking of future risk-taking capital for new investments in the pulp industry has been made (Table 11).

Table 11. Ranking of regions for investments due to availability of risk taking capital in the future in Europe.

Region	Rank
Nordic	+
EEC-9	+++
Central	+
Southern[1)]	+++
Eastern	+

[1)]Member-countries of the Inner Market only.

With regard to generation of new capacity by acquisitions and mergers, the situation is different among the regions of Europe. In the individual Nordic countries, most of the possibilities for mergers are utilized. Today, there are 3–4 large industrial blocks in each country. There are some possibilities to form mergers between Nordic countries. The Nordic producers are also aiming at a further degree of integration, which means less market pulp available in the future. In the EEC-9 there are many small companies and an extremely high requirement for structural change. From this point of view, there are strong possibilities for acquisitions and mergers in this region. Such structural changes

will probably also result in decreased requirements for market pulp. This is to some extent also valid for the Southern Europe region. From this background a rough ranking about future possibilities in Europe for requisitions and mergers can be made (Table 12).

Table 12. Future possibilities for acquisitions and mergers in different regions of Europe.

Region	Rank
Nordic	+
EEC-9	+++
Central	+
Southern	++
Eastern	

5. WOOD SUPPLY

5.1. Future Wood Supply According to the ECE Timber Committee

The most detailed study so far on future wood supply in Europe has been produced by the ECE Timber Committee (5). The estimates for future fellings are presented in Table 13. These estimates take into account factors influencing fellings dictated by tradition, harvesting cost, harvesting behavior, some afforestation, etc. Thus, the net annual increment is higher in comparison with the fellings estimates (Table 13). The estimate has not taken into account the situation caused by air pollutants, full conversion of agricultural land, and changed future silvicultural practices.

Table 13. Estimates for fellings on exploitable closed forest. Expressed in million m^3 o.b. [after the Timber Committee (5)].

Region and average increase between 1980–2020	1980	1990		2000		2010		2020	
		Low	High	Low	High	Low	High	Low	High
Nordic countries 26%	123.8	124.8	151.2	131.7	154.8	138.4	161.5	143.7	167.6
EEC-9 41%	98.2	104.8	114.0	113.0	129.3	120.5	136.7	127.1	149.0
Central 26%	20.0	23.4	25.0	24.3	26.6	24.4	26.4	24.4	26.1
Southern 64%	66.7	76.7	80.8	87.5	93.5	96.7	105.6	105.8	113.4
Eastern 16%	93.1	93.8	96.8	96.8	102.2	99.7	109.9	103.4	113.1

5.2. Changed Management of Forest Resources in Europe

Kuusela (16) has stressed that compared with the prescribed thinning and rotation regimes, over large areas in continental Europe the density of tree stands is too high and mature stands are becoming too old. Kuusela argued that in order to fully utilize the existing mature timber resources in continental Europe and to maintain a good environment, the annual fellings should equal the current NAI. In another study, Kuusela (17) studied this conservative development of management in Bavaria, and showed 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. The fellings have been at least 20% smaller than the net increment of growing stock. Kuusela (16) argued that the estimates of possible fellings and removals from the Timber Committee (Table 13) should be 5–25% higher for year the 2000. Kuusela (17) underlined: "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".

Forest managers in continental Europe are now becoming more and more aware of this situation as well as of the high risks of air pollutants. There are many indications that in the future we shall see a much more intensive forest management in continental Europe with the objective to avoid negative effects of air pollutants. This situation will generate a strong increase in the wood supply in continental Europe. This effect on the wood supply may be much stronger in comparison with direct effects of sanitation harvests (with the actual damage pattern).

5.3. Extent of Forest Decline Attributed to Air Pollutants in Europe

The information on forest decline is uncertain. The reasons are:

- the variables of damage estimation are rather subjective (e.g., crown density);
- monitoring systems vary among countries; and
- the volume estimates are very rough.

The best available information has been presented by Nilsson (18) and Nilsson and Duinker (19). The figures presented here are based on these two reports, representing the situation in 1986 (Table 14).

Table 14. Extent of forest decline attributed to air pollutants in 1986[1)] (expressed in million m^3).

Region	Damage Class[2)]		
	I	II	III
Nordic	588	n.a.	n.a.
EEC-9	268	469	456
Central	72	99	312
Southern	181	7	107
Eastern	513–839	72	310

[1)] All countries in line with the grouping employed by the FAO/ECE Timber Committee do not yet have forest decline monitoring programs.

[2)] Damage classes: I = MODERATE, severe and dead decline classes in coniferous forests; II = SLIGHT, moderate, severe and dead decline classes in deciduous forests; III = SLIGHT decline in coniferous forests (risk group).

The extent of affected wood volume represents about 6 normal yearly harvests in damage class I, about 8 in damage class II, and about 10 in damage class III. The total volume affected by air pollutants and other stress factors is thus about 3.5 billion m^3 during the mid 80s in Europe. If the affected volume will be subjected to sanitation harvests, the supply situation in Europe will be strongly changed in comparison with the situation today.

5.4. Quality of Wood Damaged by Pollutants

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 studies see Duinker *et al.* (20)). The studies are mostly based on laboratory tests and deal with lumber quality. The conclusions from these lab studies are:

1. Forest damage will not generate any negative consequences on lumber production and lumber yield.
2. Studies dealing with the consequences on pulp-and-paper processes are more limited. However it has been found that a foliage loss of about 60% will result in a drop of the moisture content in the sapwood by 25–30%. That corresponds with a moisture loss in logs during 2–3 months storage without sprinkling with water. Due to the high quality requirements from paper makers on mechanical pulp, such wood can probably not be used in the mechanical pulping process and must be diverted into the kraft pulping process.
3. Putz *et al.* (21) found that brightness during mechanical pulping is highly influenced by forest pollutants. It is possible to compensate for this loss in brightness by single-stage oxidative or reductive bleaching at a loss up to 60% of needles. The increased bleaching costs were 3–5 USD/ton. To get the same brightness in wood with a loss of more than 60% needles and dead wood, the extra bleaching cost was 15–30 USD/ton.
4. Alfthan (22) recently presented a study on paper-making using wood from declining stands in Poland. He found that the strength capacity (indices of tearness) was reduced by about 40% for strongly damaged wood in comparison with healthy wood.

5.5. Possible Conversion of Agricultural Land into Forest Land

Direct subsidies to agriculture production within the EEC is around 12 billion USD/year. The actual over-production of feed crops within the EEC 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. Due to bio-technological breakthroughs, the annual growth rate in animal production and crop yields will increase by 1–2% per year and production unit up to the year 2010 [Commins and Higgins (23), and Dewson *et al.* (24)].

There seems to be a general opinion within the EEC that structural changes are required in agriculture and that there is only one realistic alternative usage of the abundant agricultural land – some form of forestry [Kreysa and Last (25)]. The conversion of agricultural land will influence the future wood supply first in the long term (year 2030–2040). But this process will facilitate the possibility to harvest earlier in existing forest resources. Within our study at the International Institute for Applied Systems Analysis (IIASA), we have together with agricultural expertise tried to estimate how much of the abundant agricultural land can be converted to forestry [Duinker *et al.* (20)]. The result is presented in Table 15.

Table 15. Possible conversion of agricultural land into forests. Expressed in thousand ha new forest land.

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	

From the table above it can be seen that 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 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 (26)]. Once again, forest development is driven by a sector outside the forest sector – in this case, agriculture. This has happened earlier in Southern U.S. and New Zealand (the two large wood baskets). Thus, history repeats itself.

Another possibility in the future to utilize the abundant agricultural land is to produce so-called agrofibers, i.e., fiber and cellulose production by agricultural species. Investigations have started in Sweden concerning the possibilities of using such fibers in the pulping process. The results so far are promising. These fibers will compete with the fibers coming from traditional tree hardwood species (Table 16).

Table 16. Fiber length in different raw materials in Sweden. Unpublished material.

Material	Fiber Length (mm)
Spruce	3–4.0
Birch	1.1
Eucalyptus	1.0
Lucern	0.75–1.0
Artichoke	0.75
Elephant Grass	1.05
Straw	0.75
Linen (Flax)	20–40

The advantage of agrofibers in comparison to tree species is the high yield of fibers and cellulose (Table 17).

Due to the short rotation period (one growing season) for agrofibers, it is possible to tailor-make the delivery of raw material in line with the demand from industry.

Table 17. Average yield of raw material from different species in Sweden. Expressed in tons of dried substance per ha and year. Unpublished material.

Material	Total Yield of Raw Material	Yield of Fibers	Yield Cellulose
Birch	4.0	3.8	1.6
Lucern	10.6	6.0	2.5
Artichoke	13.0	7.1	2.2
Reed Canary Grass	12.0	9.0	4.0
Elephant Grass	15.0	12.8	6.5

5.6. European Timber Assessment Study at IIASA

The objective of the study at IIASA is to carry out an independent timber assessment study for Europe, including a detailed analysis of the possible effects on potential harvests of forest damage and conversion of agricultural land. The model approach is a detailed area-matrix model, which is employed for each country of Europe [Attebring *et al.* (27) and (28)]. At this stage we can only present test runs with the system (Table 18). The results of the two studies presented below *cannot* be directly compared. The Timber-Committee estimate takes into account factors influencing fellings like traditional forest-owner behaviors, harvesting cost, infrastructure, afforestation of some new land, and so on. The IIASA test runs have not taken into account any of these factors so far and are based on optimal silvicultural programs that "maximize" the sustainability of the forest resources from a biological point of view. Neither the study of the Timber Committee nor the IIASA test runs have so far taken into account the full conversion of agricultural land to forest land. In the IIASA test runs, we have also specifically looked upon the consequences of forest decline. However, it is so far just assumed that the damage pattern caused by air pollutants will increase in the future in the same way as in the 1980s.

Table 18. Preliminary results from the IIASA timber assessment study for Europe. The figures are expressed in percentage of the ECE Timber-Committee estimate.

Region & Source of Projection	1980	1990	2000	2010	2020
NORDIC					
– without damage	117	100	97	95	94
– with damage	117	100	97	95	94
EASTERN					
– without damage	131	124	111	106	103
– with damage	126	119	108	103	103
CENTRAL plus FRG					
– without damage	156	147	117	117	117
– with damage	140	133	106	102	100
EEC-9 without FRG					
– without damage	158	117	104	98	87
– with damage	158	117	102	89	89

Based on Table 18 and other sources of information, the following conclusions can be drawn concerning forest resources in Europe:

- from a biological sustainability point of view, there is a strong need to increase the harvests in EEC-9, Central and Eastern European regions;
- the harvesting potential is much higher in comparison with the estimates by the Timber Committee and Kuusela discussed earlier;
- in these regions there is already an industrial under-capacity; the law of demand and supply on fibers no longer applies;
- up to about the year 2020, the sustainability problem overshadows the negative consequences of forest decline attributed to air pollutants; the negative consequences on the wood supply will appear first after about year 2020 if the damage pattern remains the same in the future as during the 1980s;
- new inventory figures also show larger available resources in several countries in comparison with earlier reports;
- of course that wood which is already affected today by air pollutants (discussed earlier) can generate large over-supply problems with imperative sanitation harvests.

The Nordic countries have for a long time been building up inventories and can increase future harvests in line with the ECE Timber Committee estimate. There is no doubt that the Southern region can increase future production by more intensive management. A big conversion of agricultural land to forest land will dramatically change the total wood-supply structure in Europe in the long run.

5.7. Long/Short Rotation Periods

The rotation period can play an important role in the analysis of competitive position. The longer the rotation period, the more inflexible is the structure of the forest resources. The Southern region has an advantage in comparison with other regions concerning the rotation period (Table 19).

Table 19. Average rotation periods in different parts of Europe (expressed in years).

Region	Softwood	Softwood Plantations	Hardwood	Hardwood Plantations	Coppice
Nordic	80–100		60–90		
EEC-9	60–140	40–60	110–220		25
Central	100–140		110–180		30
Southern	60–90	20–50	110–180	10–20	10–20
Eastern	80–120		110–140		20–30

5.8. Forest Ownership Structure

The structure of forest ownership is supposed to have a strong influence on wood supply. The larger the number of forest owners and the smaller the sizes of the forest holdings, the more difficult are the possibilities to utilize the forest resources for industrial wood supply. A common factor in the debate about future increased wood supply in Europe is the large number of forest owners, especially in continental Europe. Even if

there is a big potential from a biological point of view, the potential cannot be utilized due to the extremely small sizes of forest holdings and the large number of forest owners (Table 20). However, with the exception of France, this group represents a rather small percentage of the total forest land.

From a wood-supply point of view, most of the forest land in Europe has a good structure of ownership (with the exception of France and the Netherlands; Table 21).

The Nordic region has a more even distribution of the sizes of the holdings in comparison with continental Europe (Tables 20 and 21). Due to the economic system, the Eastern region has a strong advantage concerning ownership structure.

5.9. The Role of Forest in Supplying Environmental and Other Non-Wood Goods and Services

In several countries, forest resources are very important for supplying non-wood goods and services (Table 22).

The percentage of forest area discussed in Table 22 deals, in most cases, with total forest area and not closed exploitable forests, which have been the basis for earlier discussions on future wood supply in Europe (see Sections 5.1, 5.2 and 5.6). Therefore, the extent of the requirements on forest resources for environmental and other non-wood goods services includes areas not used for commercial wood production.

Based on Table 22, it is difficult to make comparisons between the different regions of Europe. For example, the extent of area required for recreation is very high in the Nordic Countries in comparison with continental Europe. However, these areas in the Nordic Countries are in most cases defined as non-productive forest areas.

Rather small areas of forest seem to be required for recreation in continental Europe (Table 22). From the public debate, however, it is easy to get the impression that most of the forests in continental Europe are required for recreation and protection. Losses in wood production due to non-wood goods and services of the forest resources are considerable in some regions of Europe (Table 23).

Kreysa (35) has recently studied the non-wood requirements on the forest resources in the EEC-region. He concluded that there will be increased pressure on forest resources from environmental interests in the mountainous and Mediterranean regions of Europe.

Based on the information above, a ranking of different European regions can be made concerning restrictions on wood production due to non-wood benefits (Table 24). The most favorable regions in this respect are the Nordic and Eastern regions.

5.10. Summary of Forest Resources in Europe

In Table 25 an attempt has been made to summarize the discussion on forest resources concerning future wood supply in Europe by a rough ranking.

6. ENERGY

Due to the fact that the pulp and paper industry is a heavy consumer of electric energy and is a mature industry, it requires much cheap energy in order to be competitive on the international market. It is important to stress that if changes in the structure of energy supply and energy prices occur in different ways in the regions of Europe, it will heavily influence the competitive positions among the regions. For example, it is calculated that the announced closure of nuclear power around the year 2000 in Sweden will reduce the export value from the pulp and paper industry by 30% in comparison with the current situation. This will not happen if there are similar changes of the energy supply structure in the other regions of Europe or in other pulp and paper producing regions [Wibe (36)].

Table 20. Distribution of area and number of forest holdings according to size in selected countries of Europe. Sources are ECE (29), FAST (30), EUROSTAT (31), Skogsstyrelsen (32) and Official Statistics, Finland (33).

	AUSTRIA		BELGIUM		DENMARK		FINLAND[1)]		FRANCE	
Size of holdings in ha	Percent of forest area	Percent of total number of holdings	Percent of forest area	Percent of total number of holdings	Percent of forest area	Percent of total number of holdings	Percent of forest area	Percent of total number of holdings	Percent of forest area	Percent of total number of holdings
5 or less	8.9	67.2	12.6	91.5	7.0	73.0	1.0	14.0	21.0	85.7
5–10	7.9	15.9	4.2	3.5	4.0	13.0	4.0	15.0	15.0	6.1
10–20	9.1	9.3	5.2	2.5	5.0	8.0	11.0	23.0	14.0	6.2
20–50	10.8	5.1	7.7	1.3	6.0	4.0	30.0	30.0	9.0	1.0
50–100	6.0	1.2	7.6	0.6	4.0	1.0	27.0	13.0	8.0	0.5
100–500	13.3	1.0	17.9	0.6	18.0	1.0	23.0	5.0	21.0	0.5
500–1000	44.0	0.3	10.1	–	11.0	0.5	4.0	0.5	2.0	–
1000+			34.7		44.0		–		10.0	
Total holdings		227,774		105,878		32,055		326,880		3,269,171
	FRG		HUNGARY		IRELAND		LUXEMBOURG		NETHERLANDS	
5 or less	9.0	78.0	0.3	58.9			–	82.9	14.0	87.0
5–10	6.0	11.0	–	–	17.0	0.4	–	8.1	–	
10–20	6.0	6.0	0.2	8.9			1.3	8.1	18.0	10.0
20–50	6.0	3.0	0.6	5.4	1.0	–	1.8	2.0	2.1	
50–100	5.0	1.0	1.7	3.6	1.0	–	4.7	1.0	6.1	1.0
100–500	18.0	1.0	12.3	14.3	4.0	1.2	63.9	1.0	19.7	1.0
500–1000	8.0	0.5	10.4	3.6	15.0	24.6	25.4	0.5	28.9	0.5
1000+	42.0	0.5	74.5	5.3	57.0	73.8	2.9		11.2	0.5
Total holdings		532,893		5,646		486		12,404		21,696
	NORWAY		SWEDEN		SWITZERLAND		UNITED KINGDOM		ITALY	
5 or less		14.9	1.0	16.2	18.6	95.4	3.0	47.0	7.0	62.0
5–10		26.7	6.0	9.3	3.8	2.5	3.0	17.0	7.0	19.0
10–20		23.8	8.0	21.5	2.5	0.8	5.0	14.0	8.0	11.0
20–50		15.3	11.0	28.5	3.3	0.4	8.0	12.0	10.0	5.0
50–100		10.8	11.0	14.6	4.9	0.3	8.0	5.0	6.0	1.0
100–500		7.7	7.0	9.9	31.4	0.5	18.0	3.0		
500–1000		0.5	57.0	–	35.5	0.1	8.0	–	62.0	2.0
1000+		0.3		–			48.0	1.0		
Total holdings		142,019		236,073		258,146		51,680		837,219

1) Farm forests, which are the dominating ownership in Finland.

Table 21. Distribution of area of forest holdings according to size. Expressed in percentage of total forest land.

Size of holdings in ha	NORDIC		CENTRAL		EASTERN
	Sweden	Finland[1)]	Austria	Switzerland	Hungary
< 20	15.0	16.0	25.9	24.9	0.5
> 100	63.0	27.0	57.3	66.9	97.2

Size of holdings in ha	EEC–9								
	Belgium	Denmark	France	FRG	Ireland	Luxembourg	Netherlands	U.K.	Italy
< 20	22.0	16.0	50.0	21.0	0.4	3.1	32.0	11.0	22.0
> 100	62.7	73.0	33.0	68.0	99.6	92.2	59.8	74.0	62.0

[1)] Only farm forests.

Table 22. Percentage of total forest area with a high importance given to various functions in selected European countries.. Adjusted from the Timber Committee (34).

Country	Wood Production	Recreation	Hunting	Protection	Nature Conservation	Range Grazing	Other
Belgium	100	5	74		15	12	
Bulgaria	63	7	15	1	1	3	
Czechoslovakia	78	5	2	6	2		
Denmark	68	20	22	7	11		3
Finland	78	2		11	4		
France	68	7	77	5	1		
FRG	89	4		68	2		
Hungary	60	12	66	10	7		
Ireland	100	1					
Norway	49	25	6	37	1		
Poland	56	8	61	4	1		6
Sweden	77	20		2	1		
U.K.	67	29			7		52

Table 23. Losses in wood production due to recreation, hunting, protection and nature conservation. Based on information from the Timber Committee (34).

Region	Non-Optimal Silviculture				Hunting[1)]	Fires caused by Visitors
	Choice of Species	Rotation Periods	Silviculture Techniques	Cutting Restrictions		
Nordic	–[2)]			–	–	
EEC–9	–	–	– –	–	– –	–
Central	–		–	–	– –	
Eastern		–	–	–	– –	
Southern	– –		–	– –	– –	– –

1) Losses in wood production or increased costs due to damage by animals.

2) The more –, the greater the losses.

Table 24. Ranking of regions due to restrictions on forest resources caused by non-wood benefits.

Region	Restrictions on Forest Resources
Nordic	–[1)]
EEC–9	– –
Central	– –
Southern	– –
Eastern	–

1) The more –, the less attractive.

Table 25. Rough ranking of wood resources in Europe.

Indicator	Nordic	EEC-9	Central	Southern	Eastern
Sustainability	+	+++	+++		++
Sanitation harvests due to air pollutants	+	+++	+++		+++
Conversion of agricultural land	+	+++	+	+++	+
Rotation periods		++		+++	
Ownership structure	+				+++
Environmental restrictions	-	--	--	--	-

Therefore, it is important to have an idea about large changes in energy structures in different European regions. IIASA has built a model for techno-economic analyses of the entire European energy system which is upgraded yearly [Lapillonne (37)]. Rogner (38) recently used a model to describe how different regions of Europe can be supplied with energy in the future. His study took into account technology impact analysis, resource depletion, energy policies and R&D strategies. His results are presented in two basic scenarios: (a) the conventional technology scenario, taking into account breakthroughs of new or advanced energy technologies; and (b) the technical evolution scenario, also taking into account all productivity increases on the exploration and production side (Table 26).

All regions of Europe are facing big structural changes in future energy supply and heavy investment programs must therefore be implemented (Table 26). Solid long-term energy policies are missing in each of the regions today. This statement can be supported by the political announcements (June 1988), made in the German province of Schleswig-Holstein, to start closing down nuclear power stations in the 1990s.

In the Nordic region most of the nuclear power should be replaced by coal or gas. Also, oil should be substituted by other primary energy sources. In EEC-9 and the Central region, oil must be replaced by gas and nuclear power. The Eastern region is facing a strong increase in energy demand and must replace the use of coal and oil by gas and nuclear power. The Southwest region has to increase energy supplies rather dramatically and replace oil by coal, gas and nuclear power.

Based on this information, the regions can be ranked from an energy point of view (Table 27). A general conclusion to be drawn is that new investments in the pulp industry must be directed towards technology with low energy consumption.

Table 26. Future primary energy mix in different regions of Europe [after Rogner (38)].

Regional & Energy Sources	Conventional Technical Scenario		Technological Evaluation Scenario	
	1990	2000	1990	2000
NORTHERN				
Total consumption in Exa-joule	4.77	4.77	4.80	4.77
Coal	19%	27%	15%	11%
Oil	30%	19%	26%	18%
Gas	3%	10%	4%	14%
Nuclear	14%	7%	19%	7%
Hydro	34%	27%	36%	46%
Renewable	–	10%	–	4%
EEC-9 + CENTRAL				
Total consumption in Exa-joule	39.33	42.18	39.33	38.19
Coal	22%	24%	22%	12%
Oil	41%	31%	41%	31%
Gas	17%	20%	19%	30%
Nuclear	15%	18%	13%	19%
Hydro	4%	4%	4%	5%
Renewable	1%	3%	1%	3%
EASTERN				
Total consumption in Exa-joule	18.7	25.2	18.7	24.5
Coal	58%	47%	58%	43%
Oil	21%	14%	21%	13%
Gas	15%	19%	15%	25%
Nuclear	4%	17%	4%	18%
Hydro	2%	3%	2%	1%
Renewable	2%	3%	2%	1%
SOUTHWEST[1)]				
Total consumption in Exa-joule	4.3	6.6	4.7	6.3
Coal	21%	32%	21%	16%
Oil	55%	30%	55%	32%
Gas	5%	10%	5%	24%
Nuclear	5%	15%	5%	15%
Hydro	12%	10%	12%	9%
Renewable	–	3%	–	4%

[1)]Portugal and Spain.

Table 27. Rough ranking of different regions of Europe from an energy point of view.

Region	Ranking
Nordic	– –[1)]
EEC-9	–
Central	–
Eastern	– – –
Southern	– – –

[1)] The more –, the bleaker the outlook.

7. ENVIRONMENTAL RESTRICTIONS

Environmental concerns will increase in European society in the future. These concerns will deal with final products (chemical composition of final products), management of forest resources (as discussed earlier), industrial pollution, infrastructure for industrial development, and water requirements. Therefore, the pulp industry management must look at environmental subjects with the same degree of sophistication as on market, fiber, and production-cost topics in the future.

There will be increased pressure to reduce pollutants from the pulp industry in all regions of Europe. This pressure will direct investments into mills with closed systems for recycling, mechanical and CTMP production. The new units must be less consumptive of water and energy.

Eastern Europe is facing big environmental problems in industry, in combination with an insufficient industrial capacity, obsolete machines, low productivity, low quality, and inefficient transportation systems. Therefore, capital for investments on environmental issues will likely be less available in this region.

A rough ranking of the different European regions concerning environmental restrictions is presented in Table 28.

Table 28. Ranking of different European regions from the point of view of environmental restrictions.

Region	Environmental measures taken by industry today	Measures required in the future in industry	Knowledge about environmental technologies
Nordic	++	–[1)]	+++
EEC-9	+	– –	++
Central	+	– –	++
Southern	(+)	– –(–)	+(+)
Eastern		– – –	+

[1)] The more –, the less attractive, and the more +, the better the investment possibilities, respectively.

8. WORKFORCE

The workforce required in pulp production is rather small. The discussion on the workforce is also strongly connected with the level of knowledge. The future industry will have a high technological profile and a high degree of system thinking, meaning that the workforce must be directed to these skills; it must also be market-oriented. In some pulp mills in Scandinavia, this development has already started. Individual workers are responsible for specific orders concerning production and delivery and the workers names are printed on the individual pulp bales.

It is well documented that the workforce in the Nordic region has high skills, a good basic education, a strong education in their profession by employers and unions, orientation towards high-tech and system thinking, and openness for new business ideas. However, the Nordic workforce is difficult to move due to social constraints. Today, Nordic producers stress that productivity – with the same technological equipment – will be 10–20% higher in the Nordic countries in comparison with the rest of Europe due to the skills of the workforce.

The workforce in EEC-9 and the Central region is also of high quality, though it is not as high-tech and system- and market-oriented as in Nordic countries. One specific advance from the workforce point of view will be the establishment of the Inner Market of the EEC, meaning free movement of the best workforce available within.

A rough ranking of different regions of Europe from the workforce point of view is presented in Table 29.

Table 29. Rough ranking of different regions in Europe from the workforce point of view.

Region	Rank
Nordic	+++
EEC-9	++
Central	++
Southern	+(+)
Eastern	

9. KNOWLEDGE AND MANAGEMENT

Earlier, the knowledge situation concerning the workforce was discussed. To some extent, knowledge and management were touched upon in the discussion concerning risk-taking capital. It has been stressed that management of the pulp industry is in general conservative and has difficulty in recruiting entrepreneurs. It has also been stressed that the high investment cost forces management into a farm-bailiffship attitude; the attitude is thus to administer existing assets rather than going into new technologies and markets. The R&D is concentrated on improvements of existing technologies instead of new challenges. The higher the sunk cost (investments already made) in the sector, the more visible this behavior becomes. Thus, there is an attitude in the sector to discourage breakthroughs in R&D which will disturb the existing technological structure due to the heavy investments made. Of course, an individual company is interested to go into a new technology as long as it can control itself. In general, more "scrap-iron dealers" are needed in the sector to push the development.

By tradition, the behavior described above has been established in the sector together with a predominant commodity and production orientation instead of system, marketing and finance orientation [see for example Juslin and Tarkkanen (39)]. Another

general feature of the pulp industry is the thin management organizations. The top management has very limited resources for strategic planning and is mainly concentrated on operational activities. There is a lack of positions for strategic and entrepreneurial thinking.

I also believe that too long a tradition in the sector in a region can be a bottleneck in changing this attitude. This situation also results in a heavy dependence on consultants for strategic studies. The consulting requirement in Europe is about 0.07 million consulting hours per million tons of produced pulp and paper. It means that the total consulting requirement is about 7 million hours per year in Europe today. The problem is that there are very few competent consultants working on the European scene today. This means that the suitable existing consultants hold a monopoly and are actually driving the strategic development and decisions instead of doing what they should – serve the decision-makers with relevant information as a background for decisions. Very often, the whole strategic process is in the hands of the consultants and not in those of the real decision-makers.

The future management staff of the pulp industry must fulfill the following requirements:

- adopt new business ideas and new technologies;
- adopt new products (20 years ago about 50% of the products we have on the market today were unknown; this development will increase in the future);
- be market-oriented;
- be finance-oriented;
- adopt system and high-technology thinking;
- encourage entrepreneurship;
- endorse strategic thinking and good strong consulting support;
- be capable of picking up innovations from other sectors; and
- be R&D oriented.

In principle, I believe it is possible to find the knowledge and corresponding management (requirements described above) in all regions of Europe. However, I also believe that there are some basic differences between regions (Table 30).

Table 30. Rough ranking of knowledge and corresponding management in different regions of Europe.

Region	Existing skills	Tradition/ Adoption of new ideas	Entrepre-neurship	Possibility to move people	Strong support of consultancy
Nordic	+++[1)]	+++/-	+	+	+++
EEC-9	++	++/-	++	+++	++
Central	++	++/-	++	++	++
Southern	+(+)	+/-	+++	+++	++
Eastern	+	++/- -		+	+

[1)]The more +, the better the investment, and the more –, the less attractive the investment possibilities, respectively.

10. GENERAL INVESTMENT ENVIRONMENT

Many aspects are involved under general investment environment, and I believe it is a very important factor too seldom discussed in the decision of new investments. Earlier, we discussed the situation change during the establishment of the Inner Market in the EEC concerning risk-taking capital. Many signals indicate that this changed situation by the Inner Market will generate a general "Wild West" climate and expectation in the region and will drive economic development of the region; on the other hand, this air of expectations in the Inner Market will generate a dull feeling in the other regions. The changed agricultural policy in the EEC will increase awareness of the problems of the rural regions. It will also result in an industrial rural development driven by subsidies within the Inner Market.

This new situation will also establish new groupings and relations between industrialists, bankers, and politicians. For a long time now, such relations have been established in some regions of Europe. But after some time, these relations became too good and too conservative. The politicians and governmental organizations became more and more conservative in their incentives and were not willing to take any incentives without industry's support. With the establishment of the Inner Market, there will be new players on the scene. Many forest organizations are of the opinion that the EEC Head Office in Brussels will very soon take the lead in developing a forest industrial policy for Europe. In so doing, it can be a drawback or an advantage that only 12 people of 13 thousand bureaucrats in the EEC are working with the forest sector (see Table 31).

Table 31. Rough ranking of general investment environment in different regions of Europe.

Region	Rank
Nordic	+
EEC-9	+++
Central	++
Southern	+++
Eastern	(+)

An interesting development is taking place in the region of Eastern Europe. It is known that the domestic demand on paper is not fulfilled by the domestic production in this region. Thus, there is probably a large backlog of demand and market for forest products (including pulp). By introducing *perestroyka* in this region, new possibilities for investments in this region are available through joint-venture projects. The conditions for establishing joint ventures will be changed in the near future. Both in USSR and Poland (40) it has been announced that a foreign company involved in a joint venture can have more than 49 percent of the total shares, and the president of a joint venture can come from a Western European country. This development will make joint ventures for Western European countries more interesting. However, there are still unsolved problems in establishing joint ventures in the Eastern region:

- How can foreign companies lift out profits in Eastern countries to the West?
- Can the joint-venture company fire Eastern employees?
- To what extent will the Eastern host country bear the investment cost in hard currencies?

11. CONCLUSIONS

Going back to the consultancy reports quoted earlier, another general conclusion is that traditional pulp producers should, today, make basic investments for long-term securement of fiber (for around the period 2010–2020) and increase pulping capacities. The recommendations are to work with Argentina, Chile and the Congo for hardwood fibers and Brazil, Chile and Venezuela for softwood (see for example, Häggblom (7)]. However, from the indications in Table 32 below, I conclude that European pulp producers should look at the European scene first, before exploring developing areas in South America and Africa.

In my opinion, European pulp producers face many challenges and current strategic options, especially if we take into consideration the structural substitution of softwood pulp by hardwood pulp and the substitution of kraftpulp by mechanical pulp. It must also be remembered that over 50% of the grades on the pulp and paper market in the year 2010 have probably not yet been identified.

Table 32. Structure of competitive factors in different regions of Europe for the pulp industry.

	Market demand aspects	Closeness to markets	Risk-taking capital	Acquisitions and mergers	Harvest increase from sustainability aspects
Nordic	+	+(+)	+	+	+
EEC-9	+++	+++	+++	+++	+++
Central	+	+(+)	+	+	+++
Southern	+++	+++	+++	+++	
Eastern	+	+	+		++

	Possible supply increase by sanitation harvests	Possible conversion of agricultural land	Rotation periods	Environmental restrictions on forest resources	Energy supply
Nordic	+	+		– –	–
EEC-9	+++	+++	++	–	– –
Central	+++	+		– –	
Southern		+++	+++	– – –	– –
Eastern	+++	+		– – –	

	Env. steps taken in in industry	Env. measures should be taken	Environmental knowledge	Management skills & knowledge	Tradition/ adoption
Nordic	++	–	+++	+++	+++/–
EEC-9	+	– –	++	++	++/–
Central	+	– –	++	++	++/–
Southern	(+)	– – (–)	+(+)	+(+)	++/–
Eastern		– – –	+	+	++/– –

	Possible movement of management	Consulting support	Entrepreneurship	Workforce	Investment environment
Nordic	+	+++	+	+++	+
EEC-9	+++	++	++	++	+++
Central	++	++	++	++	++
Southern	+++	++	+++	+(+)	+++
Eastern	+	+			(+)

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