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**PRODUCT DEVELOPMENT STRATEGY FOR A NORTH AMERICAN
PAPER MILL**

A Master's Thesis, submitted on the 10th of January 1996 for inspection to fulfil the requirements for the degree of Master of Science.

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TEKNILLINEN KORKEAKOULU
Puunjalostustekniikan laitos
Kirjasto

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The objective of the work was to form a product development strategy for a certain North American paper mill. The main goal was to find competitive products for the whole production machinery to improve the profitability of the mill and the company. The machinery of the mill and the pulp production facilities formed the limits of the work.

The product development strategy should bring the key resources of the company - raw material, employees, technology, customers, culture and capital - together to create new products, which will support the company in executing its overall strategy.

The company in this case is one of the world's leading producers of newsprint and a major producer of other uncoated groundwood papers. The mill produces high-yield sulphite and groundwood pulp. At the end of 1996 a new TMP plant will be ready and the old systems are to be shut down. There are three paper machines at the mill; two old and narrow directory paper machines and one younger newsprint machine. The production capacity of the mill is 116 000 t/a of directory paper and 140 000 t/a of newsprint.

The formulation of the product development strategy started by analysing the present state of the mill and its machines. The analysis comprised main raw materials, produced pulps and paper grades, condition of the machines, transport facilities and markets. The second step was analysing the opportunities and obstacles of the mill.

Potential products for the mill are coated and uncoated mechanical papers. A rough elimination of potential products was made based on market size, its growth and present supply and demand balance. Directory paper, newsprint, Hi Brite news, SC-A grades and coated mechanical papers (FCP and LWC/MWC) were chosen for further examination.

The market opportunities for the grades suggested and also the technical opportunities for FCP and SC grades were investigated. A cost competitiveness analysis and investment cost estimates were made for the suggested grades. The results of the analysis were analysed and drawn together to find the best products for the mill to increase its profitability and competitiveness.

The conclusion of the analysis is that the mill should continue the production of directory paper with the two small machines and start FCP matt paper production with the largest paper machine.

Future options could be closing the two small machines and building a new modern machine to produce for example coated groundwood grades or SC paper.

Tekijä Työn nimi	Erika Torpo Product Development Strategy for a North American Paper Mill (Erään pohjoisamerikkalaisen paperitehtaan tuotekehitysstrategia)		
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<p>Työn tavoitteena oli muodostaa tuotekehitysstrategia eräälle pohjoisamerikkalaiselle paperitehtaalle. Tarkoituksena oli löytää koko tuotantolinjalle kilpailukykyiset tuotteet tietyin konekannan ja massan valmistuksen aiheuttamin rajoituksin tehtaan ja koko yrityksen kannattavuuden parantamiseksi.</p> <p>Tuotekehitysstrategian tulisi yhdistää yrityksen avainresurssit - raaka-aineet, työntekijät, teknologia, asiakkaat, yrityskulttuuri ja pääoma - uusien tuotteiden luomiseksi, mikä tukee yritystä yritysstrategian toteuttamisessa.</p> <p>Kyseinen yritys on yksi maailman johtavia sanomalehtipaperin valmistajia. Lisäksi se on myös merkittävä muiden päällystämättömien hiokepohjaisten papereiden tuottaja. Itse tehdas valmistaa korkeasaantoista sulfiittimassaa sekä hioketta. Vuoden 1996 lopussa tehtaalle valmistuu uusi TMP-laitos, jonka jälkeen vanhat massanvalmistussysteemit suljetaan. Tehtaalla on kolme paperikonetta, joista kaksi on vanhoja ja kapeita luettelopaperikoneita ja yksi on hieman nuorempi sanomalehtipaperikone. Tuotantokapasiteetti tehtaalla on 116 000 t/a luettelo- ja 140 000 t/a sanomalehtipaperia.</p> <p>Tuotekehitysstrategian muodostaminen aloitettiin analysoimalla tehtaan ja sen koneiden nykyinen tila. Analyysi koski lähinnä tehtaan pääraaka-aineita, tuotettuja massoja ja paperilajeja, koneiden kuntoa, kuljetusedellytyksiä ja markkinoita. Seuraava askel oli tehtaan tuotantomahdollisuuksien ja -kapeikkojen tutkiminen.</p> <p>Potentiaalisia tuotteita tehtaalle ovat päällystetyt ja päällystämättömät hiokepitoiset paperit. Potentiaalisten tuotteiden karkea eliminointi tehtiin markkinakokoon, sen kasvuun ja nykyiseen tarjonta/kysyntä-tasapainoon perustuen. Jatkotutkimuksiin valittiin luettelo-, sanomalehti-, korkeavaaleuksinen sanomalehti-, SC-A- ja päällystetyt mekaaniset paperit (FCP ja LWC/MWC).</p> <p>Valittujen tuotteiden markkinamahdollisuudet sekä FCP- ja SC-lajien tekniset mahdollisuudet tutkittiin. Kustannuskilpailukykyanalyysi tehtiin ja investointikustannukset arvioitiin kaikille valituille tuotteille. Nämä tutkimukset analysoitiin ja vedettiin yhteen. Tulokseksi saatiin parhaat mahdolliset tuotteet, jotka kasvattavat tehtaan kannattavuutta ja kilpailukykyä.</p> <p>Analyysin tuloksena saatiin suositus, että tehdas jatkaa luettelopaperin valmistusta kahdella pienellä koneella ja siirtyy valmistamaan filmipäällystettyä paperia isoimmalla paperikoneella.</p> <p>Tulevaisuudessa kaksi pienintä paperikonetta voitaisiin sulkea ja tilalle rakentaa uusi moderni paperikone, joka voisi tuottaa esimerkiksi päällystettyä hiokepitoista tai SC-paperia.</p>			

FOREWORD


I want to thank Jaakko Pöyry Consulting Oy for offering me the possibility of writing my master's thesis on an interesting project. I am grateful to everybody at Consulting who helped me by giving me the information I needed and for supporting me. Especially I want to thank my instructor Mrs Suvi Anttila for the idea to the thesis and for all her help.

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Last but not least my heartfelt thanks to my husband Ari for all the support and self-confidence he gave me before and during my work.

Espoo

January 10th, 1996

A handwritten signature in dark ink, appearing to read 'Erika Torpo', written in a cursive style.

Erika Torpo

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LIST OF ABBREVIATIONS

ADt/d	Air dry tons per day
BDMT	Bleached metric ton
CAD	Canada \$
CSF	Canadian Standard Freeness
CTD	Coated
CTMP	Chemi-thermomechanical pulp
d	Day
FCP	Film coated paper
grwd	Groundwood
LWC	Light weight coated paper
MFC	Machine finished coated paper
MT	Metric ton
MW	Megawatt
MWC/HWC	Medium or high weight coated paper
PM	Paper machine
R&D	Research and Development
SC-A+	Supercalendered paper in quality class A+ (best)
SC-A	Supercalendered paper in quality class A (second best)
SC-B	Supercalendered paper in quality class B
SC-C	Supercalendered paper in quality class C
ST	Short ton
t/a	Tons per year
TMP	Thermomechanical pulp
UCTD	Uncoated
ULWC	Ultra light weight coated paper
USD	USA \$
YPPA	Yellow Pages Publishers Association

PRODUCT DEVELOPMENT STRATEGY FOR A NORTH AMERICAN PAPER MILL

1 INTRODUCTION

The objectives of the work were to formulate a product development strategy for a certain North American paper mill. The main goals were to find competitive products for the paper machines to improve the profitability of the mill and the company.

The product development strategy has its basis in the overall vision and strategy of the company, which are influenced by the corporate goals and expectations of the different stakeholders; shareholders, customers, employees and society.

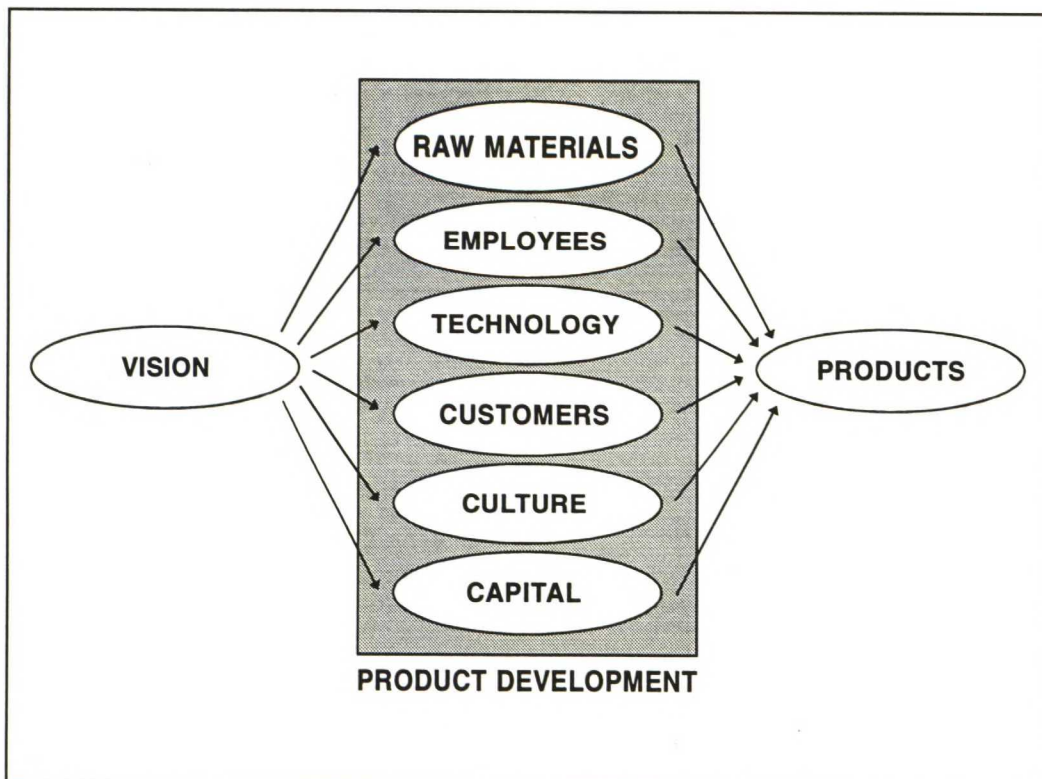


Figure 1. Product development strategy //

The product development strategy should bring the key resources of the company - raw material, employees, technology, customers, culture and capital - together to create new products, which will support the company in executing its overall strategy. See Figure 1.

The basis for product development in successful companies is constant monitoring of the market place and close contacts with customers, which ensures a free flow of information on changes in customer preferences. Only this will make the company able to respond to the market needs and to adapt to the constantly changing environment. The industry leaders in technology, product quality and market position spend time and resources to constantly challenge their own organisation and operations, in many cases even before the competitors have a chance to do so /1/.

2 PRODUCT DEVELOPMENT STRATEGY

Product development strategy is one part of the corporate strategy. It describes what products the company could or should produce to be competitive and profitable and what to do to achieve these goals.

There is not much literature on product development strategy, although many books and articles have been published about general strategy and about product development.

In the following text the presentation of the product development strategy is based on what a new product is, what are the main company strategies, how the management makes strategic decisions and what the effects of decisions are in the organisation. There is also a description of the main strategies of companies. Further, the text explains what product development is and how the product life cycle can be used in the product development strategy. In the next chapter the special characteristics of the paper industry and the industrial environment in North America (both USA and Canada) are listed.

2.1 New Products

New products are the lifeblood of any business. They energise the company's marketing, sales and distribution activities and provide new opportunities in the face of the declining markets for existing products. Because of the inexorable forces of the product life cycle, the old products gradually lose their ability to generate profit. This creates a requirement for new products to revive profit margins. New products provide new hope, promises, and challenges to the industrial marketing organisation /2/.

Companies have realised the importance of technological innovation and owe their origin and continued existence to product innovation. Innovations are crucial to the achievement of strategic objectives of most organisations and they present the essence of corporate growth and improve the future earnings stream /3/. New products may enable a company to comply with the increasingly stringent government regulations with respect to issues such as product ingredients, safety standards, energy use and pollution. No company can afford to ignore the importance of innovation /4/.

In this text the term *new product* does not mean only products which are totally new; The classification of new products - derived from business practice - is based on the degree to which the product is new to the particular company. With this approach we can identify four product categories /4/:

- 1) *new products*: products which serve an entirely new function and thus represent a new concept to industry as well as to the market;
- 2) *products new to the company*: products with which the market is familiar but which are not yet part of the company's product line;
- 3) *line extensions*: variations of products already marketed by the company;
- 4) *product modifications*: minor adaption of existing products (with respect to quality, style, etc.).

2.2 Strategy

Business strategies are closely related to the technology and marketing efforts of the firm. There seems to be a connection between strategy and the different ways of carrying out functional activities /5/.

Company strategy should deal more with the configuration and orientation of an enterprise than with its marketable results. The more innovative a company is, or wants to be, the more necessary this becomes. Product strategy should deal both with existing products and the possibility of finding new products. The balance between these types of activities reflects how innovative the intended product strategy of a company is /6/.

From an innovation management point of view, the strategic outcome on the product marketing level can be defined in terms of the product and customer focus of the company /6/.

Within the dimension of product focus, a company can concentrate on developing products that are essentially variations of existing products (product modifications), or it can focus on products that fall outside the established product line (product diversifications) /6/.

With regard to the second dimension of realised marketing strategy, customer focus, new products may either be primarily aimed at getting new customers or directed towards tying existing customers closer to the company. In the first case the result is a more offensive, competitive strategy. In the second case it is a more defensive, holding strategy /6/.

Whether the marketing strategy is offensive or defensive it may be implemented through products that are directed toward a wide range of customer needs - a general product design; or it may result in products that are aimed at a more narrow spectrum of customer needs - a specific product design /6/.

When the company begins to think about expanding or extending its core business, it should first look at its current special strengths - in the technical/production area, or in the marketing area. The company may have based its success to date on technological capacity or unique manufacturing capability, or its success may primarily stem from long-standing relations with distributors, ability to get shelf space from retailers or widespread brand recognition by consumers /7/.

Strategic planning up till the 1970's was primarily operative by nature. It was possible to utilise the continuous growth and steady market, which actually did not require strategic decisions but rather the ability to run the productional and operational processes with as few interruptions as possible. Strategic planning in turn consisted basically of precision and deepening of the core business areas. The strategic choice was made between either the present and future markets or between the existing and new products /20/.

In the 1970's, the western countries met with several problems. The energy crises, inflation and recession stopped the economic growth in almost every industrial branch. The western companies were forced to start developing their strategic planning. New trends arose, for example /20/:

- 1 Companies took an active role as investors allocating investments and business activities.
- 2 The emphasis of planning was sifted from one-year-planning to that of longer term. Later on, as a consequence of the energy crisis, they were forced to cut their long term planning again to shorter periods.
- 3 Positioning, evaluation of goals, opportunities and resources were developed.

2.2.1 Characteristics of Strategic Decisions

The characteristics usually associated with the word strategy and strategic decisions are /8/:

1. Strategic decisions are likely to be concerned with the *scope of an organisation's activities*: does and should the organisation concentrate on one area of activity, or many?

The issue of scope of activity is fundamental to strategic decisions because it concerns the way in which those responsible for managing the organisation conceive its boundaries. It has to do with what they want the organisation to be like and to be about.

2. Strategy has to do with the *matching of the activities of an organisation to the environment* in which it operates.

Since the environment is continually changing for all organisations, strategic decisions necessarily involve change. The extent and speed of environmental changes vary and the pace at which the strategy must change necessarily varies too.

3. Strategy also has to do with the *matching of the organisation's activities to its resource capability*. Strategy is not just about countering environmental threats and taking advantage of environmental opportunities, it is also about matching organisational resources to these threats and opportunities. There would be little point in trying to take advantage of some new opportunity if the resources needed were not available, could not be made available or if the strategy was rooted in an inadequate resource base.

4. Strategic decisions therefore often have *major resource implications* for an organisation. These may be decisions concerning the disposal or acquisition of whole areas of resource.
5. Strategic decisions are therefore likely to *affect operational decisions*, to "set off waves of lesser decisions". It is important to understand that strategic decisions have wide ramifications across the organisation.
6. The strategy of an organisation will be affected not only by environmental forces and resource availability, but also by the *values and expectations* of those who have *power* in the organisation.
7. Strategic decisions are likely to affect the *long-term direction of an organisation*. They tend to have long-time horizons and/or long-term implications.
8. Strategic decisions are often *complex in nature*. The complexity arises from at least three sources. First, because strategic decisions usually involve a *high degree of uncertainty*, they may involve taking decisions on the basis of views about the future of which the managers cannot be sure. Second, strategic decisions are likely to demand an *integrated* approach to managing the organisation. Third, strategic decisions are likely to involve *major changes* in organisations.

2.2.2 Corporate Strategy

The term *corporate strategy* is used here for all types of organisations - small and large commercial enterprises as well as public services. *Corporate strategy* denotes the most general level of strategy in an organisation and in this sense embraces other levels of strategy /8/. See Figure 2.

Strategy can be defined from a hierarchical perspective. Strategy can be divided into corporate level, business level, and functional level strategies. See Figure 2. Corporate strategy should answer the question of what field of business the firm is or should be in /5/. It is also likely to involve questions about the financial structure and the organisational structure of the firm as a whole /8/. Business or competitive strategy focuses on the issue how to compete in these particular business areas or product-market segments. Moreover, resource deployments necessary for success in industrial competition need to be defined at business level /5/. Whereas corporate strategy involves decisions about the organisation as a whole, competitive strategy is more likely to be related to a unit within the whole /8/. The third level, functional strategy, concentrates on the maximisation of resource productivity, co-ordination and integration of activities within a single function of a firm /5/.



Figure 2. Strategy levels

The importance of technology rests in the degree to which it can be linked to other elements of strategy. However, there is a difference between technology push and market pull, which means that technological innovations (push of technology) should match the needs or desires of customers (pull of society). Furthermore, a technology-related strategy is today driven by social and market forces. This means that technological decisions need to be made in accordance with the true value of technology. The company's future is understood all along the route from fundamental research to commercialisation /5/.

2.2.3 Competitive Strategy

The essence of formulating a competitive or business strategy is to relate a company to its environment. Although the relevant environment is very broad, encompassing social as well as economic forces, the key aspect of the firm's environment is the industry or industries in which it competes. Industry structure has a strong influence in determining the competitive rules of the game as well as the strategies potentially available to the firm. Forces outside the industry are significant primarily in a relative sense; since outside forces usually affect all firms in the industry, the key is found in the differing abilities of firms to deal with them /9/.

Developing a competitive strategy is developing a broad formula for how a business is going to compete, what its goals should be, and what policies will be needed to carry out those goals /9/.

The wheel of competitive strategy in Figure 3 illustrates that competitive strategy is a combination of the goals for which the firm is striving and the policies by which it is seeking to get there /9/.

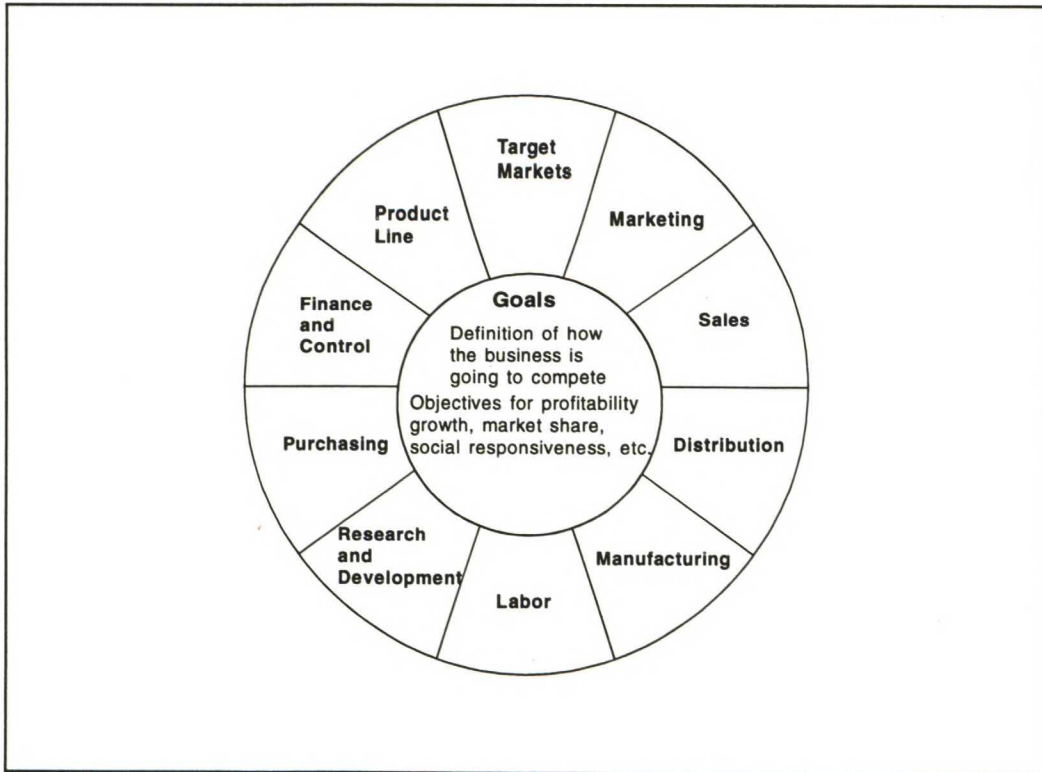


Figure 3. Wheel of Competitive Strategy /9/

The wheel of competitive strategy is a device for articulating the key aspects of a firm's competitive strategy on a single page. In the hub of the wheel are the firm's goals, which are its broad definition of how it wants to compete and its specific economic and non-economic objectives. The spokes of the wheel are the key operating policies with which the firm is seeking to achieve these goals. Depending of the nature of the business, management can be more or less specific in articulating these key operating policies; once they are specified, the concept of strategy can be used to guide the overall behaviour of the firm. Like a wheel, the policies must radiate from and reflect the hub (goals), and the spokes must be connected with each other, or the wheel will not roll /9/.

2.2.4 Innovation Strategy

Innovation refers to creation of the future. It is a complex process the totality of which may not be captured in precise and isolated blocks of meaning. Innovation management is the handling of technological change and also the outcome of this process. Strategic management is concerned with innovation strategies and innovative performance: our main interest lies in the relationship between the two /6/.

Successful innovation strategies demand creative efforts to understand and influence future conditions. They result in technological innovation, new knowledge, which by using marketing strategies may be turned into market innovation, the introduction of new products, processes and services to serve new customer needs /6/.

In this case technological innovation refers to the use of new knowledge for both product and company development. This is a broader and more open concept than product or process innovation, which often refers to the use of new knowledge to improve given, identified products or production processes /6/.

2.2.5 Research and Development Strategy

Research and development operation is part of the company's business and it is tightly linked to the business idea and strategy. The state, the products, the markets and the production machinery of the company form the basis for research and development operations /10/.

The direction of the research and development operations, especially development, is set by the strategic corporate planning, which is continuing the current risky decision-planning process. This process is one of the most significant parts of the management's tasks /10/.

When planning new products and product groups as well as opening new markets you have to pay attention to the company's present resources and present state. Also the present capabilities to create the required state in the future must be taken into consideration /10/.

The business idea answers the question why the company or product is in the market. One company may have many different business ideas. The idea is based on need and possibility. The idea should function as a base for the planning process and encourage and help to seek and present new ideas. That is why the business idea should be well known in the company /10/.

The goals specify the contents of the business ideas. The goals can be put into order of importance so they are easier to use in strategic planning, in product development etc /10/.

The strategy ties goals, operation principles and operation programme into a logical whole. The strategy is based on both elimination of the weaknesses and the present and future risks and on exploitation of the strengths and analysed possibilities. A good strategy considers also the important competitors /10/.

Operation policy means principles based on the strategy. The most important policy for product development is product policy /10/.

The definition of *product policy* specifies the principles which consider the product line, width and depth of product groups as well as development work. The product policy concept answers questions like what kind of, how much and according to which principle the products are to be made. It contains also the amount of own product development and the degree of imitation. The customer's possibility of influencing the development work is also considered in the product policy /10/.

It is important that different segments of the company do not set opposite *targets*. Product development should therefore be clearly integrated to the company so that the structure for planning is consistent for every segment /10/.

2.2.5.1 Stages of the Research and Development Strategy

The research and development strategy includes at least the following stages /10/:

1. Evaluation of present products
2. Analysis of markets; both development and marketing staff together
3. Evaluation of production methods
4. Analysis of the company's strengths and weaknesses
5. Setting of targets
6. Preparation of a development plan
7. Formulation of a product development strategy
8. Evaluation of the previous stages.

2.3 Product Development

The objectives of product development must be broken down into manageable parts, so that the search for ideas can be directed and the innovation process managed in a way that is effective for the well-being of the company. The objectives of companies and product development are based on few basic needs of corporative well-being: profitability, sufficient volume and continuity, and the values and resources of the company /3/. See Figure 4.

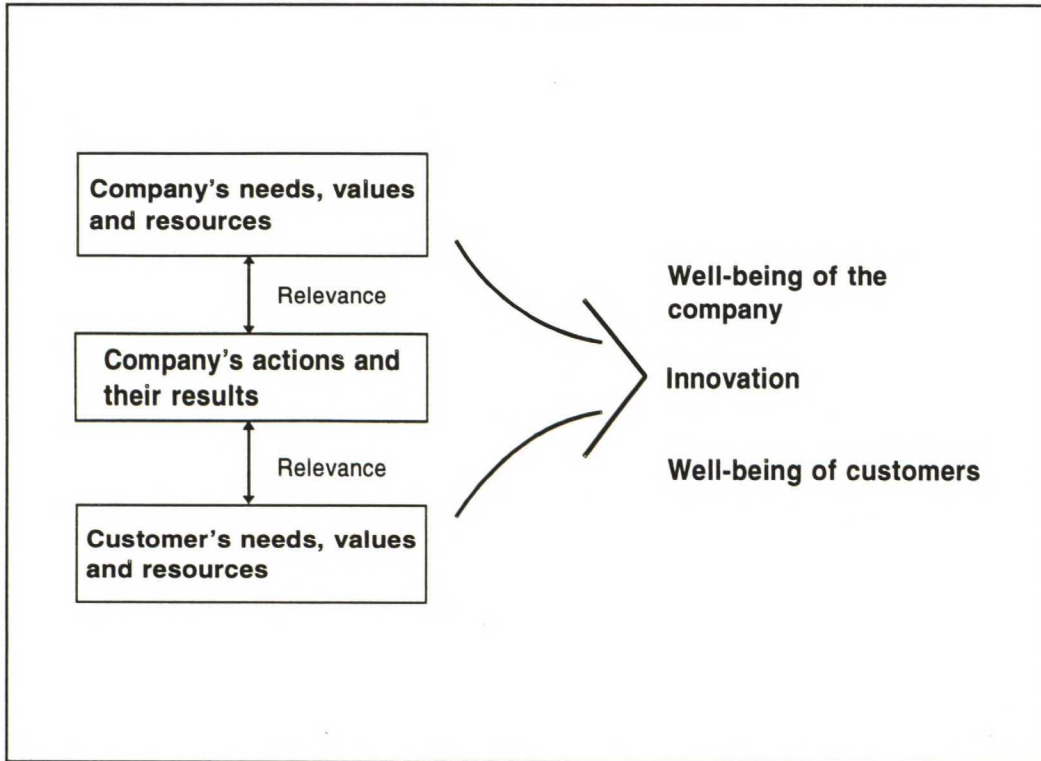


Figure 4. Importance of mutual relevance for innovations, well-being of the customers and the company /3/

The development of products takes place in separate projects, so their effects on the profitability of the company can be estimated on the basis of anticipated returns and needed investments. Risk is one of the most important factors as far as continuity is concerned and it has a central importance in innovation activities. The risk of new products can be estimated on the basis of the novelty of the markets and the novelty of the products. Efficient fulfilment of the needs of customers is one of the central factors that influence their success. Consumer needs should be assessed as early as possible in the product innovation process /3/.

In the case of product development the company maintains the security of its present markets while changing and developing new products. Some examples will illustrate the many reasons why companies might show a preference for product development. Companies in retailing will follow the changing needs of their customers by a continuing policy of introducing new product lines. Sometimes product development is preferred because the company is particularly good at R&D (research and development) or because it has structured itself around product divisions. When product life cycles are short, product development needs to be a central part of company strategy /8/. The product life cycle is presented in Chapter 2.4.

Product development raises uncomfortable dilemmas for firms. While new products may be vital to the future of the firm, the process of creating a broad product line is expensive, risky and potentially unprofitable. For these reasons there has been an increased trend towards technology transfer and collaborative ventures. Also, many organisations choose to renew the competitiveness of current products through modifications or new marketing approaches /8/.

Basically, product development is one alternative to achieve product reorientation and competitive advantage in paper industry. What gives product development the power to affect competition is the fact that changing from one paper grade to another, or even minor quality changes, entail significant adjustment costs and time. In the paper industry investment costs of major product development projects are measured millions of USD, their length in years and product life cycles in tens of years. Product development is thus perceived to have important competitive implications. Yet, if key product attributes could be changed instantaneously at low cost, the competitive impact of a new product would be sharply reduced /21/.

The major risk with product development in the paper industry is also related to the huge costs and long periods of time involved. A great deal of money and effort over considerable periods of time are tied up before major paper industry projects start to pay for themselves, and a high degree of uncertainty and risk taking are involved /21/.

2.4 Product Life Cycle

The product life cycle is a hypothetical concept describing how a typical product's sales volume and profit margin are likely to behave over time. It really describes a market, not a product. Figure 5 depicts the product life cycle and defines the five stages commonly used to describe it. Slight variations in the description of the stages are sometimes found, resulting in a four-stage model, but these variations are insignificant /2/.

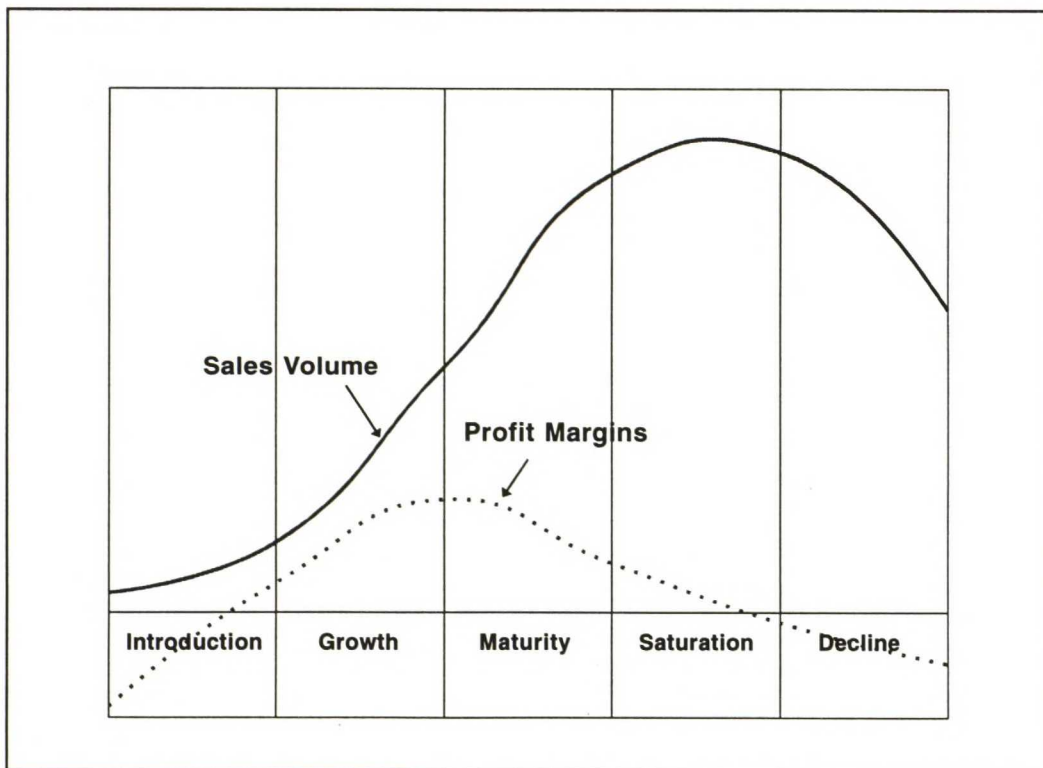


Figure 5. Product life cycle /2/

In this five-stage model it is significant that there is an inflection point in the sales volume curve at the dividing line between the growth and maturity stages. At this point, the profit margin curve is at its peak. In the maturity stage, the sales volume continues to increase although at a decreasing rate, but profit margins are falling /2/.

2.4.1 Stages of the Product Life Cycle

The behaviour of the product life cycle is caused by three forces over which management has little or no control: changing customer needs and preferences, advancing technology, and changing competition.

In the *Introductory* stage of the product life cycle, the market is small and growing, there are very few competitors, and the market will tend to be undersupplied once it begins to develop. The company may have a virtual monopoly with a new product, but profit margins are low, reflecting cost of product and market development, even though prices may be as high as they will ever be. Profit margins improve with significant growth in sales volume, since production and marketing efficiencies permit lower costs per unit, and the rate of market acceptance continues to grow. The firm's major marketing problems are to find customers, creating awareness and trial, and building distribution on a selective basis /2/.

In the *Growth* stage, the market has become much larger and is growing rapidly. There are many more competitors and their numbers are increasing. The market is likely to fluctuate between being over- and under-supplied as new firms enter the business and new capacity comes on line in large increments. The marketer's principal concerns include forecasting the rate of market growth and capacity expansion, building and holding market share, creating brand differentiation and customer preference, developing product line extensions, continuing to stimulate trial by new users but also gaining expanded repeat usage by existing customers, and broadening distribution /2/.

In the *Maturity* and *Saturation* stages, the number of competitors reaches a maximum and begins to decline. The market remains oversupplied with excess capacity, which will continue to expand through the mature stage but at a slower rate. Sales continue to grow, but profit margins decline as the result of competition, which may require lower prices, increased promotional expense and, perhaps, the additional expense of product improvements or product line extensions resulting in smaller production quantities of more specialised items. Distribution expense and other service cost items may also increase. Marketing strategy focuses on maintaining share in an increasingly segmented and fragmented market with multiple models, brands, and product line extensions. Marketing communications attempt to create product differentiation and to build trade support. Distribution may be consolidated and become more selective, especially in the saturation stage, as the firm is likely to focus on fewer market segments. In the saturation stage, all competitors are likely to be fighting to reduce their costs and there is likely to be significant price erosion as firms fight to hold market share, resulting in very low or even negative levels of industry profitability /2/.

In the *Decline* stage, there may be only a few surviving competitors. Market price may be defined by the cost structure of the least efficient surviving producer. The remaining firms will have reduced their expenditures on marketing and R&D in order to improve profit margins, instead of attempting to grow the size of the market or to steal customers from competitors. Cost per customer served may be at their lowest level in the history of the industry, with a declined number of distributors and marketing concentrated on a smaller set of market segments. The market will be oversupplied and capacity will continue to shrink slowly. The remaining firms are likely to enjoy substantial positive cash flow from these products as prices stabilise and marketing and manufacturing costs continue to decline /2/.

2.4.2 Uses of the Product Life Cycle

A new product seldom actually follows the prescribed route of sales volume and profitability in the product life cycle concept. It should be regarded as a forward-looking, conceptual tool for strategic planning, not a backward-looking description of a basic marketing truth. It is a description of forces at work in the market that will influence product sales and profit margins. It is not a prediction of outcomes, which depend on marketing actions, but it is highly normative /2/.

The product life cycle should be seen not as a model of some immutable laws of market behaviour but as a pattern of marketing strategies, changes in market structure, and resulting sales and profit performance over time. They reflect specific strategic choices and actions by managements contending for the customer's preference with investments in technology and market development /2/.

The product life cycle concept is an important planning tool and has three very significant implications for marketing management. First, it shows clearly the need for a continuous stream of new product ideas. Second, it suggests that different marketing strategies are needed at different stages of the product life cycle. The marketing programme should contain an appropriate mix of product quality, price, distribution, and promotional features to reflect the nature of competitive forces at each stage. Third, the product life cycle shows the importance of planning for the total life of the new product at the time the product is being developed and its market introduction planned. Without such a long-term view, encompassing the realities of competition and tight margins in the later stages of the product life cycle, estimates of long-run profitability and return on investment may be exceedingly optimistic /2/.

There is one other fact about the product life cycle that should be noted. Firms seldom have careful procedures and systems for evaluating old products and deciding to eliminate them when they begin to consume resources instead of contributing to the firm's profitability and growth. Systems for the evaluation and "euthanasia" of old, sick products have as much potential for sustaining company profitability as those whose purpose is to develop and introduce new products /2/.

In the use of product life cycle, there is always a danger that such generalised strategies which are advanced by academics may mislead. Each situation must be treated as a distinct problem or opportunity. Three basic uses of the concept are /11/:

- 1) *As a predictive or forecasting tool:* while its value as a method of sales forecasting is largely unproved, it serves to rationalise for the management the possible sales behaviour of the product over time.
- 2) *As an instrument of planning:* it enables management to anticipate the changes in the environment which affect sales and permits them to adjust their marketing mix inputs to the best possible advantage.
- 3) *As an instrument of control:* management can review periodically product performance by life cycle stage and correct it based on anticipated behaviour.

3 PRODUCT DEVELOPMENT IN THE PAPER INDUSTRY

3.1 Special Characteristics of the Paper Industry

Pulp and paper manufacturing is a very low research- and technology-intensive industry whose products reflect industrial use more closely than final consumer demand /6/. Research and development represents approximately 0.5 to 2 % of the paper companies' turnover /12/. For example for the North American company Westvaco it was 1.2 % of the turnover in 1994 /13/ and for Finnish Kymmene 0.4 % in the same year /14/. In the electronic industry the share of research and development is higher. For example in Finnish Nokia it was 6 % of the turnover in 1993 /15/.

3.1.1 Special Characteristics of Production

Continuous production is characteristic of the paper industry, and standard products and high production volume are characteristic of continuous production. The paper industry is very capital-intensive; for example a new newsprint machine costs about USD 400 million. The raw materials (fibre, chemicals, electricity) are a significant part of the manufacturing costs /16/. For example for newsprint and LWC paper the raw material costs amount to over 70 % of the manufacturing costs of paper machines with capacities of about 200 000 t/a. For small machines with a capacity of about 50 000 t/a, these costs could be 50 % of the manufacturing costs.

The change of paper grade on the paper machine causes extra expenses for instance in lost production time. Therefore the paper mill can take notice of a client's wishes of special paper properties only if the order is big enough or if the time of delivery is long enough so a few orders can be combined. The best product for a certain paper machine is paper which can be produced with a long time run; then the best profitability of the machine can be achieved /16/.

3.1.2 Limitations of the Production Machinery

In the paper industry the production machinery is a big investment. The investment costs for a new newsprint machine with a capacity of 300 000 t/a are about USD 400 million and for a new LWC machine with a capacity of 350 000 t/a USD 600 million. To eliminate the risk of the investment, the company want to be sure that the chosen technology works before making any decisions. Because of this, the introduction of new technology is quite slow. The progress of technical development of the production machinery is also slow, like "evolution" /16/.

There seems to be a cultural difference between North American and Scandinavian companies in their willingness to try and test new machinery developments. The North Americans are conservative and first want to see reference machines in operating. If they want to expand their mill, they want an installation which duplicates the one which is already running, even if it is then trailing the state-of-the-art /12/.

The Scandinavian companies are receptive to trying a new machine design or concept if it seems logical and makes sense. They will accept the risks and costs involved. If it is successful, there are people from all over the world waiting to see it. If not, no one outside the country knows about it. All information on such failures is circulated to each company in the country to prevent their national competitors from making the same investment, or the national technical knowledge pool is given a chance to solve the concept or design weakness which showed up /12/.

3.1.3 Products of the Paper Industry

The basic elements of the paper manufacturing technology are similar to every paper grade but the properties of the products are very different. The products can be divided into consumer and industrial goods. They can also be classified as woodcontaining and woodfree papers, then as bleached and unbleached, and as coated and uncoated papers. Products can be divided by property into different paper grades and by quality into different classes. There are many kinds of products under the word paper /16/.

There are usually big differences in the product development of consumer and industrial goods. The main goal for both of them is top quality of the paper grade in its own class. The other goals may be different depending on the paper grade and the end-user. Purchase criteria for industrial buyers are technical properties and costs of the paper. For end-user the criteria usually are the appearance and price of the paper /16/.

3.2 Industrial Environment in North America

Corporate culture in North America is very different compared with European and Scandinavian companies. Most of the companies in North America are listed on the stock exchange so their intention is to make a profit to satisfy the shareholders and keep the stock prices as high as possible. The companies pay their dividends to shareholders four times a year. The shareholders' needs are first priority and the dividends must always be paid in time. This means that the strategies of the companies are mostly short-term plans. Long-term planning also improves profit, but not necessarily this year or this month and this is usually too late for the stock prices. The money for investments must be collected over a long time because neither the firms nor the shareholders like to take big loans.

3.3 Corporate Planning and Product Development in North America

The product development organisations in North America are quite big, with about 100 to 400 people /12/, and they are usually centralised. Research centres are typical of big companies whose production is over 4 million tons /12/.

The paper markets are large in North America. Total paper and board demand in North America in 1993 amounted to 88 million tons and per capita demand to 300 kg. In Western Europe demand was 61 million tons and per capita demand 160 kg /17/. Because of that the North American companies can be specialised in relatively small segments and still produce large quantities of paper /16/. The paper industry is very centralised. There are 5-20 competitors in the same product segment. For example, there are 13 coated groundwood producers in North America and the five biggest companies represent 60 % of total coated groundwood capacity.

The relation between product development and strategy seems to be quite clear in North America. The companies wanting to keep their technological leadership have large research centres while the rest of the companies do not invest much in product development /16/. Product development concentrates in North America mostly on quality improving, not on developing new products.

4 PRODUCT DEVELOPMENT STRATEGY FOR A NORTH AMERICAN PAPER MILL

This study is based on a real case. The company and the mill are located in North America and the information on the company is actual. In this text the company is called the Company and the mill the Mill.

The Company is looking for a low capital investment, so for example a new machine is out of the question at this moment.

The objective of the mill level analysis is to improve the overall long-term viability. The first target is to

- identify new product options which provide increased value added
- improve the cost position of the Mill
- select product options, which are viable in the long term or generate cash for future investment.

The second target is to develop mill level product development capability in line with the corporate product development strategy. The learning process focuses on the market, technical and financial issues in connection with strategic planning and product development.

4.1 Definition of the Company

The Company is one of the world's leading producers of newsprint and a major producer of other uncoated groundwood papers.

The Company operates with several mills in North America, of which some are 50/50 newsprint joint ventures. The distance between the farthest mills is about 2 500 km. Total capacity of the Company is over 1.8 million tons of newsprint and 0.6 million tons of uncoated groundwood grades. Net sales in 1994 totalled USD 1 500 million and the operating profit USD 19 million. The sales increased by 13 % from the year 1993. The increase is attributable to the exchange rates between the Canadian and United States dollars, improved newsprint prices and higher newsprint sales volumes.

Figure 6 presents how the net sales and the operating profit of the Company are divided in 1994 between the wholly-owned paper mills, newsprint joint ventures and other operations.

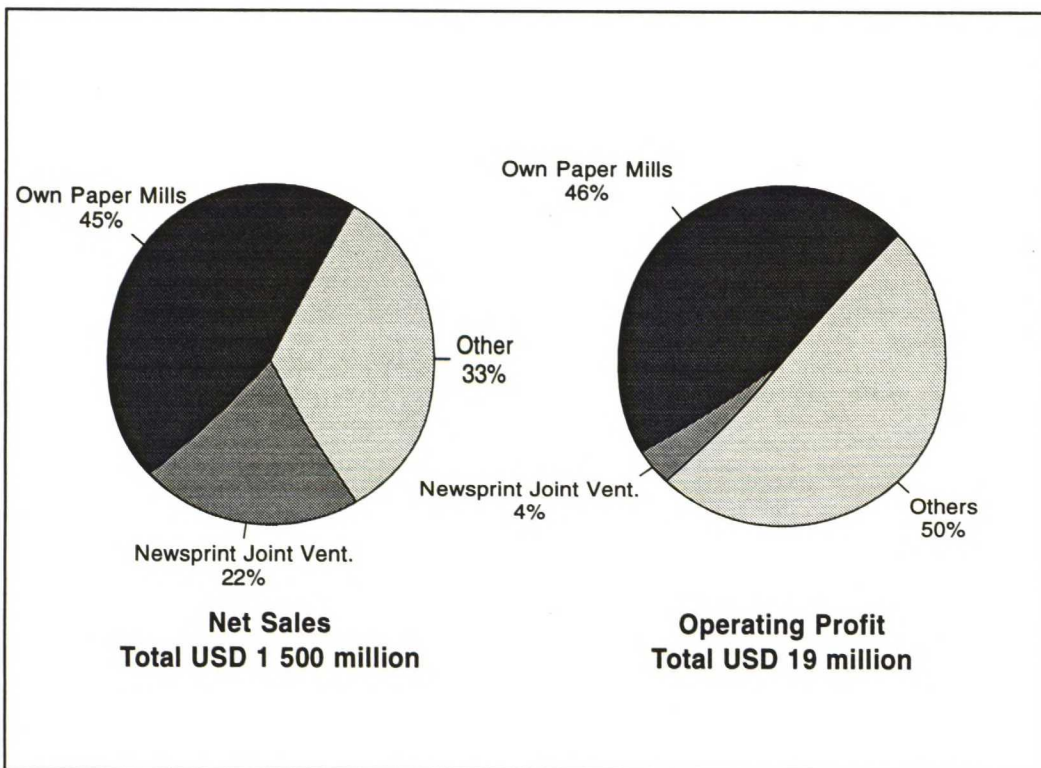


Figure 6. Net sales and operating profit of the Company in 1994

The Company is one of the world's largest newsprint manufacturers. It supplies about 10.5 % of all North American newsprint consumed and accounts for 19.6 % of all North American newsprint exports. The Company's share of the world newsprint market is 5.8 %. Newsprint net sales by market in 1994 is shown in Figure 7.

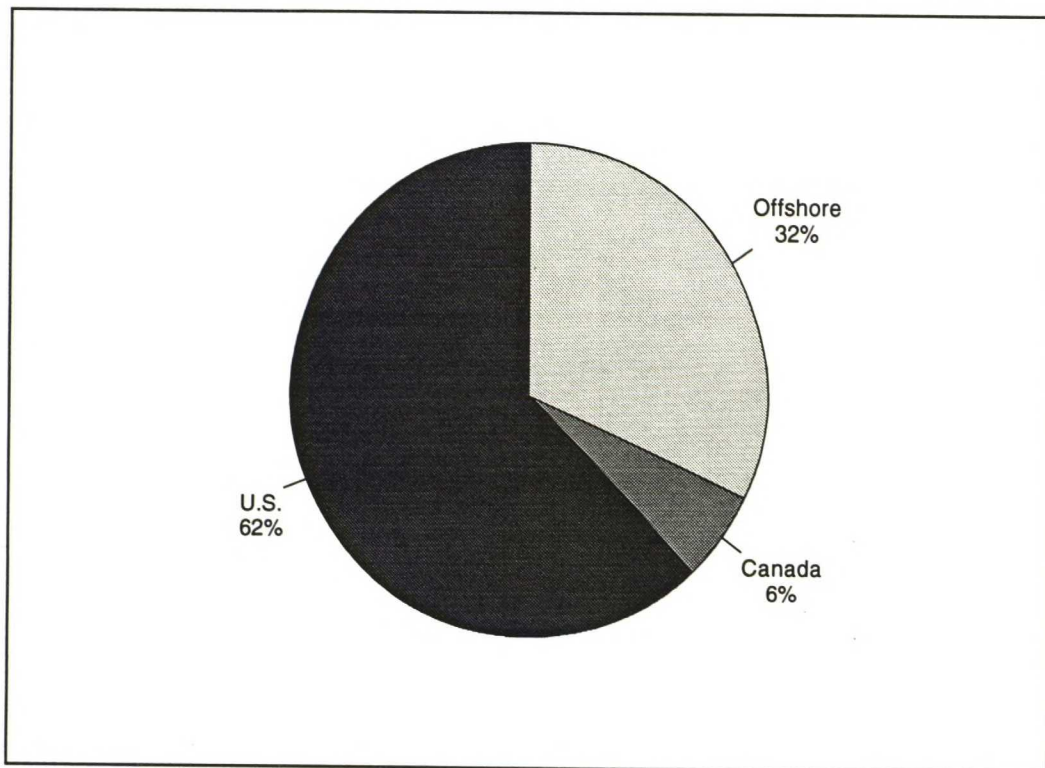


Figure 7. The Company's newsprint net sales by market in 1994

The vision of the Company is to be one of the world's finest manufacturers and marketers of groundwood papers, which can be achieved only by building a sustainable product development strategy that provides higher value product opportunities to maximise the Mill Business Unit's net present values.

4.2 Definition of the Mill

Construction of the Mill started in the autumn of 1924 and was completed in December 1925. In 1994 there were about 700 employees. The Mill is located by a river, not far from the ocean and near a town, with a population of about 30 000.

At present the Mill produces high-yield sulphite and groundwood pulp. At the end of 1996 a new TMP plant at the Mill will be ready and then the sulphite and groundwood plants are to be shut down. The Mill has also produced deinked waste paper pulp since early 1995. The Mill produces groundwood papers on three paper machines. The production capacity of the Mill is 116 000 t/a of directory paper on two machines and 140 000 t/a of newsprint on one machine.

The Mill's production in 1994 amounted to 110 000 tons of directory paper and 129 000 tons of newsprint. Net sales of the Mill in 1994 were USD 114 million and the operating profit USD 20 million which is 20 % of the sales income. The calculations are in Appendix 1.

4.3 Alternatives of the Product Development Strategy

The ultimate goal for a product development strategy is to support the conclusive business strategy to increase the shareholder value. The basic direction for product development alternatives is generally derived from the defined business strategy.

The product development alternatives are either to diversify the product portfolio or to develop the current business segments. The alternatives are searched not only from the current business segments but also from other potential segments suitable for the current machinery. Diversification of fibre raw material outside groundwood fibre based grades would need an extensive use of chemical pulp and that is ruled out because the pulp would have to be bought from the outside.

In the product development strategy there are at least four different ways to increase profitability of the whole company; volume growth, improvement of cost position, production of value-added products and exit from current business /1/. See Figure 8.

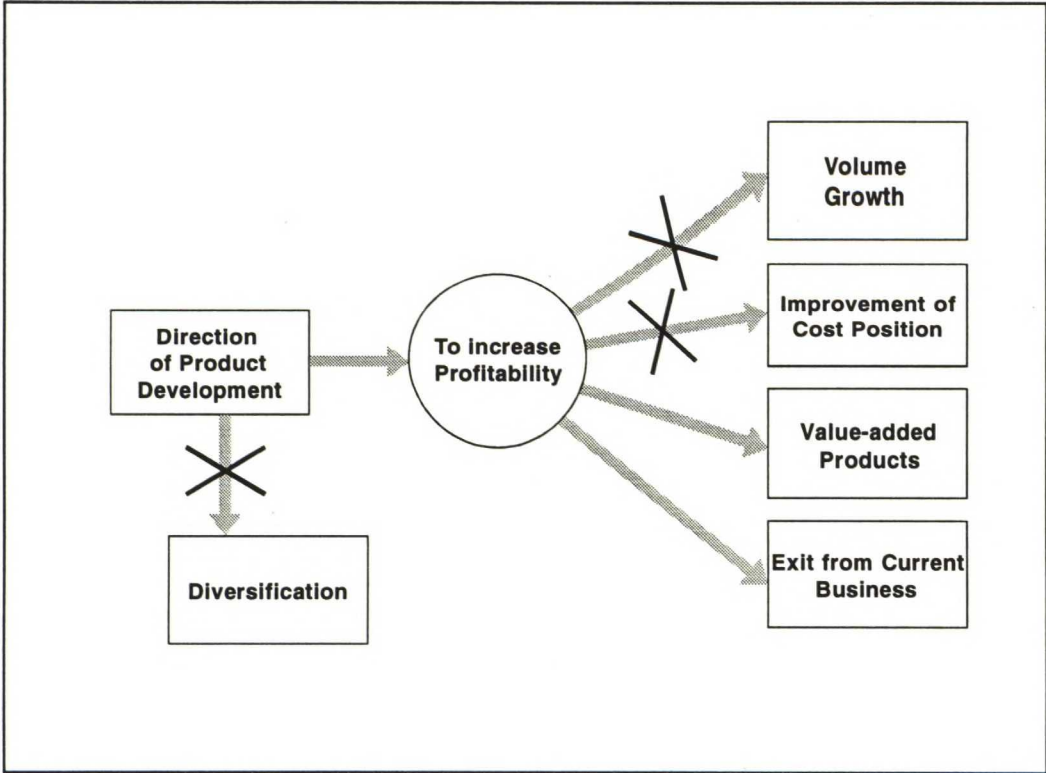


Figure 8. Alternatives of the product development strategy /1/

Volume growth can be achieved by increasing production and with new projects and rebuilds. This alternative has already been applied at the Company, which today is the leading producer of newsprint.

The improvement of cost position option can be reached by improving efficiency, lowering costs and improving operations. The use of recycled fibre also lowers costs. A cost lowering and operations improvement project is being implemented at the Company's Mill Business Units.

The production of value-added products option needs upgrading of operations, new technologies and also inventions of specialty papers. For future strategic development, value-added products are worth exploring which can result in better profitability.

Immediate or gradual *exit from current business* may also be a vital alternative to improve the overall profitability of the Company.

4.4 Elements of the Product Development Strategy

The elements of the product development strategy in successful companies are /1/:

Administration:

- Organisation model, staff vs. line
- Management and coordination
- Planning
- Financing

Access to physical resources:

- Laboratories
- Testing facilities
- Machine time availability

Source of information:

- Co-ordination meetings
- Contacts with universities
- Channelling market information
- Cooperation with research institutions

Human resources:

- Multitude/structure of skills
- Depth/amount of core skills
- Training
- Recruiting, job rotation
- Contacts with other companies

Project list:

- Length of rolling idea list
- Number of active projects

Operating environment:

- Culture
- Spending policy

Project handling:

- Project team structure, members
- Concept development
- Technology development
- Use of market research
- Transfer to line organisation

Development work capitalisation:

- Typical screening ratios
- Major successes
- Patents

4.5 Redesign Value Chain

Firms create value for their buyers by performing customers activities. They can be broadly divided into primary activities, which are involved in the ongoing production, marketing, delivery and servicing of the product, and support activities, which provide purchased inputs, technology, human resources or overall infrastructure functions to support the other activities. The ultimate value a firm creates is measured by the sum the buyers are willing to pay for its product or service /18/.

The activities performed in competing in the paper industry can be grouped together in categories as shown in Figure 9. This can be called a value chain. All activities in the value chain contribute to buyer value /18/.

A firm is more than the sum of its activities. A firm's value chain is an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities /18/.

Improving the competitive position of the Mill Business Unit needs examination of the redesign value chain from the customer point of view. In this case the redesign value chain includes raw materials, manufacturing, distribution, marketing, sales and services.

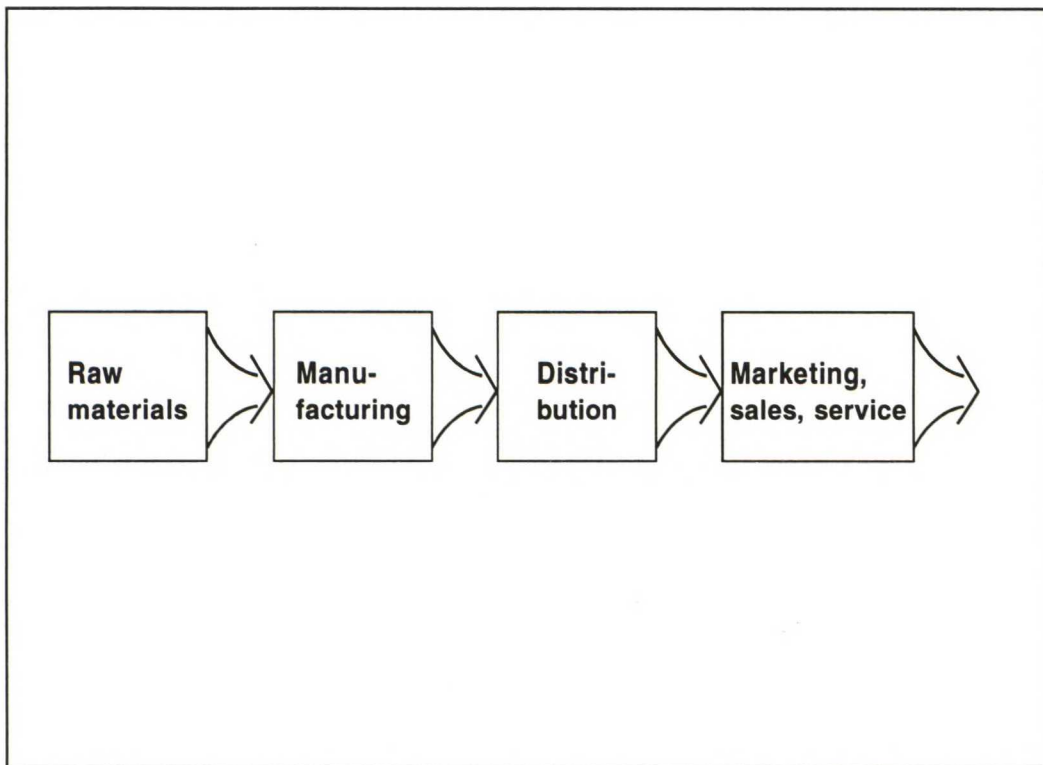


Figure 9. Redesign value chain /1/

The raw material sector includes the examination of present and new raw materials and their quality and price. The use of recycled fibre should be examined, as also the possibilities of manufacturing and buying recycled fibre pulp. Further, the product development and environmental aspects should be considered as well as costs.

In manufacturing the investigation of products and the technical status of the machines are important. Other aspects to be considered are product development and costs as well as purchasing and logistics.

Networks, physical distributions and warehousing must be examined in distribution.

In the marketing, sales and service sector it is important examine product and brand images and identifications as well as the state of the sales and network. Customers and their coverage, used marketing practices and also the technical service must be examined.

4.6 Decision-Making Process

The process of screening new products and making decisions about a new product line can be divided into four main categories of analysis /1/:

- checking the fundamental success factors
- quantifying the opportunity
- understanding the competitive dynamics
- determining the implementation requirements

The fundamental success factors require an analysis of /1/:

- availability and price of raw materials
- availability and cost of technology
- potential customer base
- knowledge of the customer's business
- capabilities and functions of people in the whole organisation
- corporate culture

Quantifying the opportunity is a demanding part of the analysis. Critical information on market opportunities is needed already at the very beginning of the product screening process to validate whether to continue with a special development project /1/.

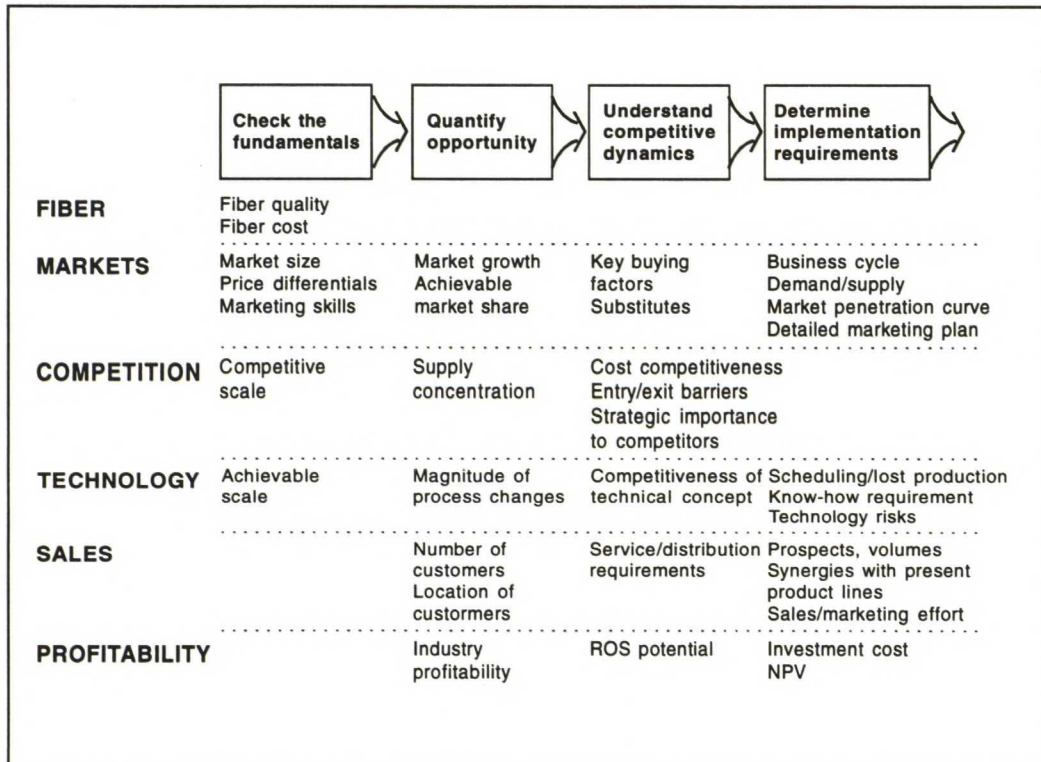


Figure 10. New product screening - Key factors/analyses /1/

At this stage the analysis concentrates on substantiating only the issues relating the market and cost, since only limited information is available on the product, its specifications and the potential customer perceptions /1/.

The main issues to be analysed include /1/:

- size and growth of the market
- emergence of the opportunity over time or market penetration
- current and future price level
 - * production costs
 - * costs of developing, testing and launching the new product

The third stage of the screening process is to clarify the competitive dynamics.

The main questions to be addressed are /1/:

- who are the main competitors in the new product area
- what is their competitive edge
- who are the possible new entrants and/or substitute producers at present and in the future
- how do the customers perceive the different producers/their products
- what will be the competitive advantages of the new developed product compared to the current ones in the market

The final stage of the screening process addresses the requirements to implement the product development idea in full production scale and how to launch it to the market. The purpose is to find out if the contribution of the new product exceeds the risk related to the process /1/.

5 SPECIFIC DEFINITIONS OF THE MILL

5.1 High-Yield Sulphite Pulp Mill

Main grade:	High-yield pulp at 75 % and 500 CSF.
Production concept:	Acid cooking in batch digester.
Year started:	1926 low-yield sulphite. Conversion to high-yield in 1965.
Capacity:	Actual: 120 BDMT/day Historical: 220 BDMT/day Recent: 100 BDMT/day

5.1.1 Main Machinery and Dimensions of the Pulp Mill

Acid plant:	1 x sulphur burner, approximately 10 MT/d. 1 x combustion chamber. 1 x absorption tower. Very old equipment.
Digester:	Total number of digesters: 5. Only 3 are used for cooking. One is used as residual acid tank. Equipment and control systems are very old.
Blow pits:	Total number of blow pits: 5. Only 3 are used for digester blowing. One is used as mixing tank. Very old equipment.
Refiners:	Three in first stage. Five in second stage.

Screens: 3 x Cowan screens.
 1 x disc filter (1980).
 1 x washer.
 Very old equipment.

All the machines of the pulp mill are very old. No modifications or improvements are planned for the pulp mill because it is scheduled to be shut down at the end of 1996 upon the start-up of the new TMP plant.

Specific wood consumption: 3.5 m³/ton
 Specific energy balance: 1000 kWh/ton
 Sulphur: 71 kg/ton
 Caustic soda: 78.5 kg/ton

5.2 **Groundwood Plant**

Main grade: Standard groundwood at 80 CSF.
 Low freeness groundwood at 50 CSF.

Main raw materials: Black spruce, Balsam fir and Jack pine.

Production concept: Stone groundwood with manual magazine loading
 (4 ft=120 cm long logs). The process is very old.

Capacity: 480 ton/day:
 - 305 tons of standard groundwood.
 - 175 tons of low freeness groundwood.

5.2.1 Main Machinery and Dimensions of the Groundwood Plant

- 24 x stone grinders.
- 6 x Pascol screens.
- 5 x pressurised screens in first stage.
- 2 x pressurised screens in second stage.
- 4 x cleaner stages for low freeness pulp.
- 3 x reject refiners 1-42IB and 2-412.
- 4 x pressurised screens for low freeness groundwood.
- 2 x disc filters for low freeness groundwood.
- 2 x disc filters for standard freeness groundwood.

5.2.2 Balance and Consumption Data of the Groundwood Plant

Specific wood consumption:	2.85 m ³ /ton
Freeness level: Standard:	80 CSF
Low:	50 CSF
Specific power consumption:	2.2 kWh/ton

The process is very old and it is planned to be shut down at the end of 1996 as the new TMP plant will be started up.

5.3 DEWA Plant

The Mill has produced also deinked waste paper pulp since early 1995.

Capacity:	40 000 t/a
Machinery:	Deinking fibre preparation flotation
Start-up:	Early 1995

5.4 Main Raw Materials

5.4.1 Wood

Species:	Black spruce:	88 %	
	Balsam fir:	10 %	
	Jack pine:	2 %	
Supply pattern:	Public forest:	90 % (400 000 m ³ /a)	
	Private forest:	10 % (40 000 m ³ /a)	
Wood cost:	Public forest:	32 USD/m ³ (1994)	Same cost for all species
	Private forest:	41 USD/m ³ (1994)	

5.4.2 Purchased pulp

Table 1. Purchased pulp to the Mill

Pulp type	Price	Amount	Brightness
	USD/MT	(Budget 1995) MT	% ISO
BCTMP	600	3 900	
Kraft	770	20 300	88-90

5.4.3 Other Raw Materials

Table 2. Other raw materials to the Mill

Raw material	Price	Amount
	USD/MT	(Budget 1995) MT
Old newspaper/old magazine (ONP/OMG)	130	56 000

5.5 Paper Mill

5.5.1 Machines of the Paper Mill

The paper grades that the Mill is producing are presented by paper machine in Table 3. The detailed concept of the paper machines is in Table 4 on the next page.

Table 3. The Mill's paper grades

	PM1	PM2	PM3
Grades	Directory (White/Yellow)	Directory (White/Yellow)	Newsprint
Grammage, g/m²	29.3-40.0	32.6-51.8	45.0-51.8
Fibre	Kraft, low freeness groundwood, deinked waste	Kraft, low freeness groundwood, deinked waste	High-yield sulphite, standard groundwood, deinked waste

Finishing: One Lamb low-profile wrapping machine. Can wrap up to 2.4 m wide and 1.3 m diameter rolls.

Capacity : 2000 rolls/day.

Table 4. The Mill's concept and main data

	PM1	PM2	PM3
Builder	Beloit Corp.	Beloit Corp.	Dominion Eng.
Start-up	1926	1926	1967
Rebuilt	1965, 1986 (conversion from newsprint to directory)	1965, 1987/89 (conversion from newsprint to directory)	1985, 1988
Production concept	Twin wire	Twin wire	Twin wire
Wire/trim, mm	6100/5650	6100/5650	8380/7695
Speed, m/min	610	610	915
Capacity, t/a	58 000	58 000	140 000
Forming method	Fourdrinier + Top Flyte former	Fourdrinier + Top Flyte former	Fourdrinier + Bel- form former
Headbox	Black Clawson, 1984	Black Clawson, 1984	Valmet, 1988
Top former	Black Clawson, Top Flyte, 1986	Black Clawson, Top Flyte, 1987	Beloit, Bel-form, 1985
Presses	1st/2nd Bi-Nip, Valmet, 3rd Valmet, 1986	1st/2nd Bi-Nip, Valmet, 3rd Valmet, 1987	1st/2nd/3rd straight through presses, Dominion
Drying method	Multicylinder	Multicylinder	Multicylinder
Dryers	3 sections Open hood Old gear system	3 sections Open hood Old gear system	4 sections Closed hood New closed gear system, breaker stack
Calenders	3 nips/4 rolls Old stacks Rebuilt 1986	3 nips/4 rolls Old stack	2 stacks x 3 nips
Winder	Beloit soft nip winder, 1995	Old Beloit winder, rebuilt end 1995	Old Dominion winder

5.5.2 Condition of the Paper Machines

Capital has been spent on wet end rebuilds in PM1 and PM2, but the implementation has been left "half way" on both PMs. Headbox, wire and press section have been dimensioned for low speed, 600-700 m/min. A significant speed-up would require new investment in wet end, press section and machine foundations. The machines have least limitations at lower speeds and higher basis weights. The future use of TMP makes the directory business viable.

The production and efficiency of PM3 are limited by the present configuration. Press section, open draws and winder are bottlenecks to production. There are no layout and technical limitations for future rebuilds. The future use of TMP will improve the quality level of newsprint. Low brightness will limit the natural product development for a medium size machine to improved new grades. The total efficiency of PM3 is about 88 % and can be rated as "fair".

5.5.3 Manufactured Paper Grades

PM1 produces both white and yellow directory paper in grammages 29.3, 32.6, 36.6 and 40.0 g/m². PM2 produces the same paper in grammages 32.6, 36.6, 40.0, 41.5 and 51.8 g/m².

PM3 is a newsprint machine and grammages are 45.0, 48.8 and 51.8 g/m².

Latest product development for PM2 and PM3 is higher bright offset paper, which is produced in grammage 51.8 g/m². The brightness of the paper is 65 % ISO.

The Mill also produces a 10 % recycled content white and yellow directory sheet and it is committed to meet the Yellow Pages Publishers' Association (YPPA) recycled content guidelines. Up to 12 % recycled content newsprint can be produced on limited volumes.

In North America YPPA has developed a voluntary environmental action programme which establishes recycled content goals for phone books and addresses the issue of recyclability. The plan recommends that YPPA publishers use 10 % recycled paper by 1993, 25 % by 1995 and 40 % by 1998 on an aggregate basis /19/.

5.6 Transport Facilities

Transport of the Mill's papers to customers and warehouses are handled by trains, trucks and ships. In 1994 about 47 % of the transports was made by trucks, 35 % by trains and 18 % by ships.

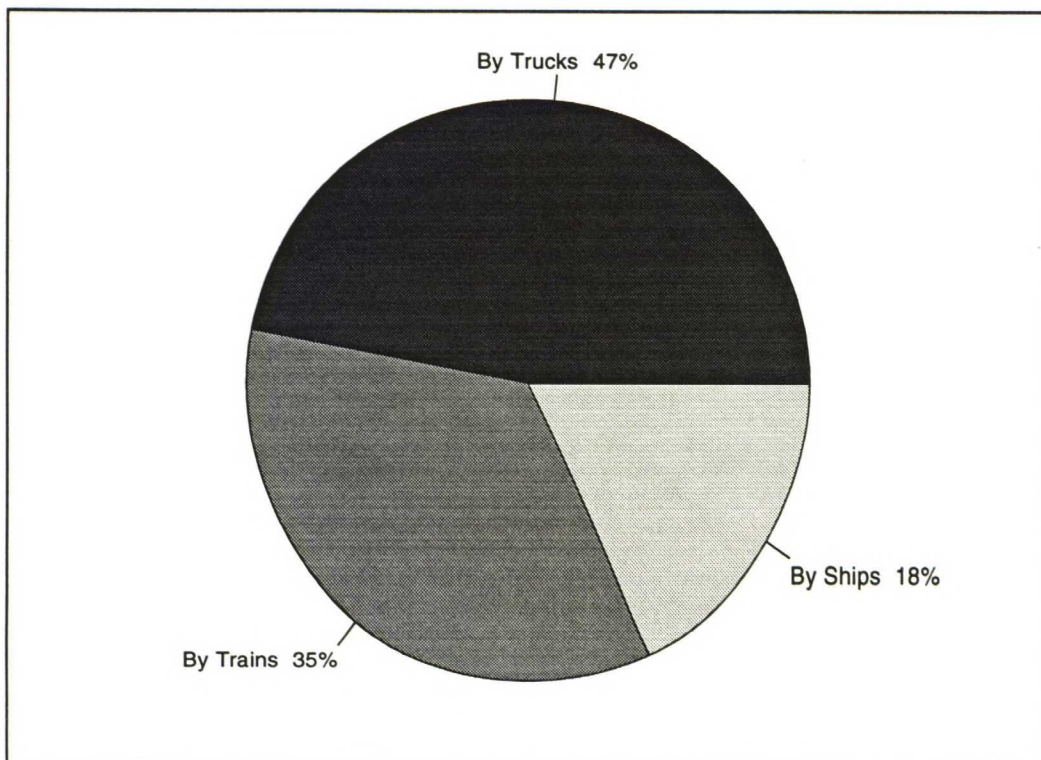


Figure 11. Transport from the Mill in 1994

5.7 Markets

Over 90 % of directory paper production is sold to North America and 75 % of it to the USA. The rest of the directory paper is sold mainly to Europe. Of newsprint production some 70 % is sold to North America and 80 % of it to the USA, the rest of it to Europe. See Figure 12.

Customers of the Mill are for instance the Regional Bell Operating Companies (RBOCs), independent directory publishers, commercial printers and newspaper publishers.

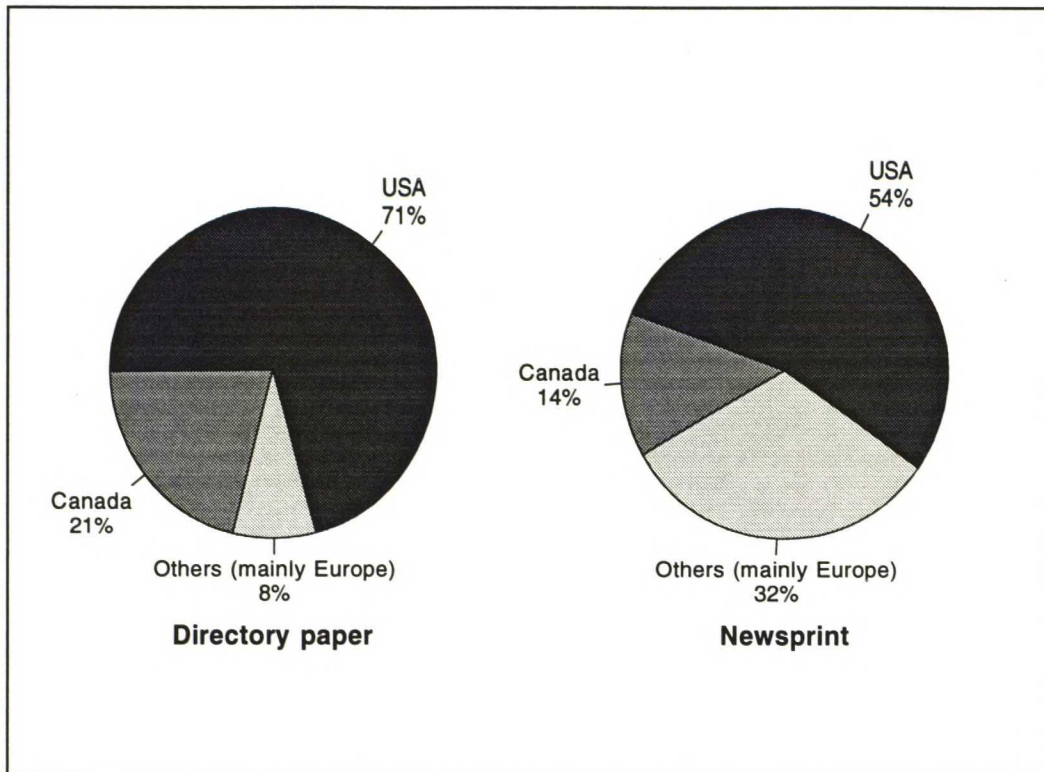


Figure 12. Sales of the Mill in 1994

6 ANALYSIS OF OPPORTUNITIES AND OBSTACLES

6.1 Strengths and Weaknesses

6.1.1 General

Productivity and cost structure of the Mill are quite low.

Natural gas and purchased electricity prices in the Mills region are competitive compared with other North American regions. Regional softwood (roundwood and chips) costs are higher in this region. US No. 2 clay prices are higher than in US South due to additional freight. Oil prices are also higher than in most regions.

The workforce is an important strength of the Mill. The Mill has extraordinarily flexible working arrangements which are rare in North America. This is the result of a long-term development of the relationship with the union.

The Mill uses hydro power which is a cheap way of producing electricity.

6.1.2 Pulping System

At the Mill's existing old-fashioned pulping system will be closed when the new TMP plant is ready by the end of 1996. TMP fits the future product strategy; newsprint/directory paper versus higher value-added products. The Mill's freeness level is good which makes savings in kraft use. The fibre quality is also good.

6.1.3 Paper Machines

There are no layout limitations for production increases at the Mill.

The width of PM3 is relatively good (wire 8380 mm). PM1 and PM2 are quite narrow (wire 6100 mm for both machines) and they are very old. When producing light weights the speed and width of the PM1 and PM2 are insufficient. PM3 which produces newsprint is in a middle position.

6.1.4 Markets

The Mill's current market position in directory paper and newsprint is good. The main market for both grades is the USA. Directory paper is sold mainly in North America. About one third of the newsprint production is sold to Europe.

6.2 Potential Products

Potential products for the Mill are coated and uncoated mechanical papers. Paper grades which include much chemical pulp are not suitable products for the Mill, because then it would have to rely on purchased kraft pulp.

<i>Potential products:</i>	Directory paper	SC-A
	Newsprint	SC-A+
	Hi Brite news	MFC (Machine finished coated)
	Premium Hi Brite	FCP (Film coated)
	Standard book paper	LWC (Coated #5)
	Grwd forms bond	ULWC
	SC-C	MWC/HWC
	SC-B	Wallpaper base

The grade definitions of the potential products for the mill are in Appendix 2.

6.2.1 Elimination of Potential Products

A product has been eliminated if the market size of the product is small and the present supply satisfies the markets. The market size and its growth for different paper grades are presented in Appendix 3.

Eliminated products:

Groundwood forms bond has not enough value added. The market size is small, about 300 000 t/a, and it is decreasing.

The situation is same for *Standard book paper*. The market size is 200 000 t/a and not growing.

SC-C has a low price premium over newsprint. Growth in the market size is low and the current supply satisfies the markets. The investment is too high compared to the price premium.

SC-B has also low price premium over newsprint. Growth in the market size is low. Insert market will remain the main end use sector where the Company already has good market position.

MFC's market size is small, about 100 000 t/a. Niche market is supplied by current producers.

LWC has large markets, 5 million t/a, but the Mill's machines are small compared with the competitors' machines, whose capacities are 350 000 - 400 000 t/a. The investment costs are high.

Wallpaper base production needs lot of product development and time. The smallness of market, 80 000 t/a, causes the need for very strong marketing effort.

6.2.2 Strengths and Weaknesses of Potential Products

The following products were chosen for further examination:

Chosen products:

- Directory paper
- Newsprint
- Hi-Brite news
- SC-A+
- SC-A
- FCP (Film coated)
- ULWC
- MWC/HWC

The strengths (+) and weaknesses (-) for the chosen products at this point of the strategy making are presented below:

Directory paper:

- + Current market position and knowledge
- + Production know-how
- + Cost position when the TMP plant is ready
- + Availability of recycled fibre
- + Two machines make the production flexible
- + Market size
- + Decreasing competition
- Size of the machines

Hi-Brite (78):

- + Low investment alternative
- + Current price premium
- Market risk
- Viability during next recession
- Competition from standard newsprint

- SC-A+:*
- + Potential in roto printing market and Sunday magazines
 - + Current customer base
 - Competition with the Company's other mill
 - High investment cost
 - Reliance on purchased kraft in current and long-term production
- FCP:*
- + Market size and growth
 - + Current customer base
 - + "Business logic"
 - + PM3 scale is competitive
 - + New TMP line
 - + Lower kraft content than in blade coater
 - High investment alternative
 - PM1 and PM2 scales are below average
 - Reliance on purchased kraft
- ULWC:*
- + Market size
 - + Market growth
 - + Fibre quality
 - Product development
 - Size of machines
 - Competition from large machines in the future
 - Current speed limiting production of lower basis weights
- MWC/HWC:*
- + Market size
 - Market growth
 - High investment cost for relatively small machines
 - Competition from low cost Southern producers

6.3 Market Opportunities for the Suggested Grades

6.3.1 Directory

The market for uncoated groundwood directory paper is about 800 000 tons. The growth of the market is relatively good, over 2 %/a by the year 2000. Prices are expected to increase considerably.

6.3.2 High Brite News

The market for high brite news is about 1.2 million tons with minimal growth expectations. The market is forecast to grow slowly, namely about 0.5 to 1.0 %/a by the year 2000. Main end use sectors are inserts, flyers, supplements and comic books. The grade definitions are in Appendix 2.

As the quality of standard newsprint has been gradually improved, the high brite news producers with old, less efficient machines have been under the greatest pressure. The hardest pressure comes from the standard newsprint, soft-nipped newsprint and SC grades. A lot of the mills that have been producing this grade have been pulled out of the market. Main current producers include newsprint producers like Stone Consolidated, MacMillan Bloedel, Boise Cascade and Fletcher Challenge.

The prices of high brite news have been most depressed especially in commercial printing sector, where these papers have been sold below newsprint prices.

6.3.3 Premium High Brite (78)

The premium high brite market is very difficult to determine, but the market is estimated at about 30 000 - 50 000 tons. Currently there are no North American producers in this grade.

The primary end uses for premium high brite paper are inserts/flyers, some magazine sections, possibly telephone directories and commercial printing applications. The potential niche markets to be created include also catalogues, free shoppers, and even some book production.

There is a good market opportunity for the Company in this area, if it can differentiate the product clearly from standard and high brite newsprint as well as identify and serve one major or several smaller niche markets and get away from the severe price competition of the commodity standard and related newsprint markets.

6.3.4 SC Papers

The supercalendered (SC) papers are uncoated clay-filled papers produced with high smoothness, opacity and brightness. SC papers are classified in three different sub-grades by filler content, namely SC-A (filler content up to 25 %), SC-B and SC-C grades. To reach the smoothness requirements SC-A grades are calendered with supercalender, for SC-B and SC-C also soft calendering is used. Grade definitions are shown in Appendix 2. The latest development is the SC-A+ grade with filler content up to 35 % and properties not far from LWC. SC-A+ grade is used in magazines and catalogues.

In the North American market the main sub-grade is SC-A, which represents about 80 % of the total SC paper consumption. Main end uses in North America are inserts/flyers, catalogues, magazines and commercial printing. In Western Europe the main end use is magazines.

The SC paper production was 1.3 million tons in North America in 1994. About 1.0 million tons were SC-A and SC-B grades and about 300 000 tons SC-C grade. All paper was delivered to the North American market.

The SC paper imports from Europe were 570 000 tons representing about one third of the North American consumption. Imports of SC papers consist of traditional SC grades, SC-A and the newly developed SC-A+ grades. The leading importing company is United Paper Mills. Norske Skog is the other major importer. Other companies represent 3 to 7 % of the total imports.

The European imports have increased by about 200 000 tons in the last five years. The main reasons for success of the European companies in the US markets are lack of North American investments in capacity, consistent quality development work done by European producers and aggressive marketing and sales.

The new state-of-the-art machines in North America and in Europe are in a totally different size category than majority of the old machines, which have a width of 6 meters and capacity not more than 150 000 tons. The structure of the SC paper industry is changing slowly and new machines are rare and only few machines are closed. See Figure 13.

The demand of SC-A and SC-B grades is forecast to reach 1.8 million tons by 2000 in North America. The market situation will continue to be very tight since there are no decided capacity additions. The situation is very similar in Europe, which means that the North American shipments from Europe will remain at current level at best or may even decline, if no new capacity is added shortly. See Figures 14 and 15.

The potential market in SC papers for the Company is sizeable if it can take majority of the market growth and/or replace part of the imports. The best market potential and opportunities lie in gravure grades, high quality SC-A and SC-A+ grades. Barriers of entry are high for completely new suppliers and competition is limited to the current producers.

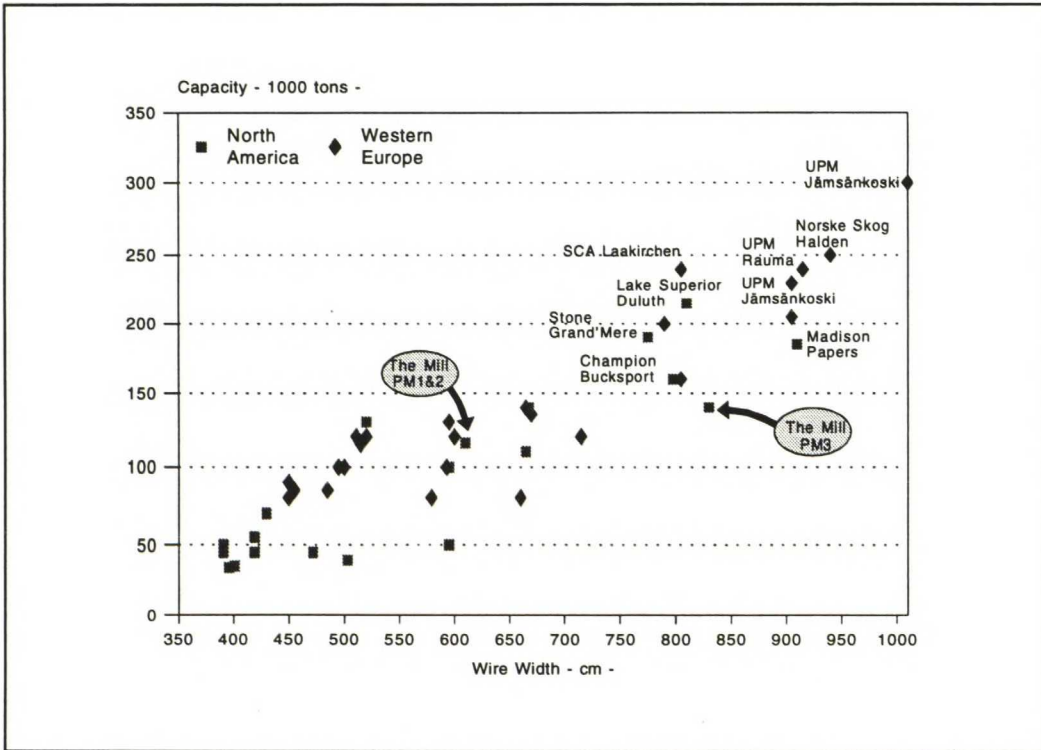


Figure 13. Selected SC paper machines in North America and Western Europe
//

One of the major threats in the long term is stagnating market for SC offset. Market might get too attractive by the volume, growth and price that several companies make simultaneous investment decision and create overcapacity. Also rapid quality development in Europe making SC-A+ the standard grade and increasing the higher quality expectations from the buyers is a major threat.



Figure 14. SC paper supply/demand balance in North America

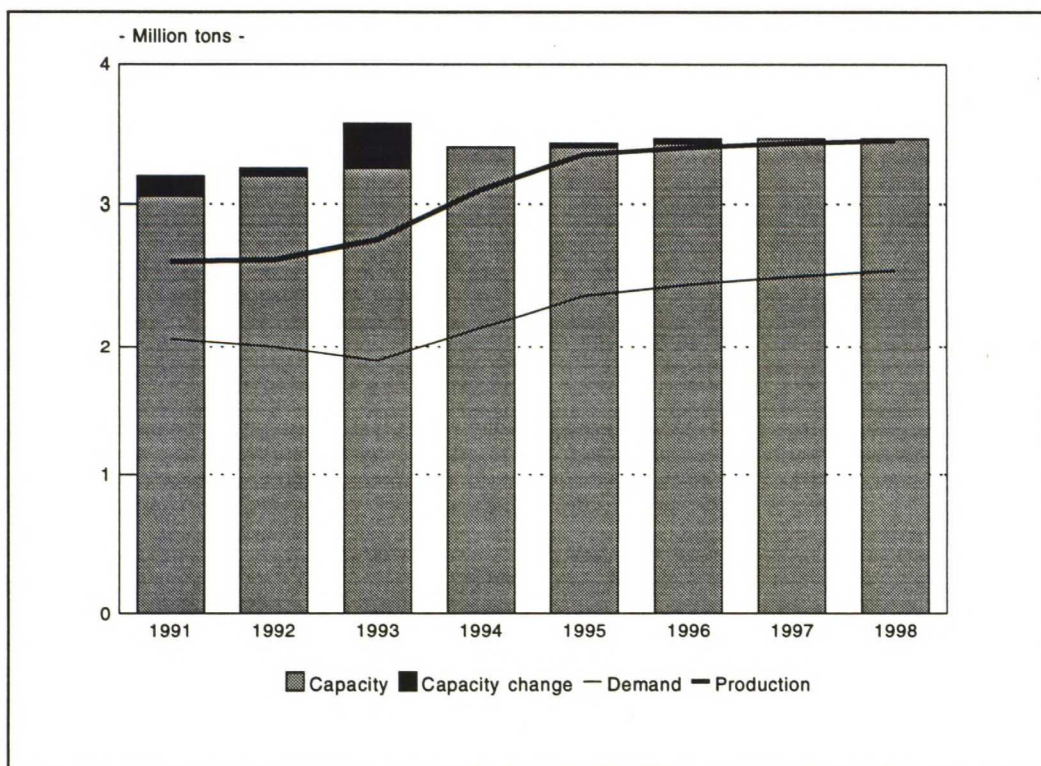


Figure 15. SC paper supply/demand balance in Western Europe

6.3.5 Coated Groundwood Grades

Coated groundwood grades MFC (machine finished coated), LWC (light weight coated), MWC/HWC (medium/high weight coated) and FCP (film coated) papers comprise about 70 % of mechanical pulp, rest is chemical and waste paper pulp. See Appendix 2.

The North American market for coated groundwood paper was 4.95 million tons in 1994. The consumption grew 2 % over the previous year.

About half of the coated groundwood papers are used for printing magazines in North America, in Western Europe the figure is 45 %. Other main end use sectors are mail order catalogues, inserts and flyers and other commercial printing.

Following the tightening of the market situation balance the coated groundwood paper prices have increased rapidly and are expected to increase further as there are no major capacity additions coming on stream until late 1995. No major increase in shipments from Europe can be expected as the market is very tight also in that region. The tight market is open to new product ideas and SC-A and SC-A+ grades have made inroads into the traditional coated groundwood markets like catalogues.

The long-term development of coated groundwood papers in North America is very favourable. By the year 2000 the coated groundwood market is forecast to reach almost 6.0 million tons. The currently known capacity increases are very small compared to the demand growth and the market can easily absorb two to three large-scale new machines in the next five years. See Figure 16

The coated groundwood paper production was 4.6 million tons in North America in 1994. Export outside the region was 170 000 tons and the main markets were in Europe, South America and South East Asia.

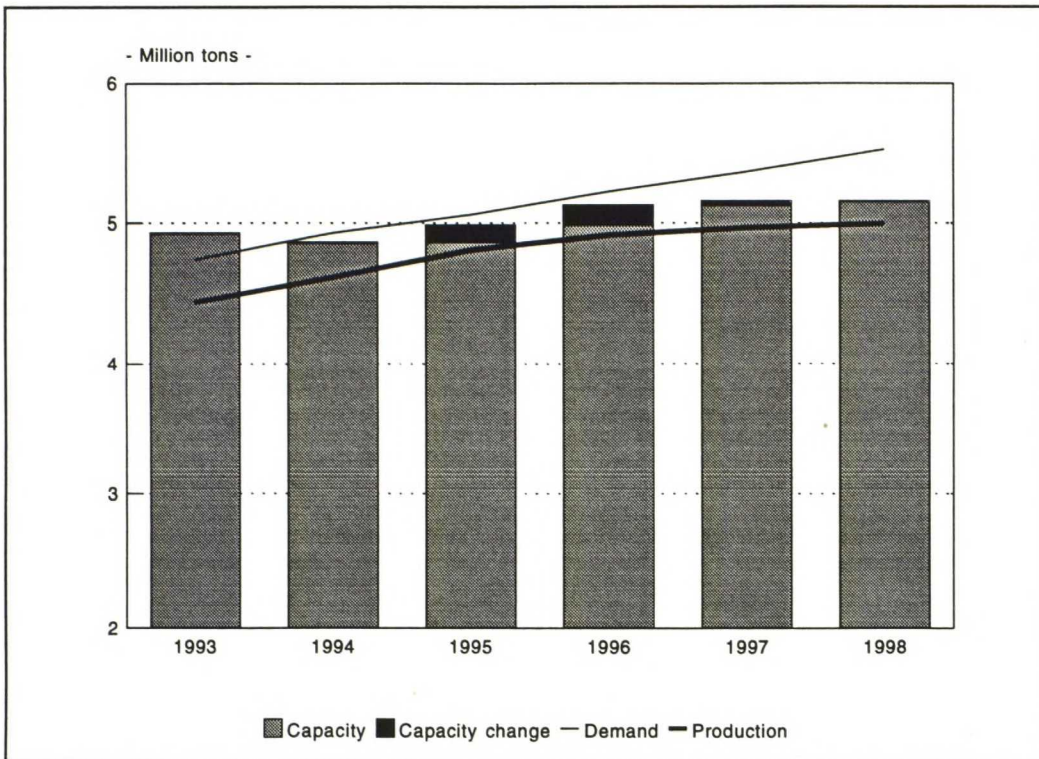


Figure 16. Coated groundwood paper supply/demand balance in North America

Imports of coated groundwood papers from Europe were 445 000 tons in 1994 representing less than 10 % of the North American consumption. The development of imports has been slow, namely about 60 000 tons in five years.

There are still a number of small and narrow machines both in North American and European coated groundwood industry. Many of those have specialised in production of heavier basis weights or slightly mechanical coated grades. The largest machines currently operating are 9-9.5 meters wide and have a capacity of 250 000 tons approaching the 300 000 ton limit. See Figure 17. The new generation of coated groundwood machines will have capacity of 400 000 - 450 000 tons.

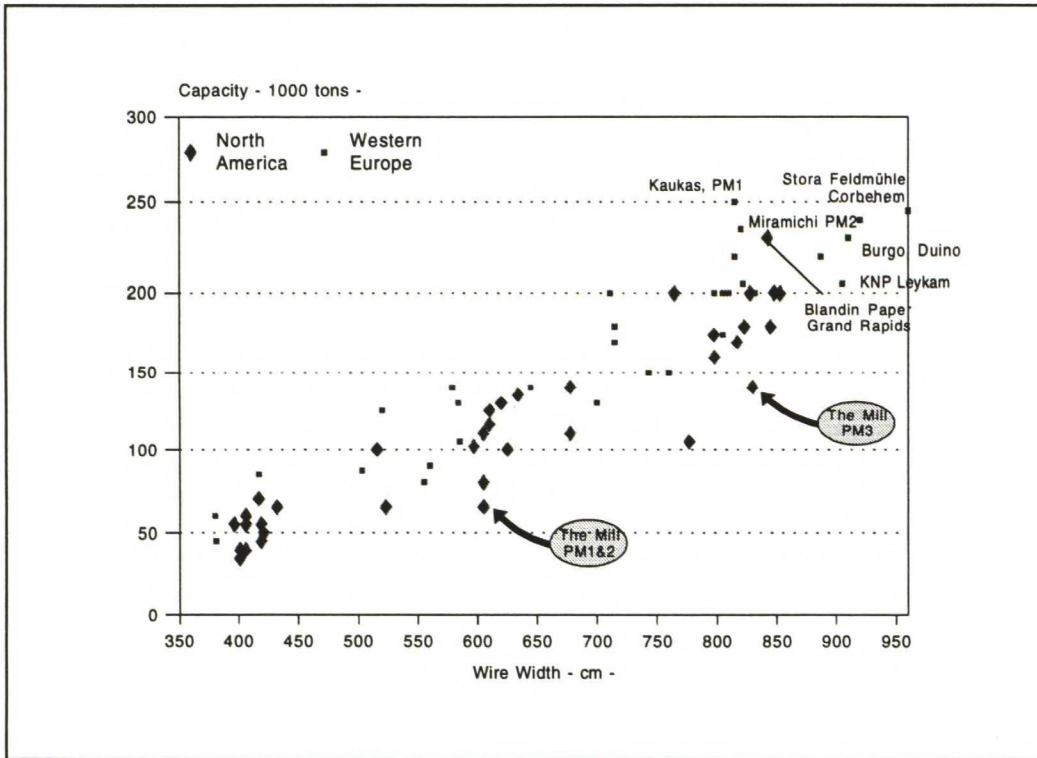
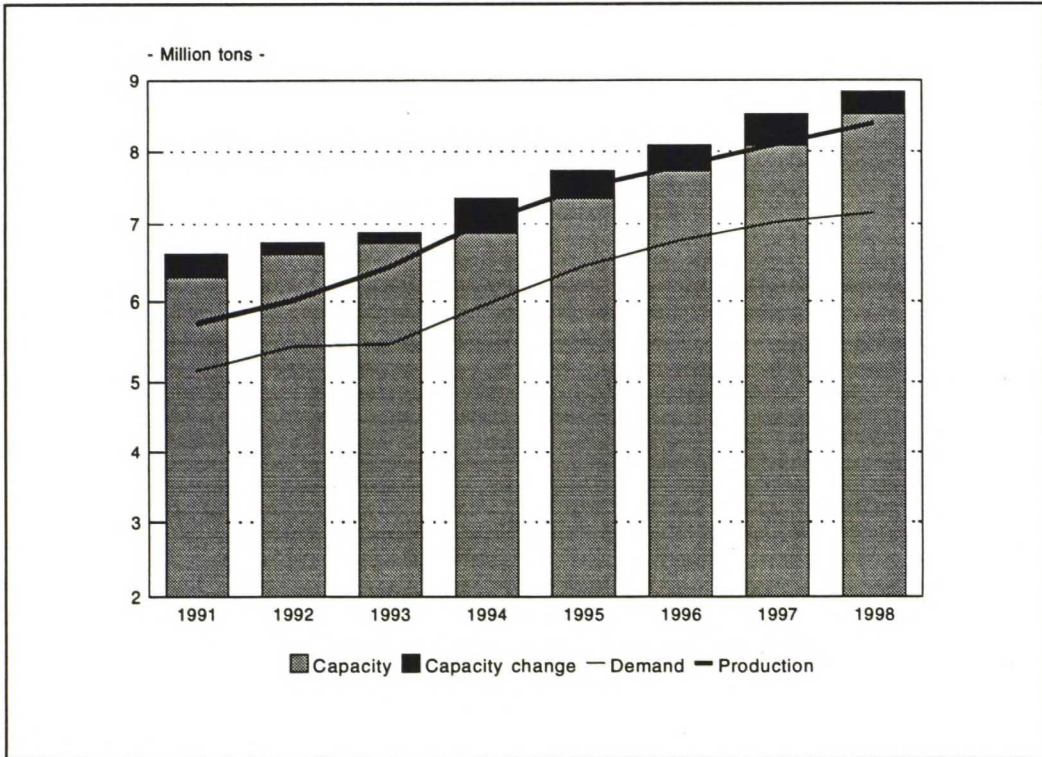


Figure 17. Selected coated groundwood paper machines in North America and Western Europe

The coated groundwood markets are currently in balance, in Western Europe there is shortage of paper. It is very likely that new investments will be announced in the near future (end of 1995 or beginning of 1996), but both markets can tolerate substantial capacity increases. See Figure 18.

For the Company the coated groundwood paper market is a natural choice for forming a wider product line in groundwood papers, especially when the company's vision is to become the finest producer of groundwood papers and it is aiming to grow as a company.

Conversion of prominent machine to coated groundwood papers followed by another conversion shortly and later possibly building a new world scale machine at the best site would make the Company a major supplier of coated groundwood papers in the North American market.



*Figure 18. Coated groundwood paper supply/demand balance in Western Europe
//*

The competitive edge is now in the timing of the decision; a grade conversion will benefit faster as the current shortage and high prices can be exploited.

The market opportunity in the long term is also good. The market is growing rapidly and coated papers will continue to be the main paper grade in magazine market, in printing mail order catalogues, four colour inserts and advertising material.

6.4 Technological Opportunities

6.4.1 Technological Opportunities for FCP

Film coated paper is suitable for offset printing. The paper's suitability for gravure printing has not been examined.

Film coating is easier to handle than blade coating. With blade coater there could be 4 to 6 brakes per day but with film coater only one. Film coating does not set so high requirements for base paper than blade coating.

Film coating is done either with two nips where one side is coated per nip or with one nip where both sides are coated at the same time.

Two-side coating with one nip is easier compared with one side at the time. Although it requires a faster drying method and stronger paper because both sides get wet at the same time. Even paper whose consistence is pure TMP can be coated with a two-nip film coater, but there will be difficulties when printing it with Heat Set offset.

FC method gives a possibility to produce different kinds of paper grades with the same production machinery or with slight modifications. The quality of the base paper is the most important; it can be like newsprint or more like SC paper. The amount and quality of coating is another way of changing the paper properties. Calendering before or after coating with different calenders changes also the properties.

The paper's property concept can be changed by customer's requirements. However, this flexibility can also be a problem. As there is no exact place for FCP among SC and LWC papers, a strong marketing effort to get customers is very important.

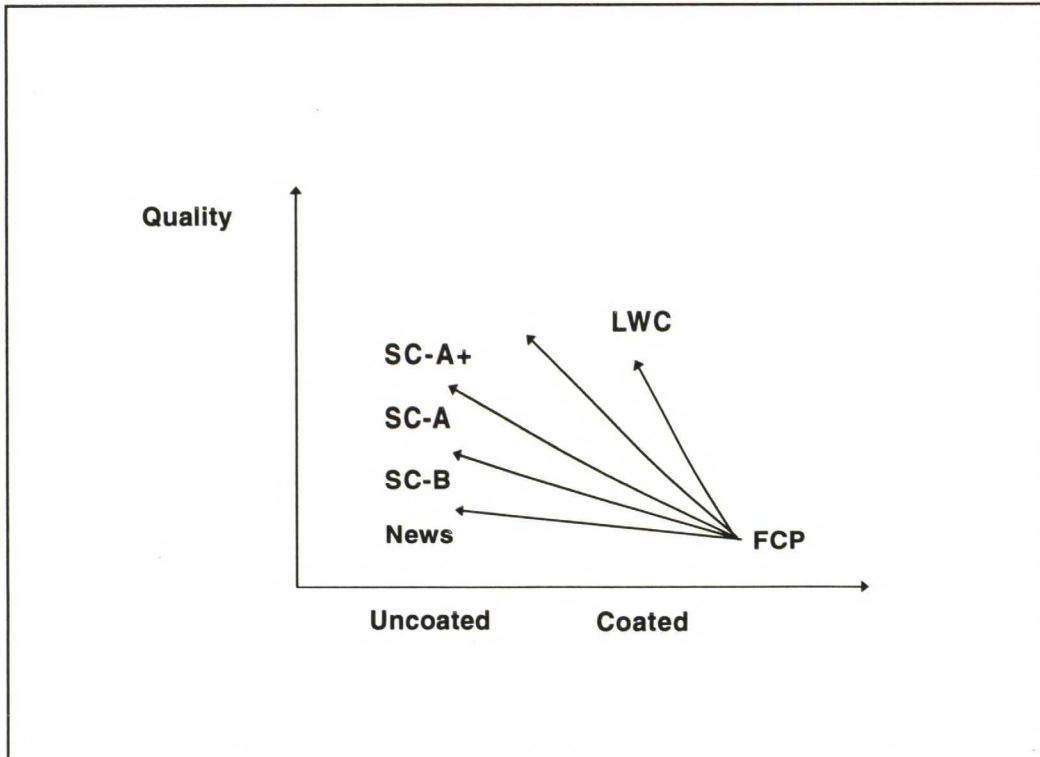


Figure 19. Position of FCP

- Future concepts:
- double coating with FC
 - long nip calendering
 - connected film and blade coating (pre-coating with FC)

6.4.2 Technological Opportunities for SC

High quality SC papers are technically very demanding. To produce top quality grades needs years of developing. When a paper machine is producing SC paper it cannot produce any other paper grades and only the quality can be improved.

In the future the temperatures and pressures of calenders are increasing.

6.5 Different Options

6.5.1 Different Options for PM1 and PM2

The PM1 and PM2 are quite old, narrow and slow machines. It is not very economical to totally rebuild them, so the options are few.

Production options for PM1 and PM2 are to continue to produce directory paper or to move on to produce coated papers like MWC or ULWC with one off-machine coater. The spare grade for ULWC is LWC. Also producing Hi-Brite news is a possibility.

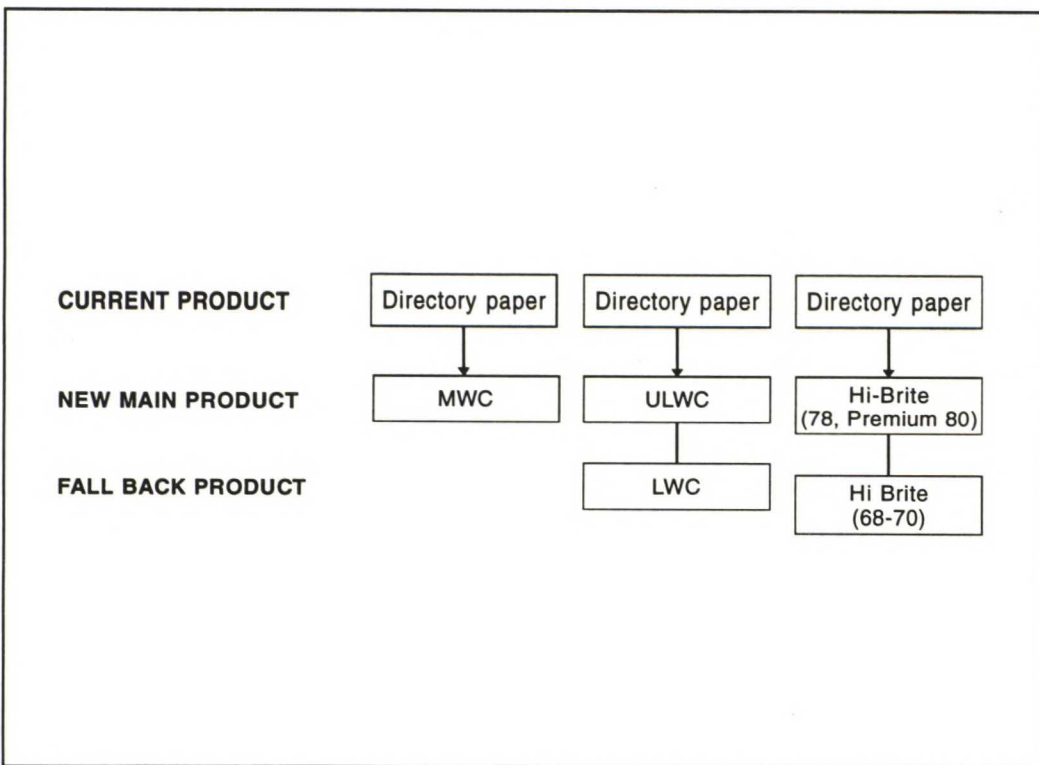


Figure 20. Possible products for PM1 and PM2

If the efficiency of the PMs cannot be improved, one option is to use the machines as pilot machines for the Company's other mills. That would require some rebuilding. If the Company wants to move on for example to producing coated mechanical papers, they can invest in a pilot size press or some other coating machine.

6.5.2 Different Options for PM3

Possible products for PM3 are matt or glossy FCP (film coated paper), SC-A+ and its spare grade SC-A, and also Premium Hi Brite.

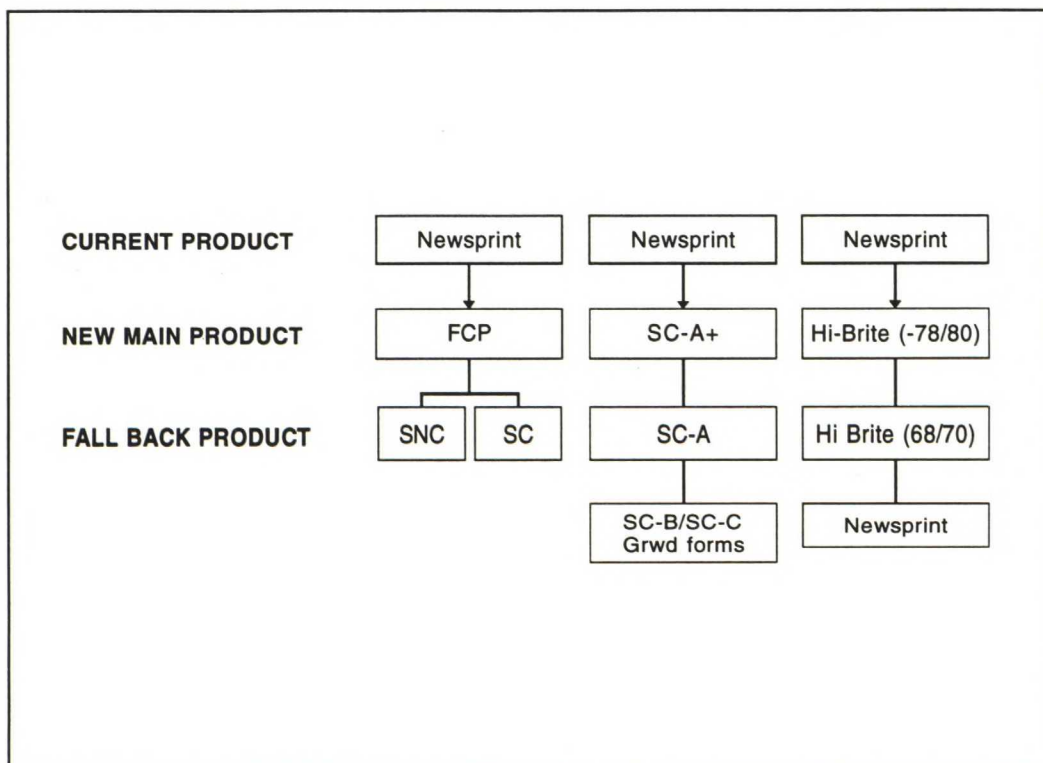


Figure 21. Possible products for PM3

6.6 Technical Concepts for New Products

6.6.1 Technical Requirements for PM3 for SC-A Production

At the first step:

- Low freeness TMP with peroxide bleaching
- New filler dispersing
- PM short circulation
- Rebuilds of wire and press sections
- New supercalenders (3 pieces)
- New single drum winders

At the second step:

- Total PM speed up
- New packaging line
- Roll storage extension

6.6.2 Technical Requirements for PM3 for Matt FCP Production

At the first step:

- PM short circulation
- Rebuild of wire and press sections
- New coated broke system
- New coating colour kitchen
- On-machine coating with soft-nip calendering
- New single drum winders (2 pieces)

At the second step:

- Low freeness TMP with peroxide bleaching
- Total PM speed up
- New packaging line
- Rebuild of roll storage

6.6.3 Technical Requirements for PM3 for LWC (FCP Glossy) Production

At the first step:

- PM short circulation
- Rebuild of wire and press sections
- New coated broke system
- New coating colour kitchen
- On-machine coating
- New supercalenders (2 pieces)
- New single drum winders (2 pieces)

At the second step:

- Low freeness TMP with peroxide bleaching
- Total PM speed up
- New packaging line
- Rebuild of roll storage

6.6.4 Technical Requirements for PM1 & PM2 for Coated Production

At the first step:

- New coating colour kitchen
- Off-machine coating with re-reelers
- New supercalenders (2 pieces)
- New winders (2 pieces)

At the second step:

- Roll conveyors to packaging line

7 COST COMPETITIVE ANALYSIS

Jaakko Pöyry Consulting Oy has made the calculations of the cost competitive analysis.

7.1 Jaakko Pöyry Model for Cost Competitiveness Analysis

The Jaakko Pöyry approach is to model competitiveness on a consistent basis between mills. Proprietary computer models, which are developed by Jaakko Pöyry Consulting, are used in calculations. Sources of input information for the models include Jaakko Pöyry pulp and paper mill databanks. Data is supplemented with information from trade publications, labour contacts, and other publicly available sources. Typically, when estimating cash manufacturing costs, an accuracy level of $\pm 5\%$ to 10% can be achieved for bottom line manufacturing costs without obtaining proprietary information from the mills /1/.

The technical and economic elements are combined to determine line item costs /1/:

- | | |
|---|--|
| <ul style="list-style-type: none"> - Variable costs: * wood * purchased fibre * chemicals * energy * operating supplies | <ul style="list-style-type: none"> - Fixed costs: * labour * maintenance materials * mill overhead |
| <ul style="list-style-type: none"> - Freight costs (selected grades and locations) | |

Key conclusions or discoveries of analyse are directional and not absolute. The conclusions are /1/:

- Cost and size relationship to competitors
- Relative level of cost differences between competitors
- Detailed analysis reveals cost competitive strengths and weaknesses
- Mills/machines that are likely to move out of grade production, either by improved value added or by shutting down
- Potential path for improving competitiveness.

7.1.1 Strategic Capacity Evaluation Methodology

The objective of a Strategic Capacity Evaluation (SCE) is to assess the technological status and the market significance of case mills with competing capacity /1/.

The assessment of the technological status of the case mills is based on an indicator called "apparent age" which is developed by Jaakko Pöyry Consulting. This indicator is based on the correlation between paper machine age and its technological condition /1/.

Mill capacities, as a measure of significance in the market, refer to the current estimated capacity for the selected grade. The capacity estimates are calculated based on trim, speed and assumed dryer limitations. Capacity refers to saleable tonnage prior to any converting operations /1/.

The results of the SCE analysis are presented graphically in a grid based on apparent age and capacity. The SCE grid is divided into four quadrants using the capacity weighted average apparent age and capacity /1/.

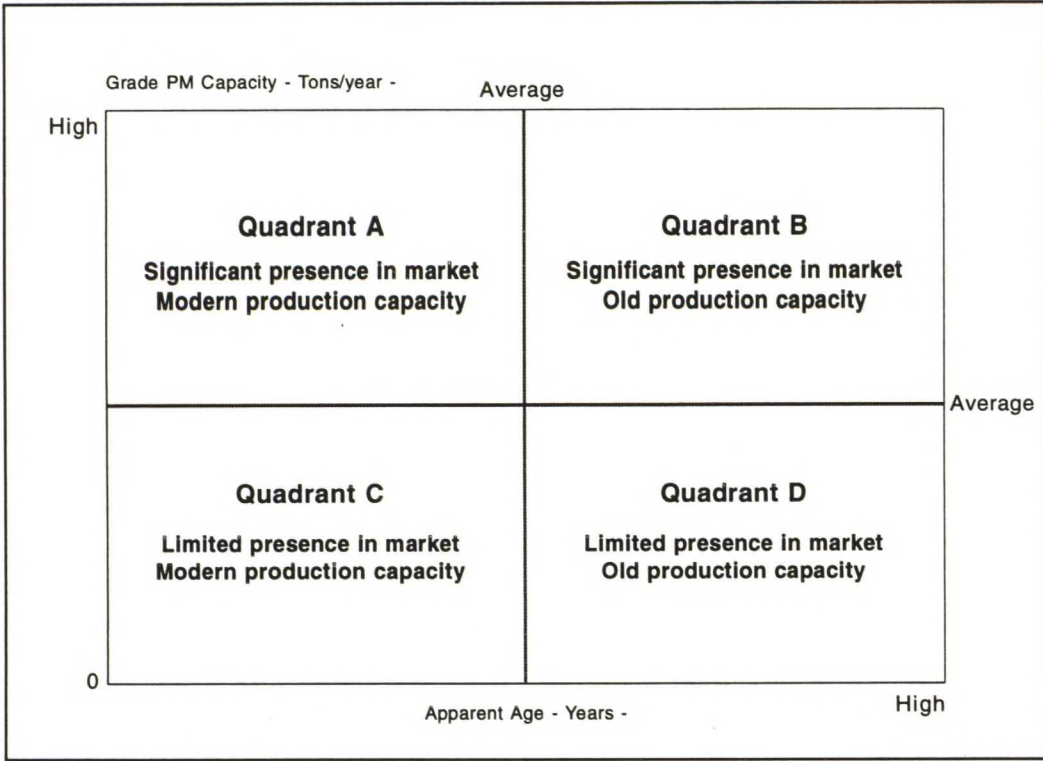


Figure 22. Strategic capacity evaluation - Quadrant explanations //

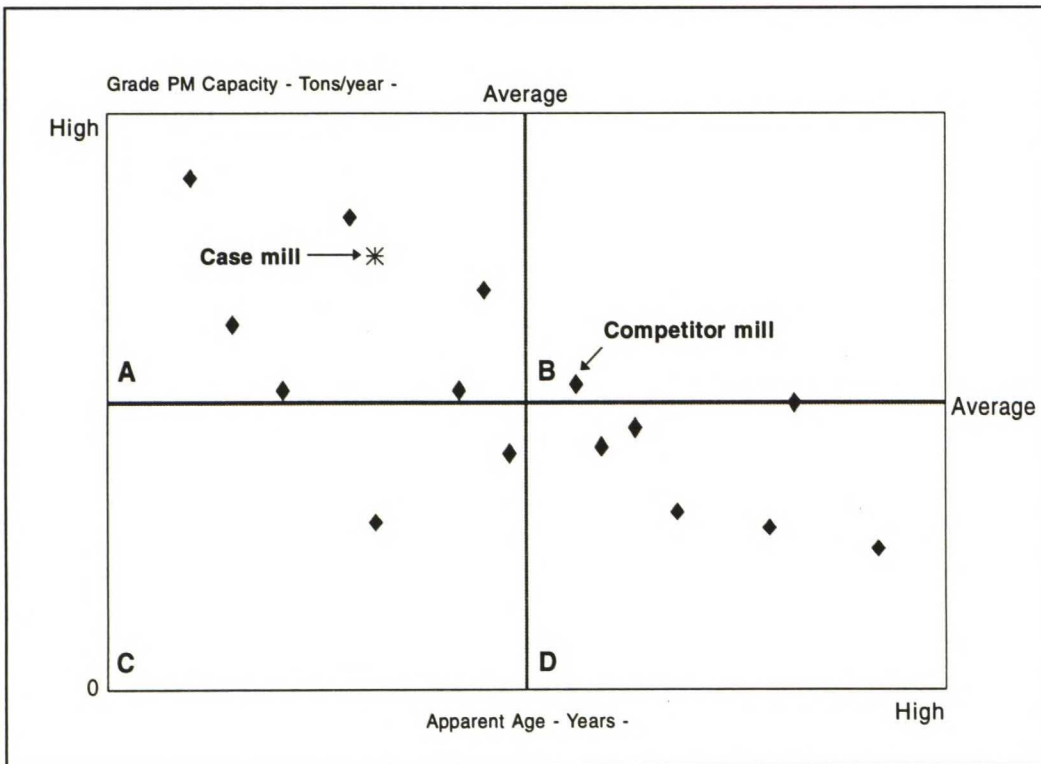


Figure 23. Strategic capacity evaluation - Sample analysis //

Paper mill's apparent age is calculated using the original start-up dates and the timing and nature of rebuilds and modernisations carried out on individual paper machines of a given paper mill. Rebuilds have been classified according to their impact on the paper machine's technical structure as follows /1/:

- Class 1 15 % reduction of apparent age
 - * minor rebuilds of headbox, former, press section, drive or auxiliaries, etc.

- Class 2 30 % reduction of apparent age
 - * major rebuilds of former, press section or drive; partial rebuilds of dryer and coater, etc.

- Class 3 50 % reduction of apparent age
 - * complete rebuilds or replacement of dryer or coater, etc.

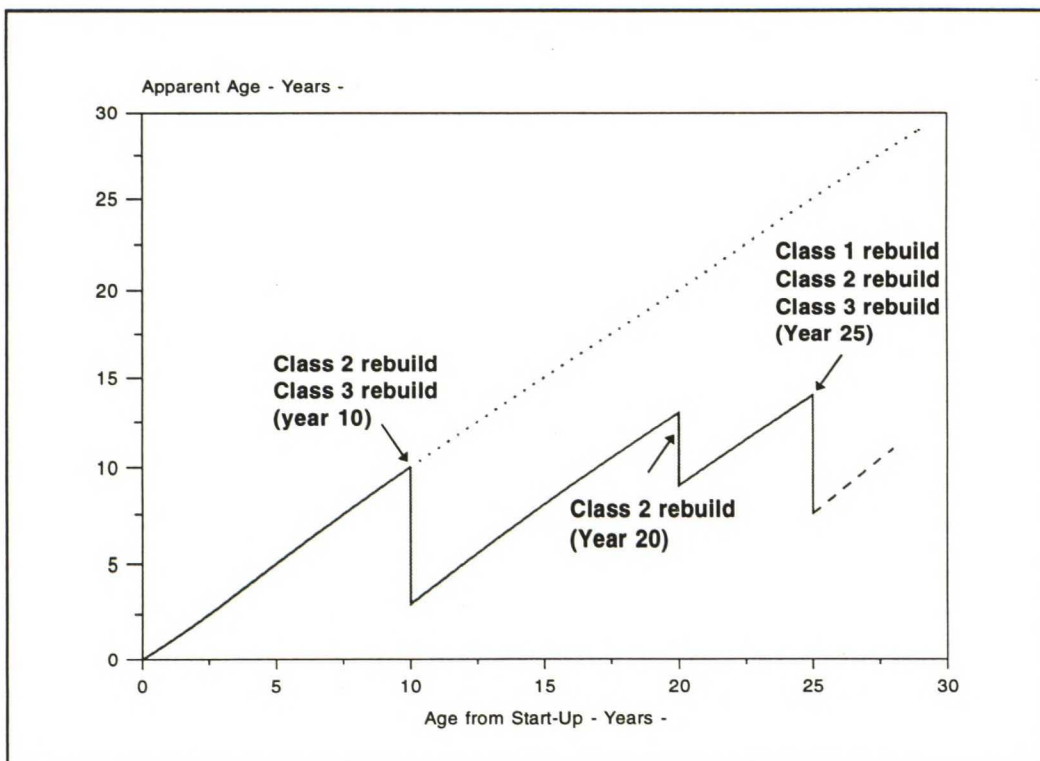


Figure 24. Strategic capacity evaluation - Impact of rebuilds on apparent age /1/

Strategic Capacity Evaluation provides an understanding of the competitive environment /1/:

- Strength and size relationship to competitors
- Relative level of recent investments in grade capacity
- Likely mills to have economy of scale advantages and disadvantages
- Mills/machines that are likely to move out of grade production
- Effect of capital investments
- Potential path for improving competitiveness.

7.1.2 Financial Modelling

Financial modelling is based on Jaakko Pöyry assumptions, developed in collaboration with the Company's mill teams /1/:

- The 1994 production and operating cost level is used as the basis for modelling with TMP factor.
- Pulping and furnish mix are based on expected current and expected operating conditions.
- Product pricing (mill net) is estimated by Jaakko Pöyry Consulting.
- Material and labour unit prices are based on 1994 levels, except for purchased kraft which is set at 640 USD/ton (trend).
- Capital costs have been estimated by Jaakko Pöyry Consulting, based on a general understanding of each mill layout and future requirements.
- Net Present Value (NPV) calculation is based on 10 year non-inflationary cash flows, perpetuity calculation for terminal value, 12 % discount rate, flat real pricing at 1995 levels, inflated at a constant 3 %/year escalation rate.

7.1.3 Cash Manufacturing Costs Versus Cumulative Annual Capacity

Cash manufacturing costs versus cumulative annual capacity in Figures 26, 28, 30, 31, 33 and 34 shows the Mill's cash manufacturing costs compared with other machines in North America, which produce the same paper grade. Every step of the line is one paper machine. The width of the bar is the paper machine's capacity. The cost leader machine is the first step in the first quartile and machines with highest manufacturing costs are in fourth quartile /1/.

7.2 Cost Competitive Position

7.2.1 Cost Competitive Position for Newsprint

Among the North American newsprint producers PM3 represents average producer in terms of apparent age. Its capacity is slightly under the average.

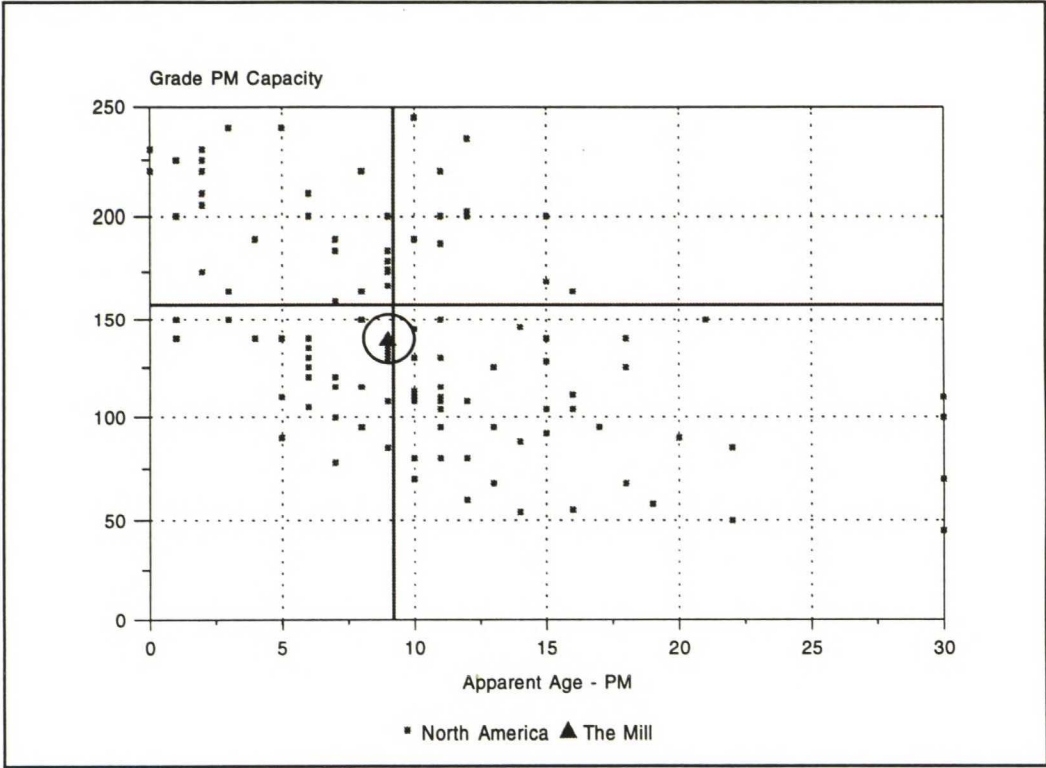


Figure 25. Newsprint - Strategic capacity evaluation - Grade PM capacity versus apparent age for PM3 /1/

In terms of manufacturing costs PM3 falls into the third quartile of North American producers. Its manufacturing costs are about USD 100/t behind the cost leader. The transfer to TMP would improve its cost position significantly shifting it to the first quartile and only about USD 40/t behind the cost leader.

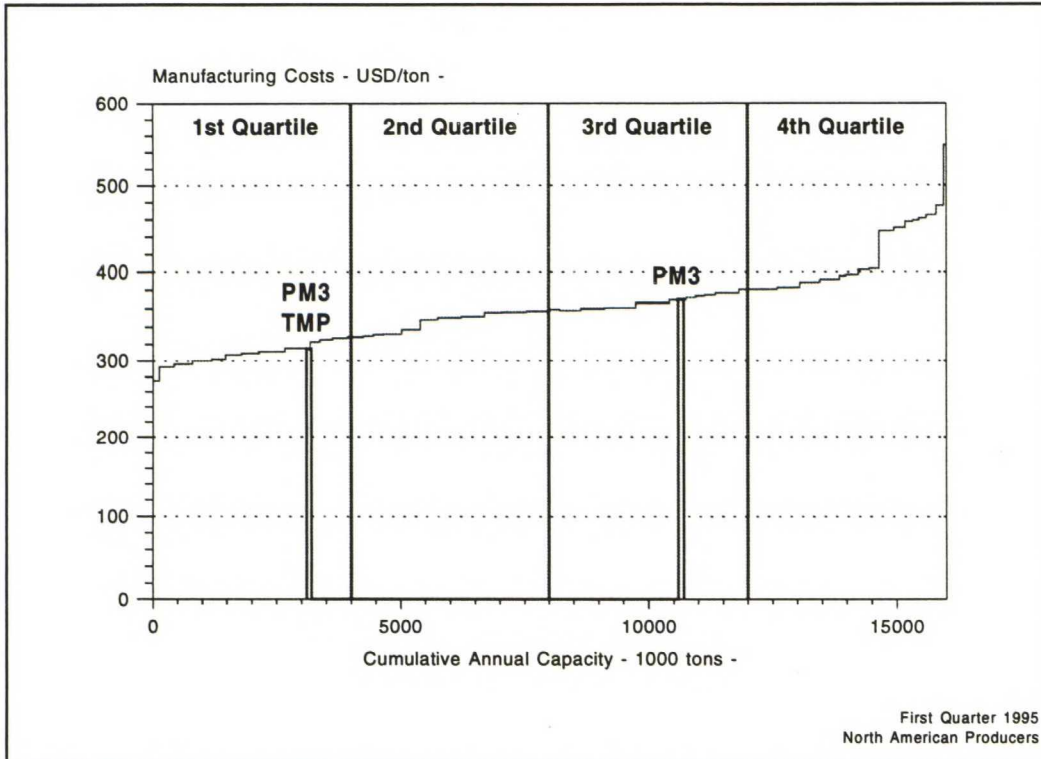


Figure 26. Newsprint - Cash manufacturing costs for PM3 //

7.2.2 Cost Competitive Position for Directory Paper

Both capacity and apparent age of PM1 and PM2 are below average. The machines are small and old. North American producers of directory paper are in average relatively small and technically in poor condition.

At this time the machines are positioned in the fourth quartile in cost comparison, over USD 120/t behind the cost leader. But when the Mill transfers to TMP the machines' position improves to the first quartile, only about USD 20/t behind the cost leader.

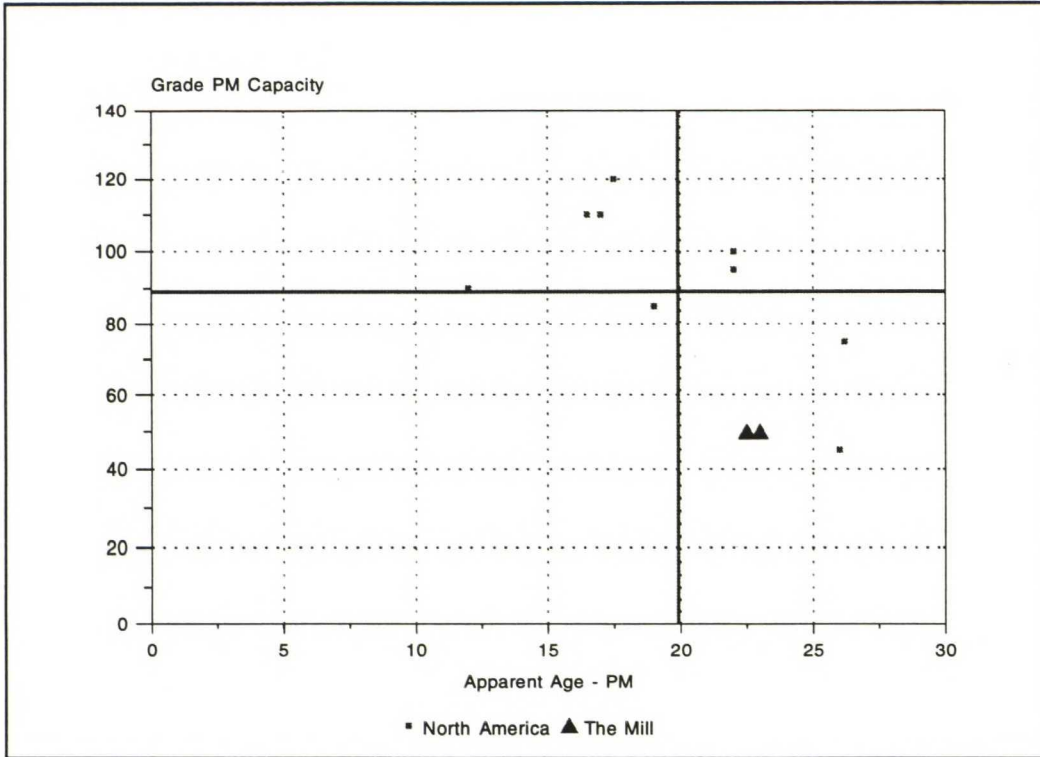


Figure 27. Directory - Strategic capacity evaluation - Grade PM capacity versus apparent age for PM1 & PM2 /1/

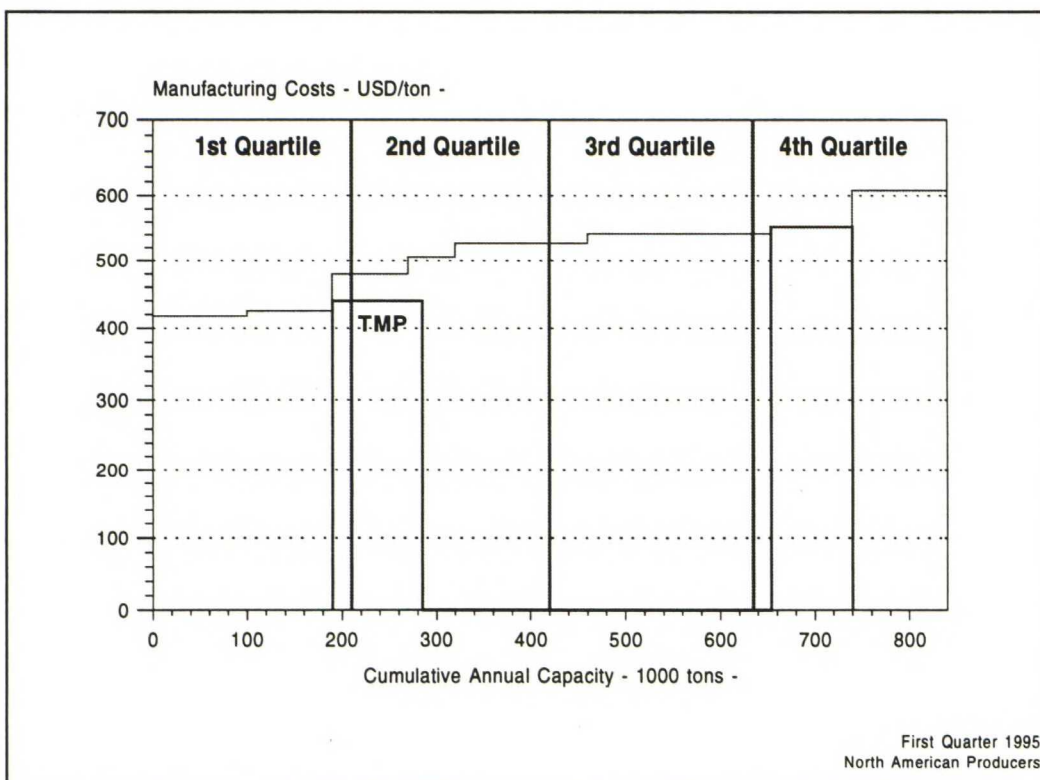


Figure 28. Directory - Cash manufacturing costs for PM1 & PM2 /1/

7.2.3 Cost Competitive Position for Coated Groundwood Paper

Among the coated groundwood paper producers PM3 would be better than average both in capacity and apparent age. PM1 & PM2 would be very small but well maintained. The places of the machines are hypothetical in these figures. The calculations have been made after hypothetical rebuilds.

PM3 could be positioned in the first quartile both in terms of manufacturing costs and delivered costs. Even the small PM1 & PM2 could have a competitive position better than average. In terms of delivered costs the small PMs could be in the first quartile.

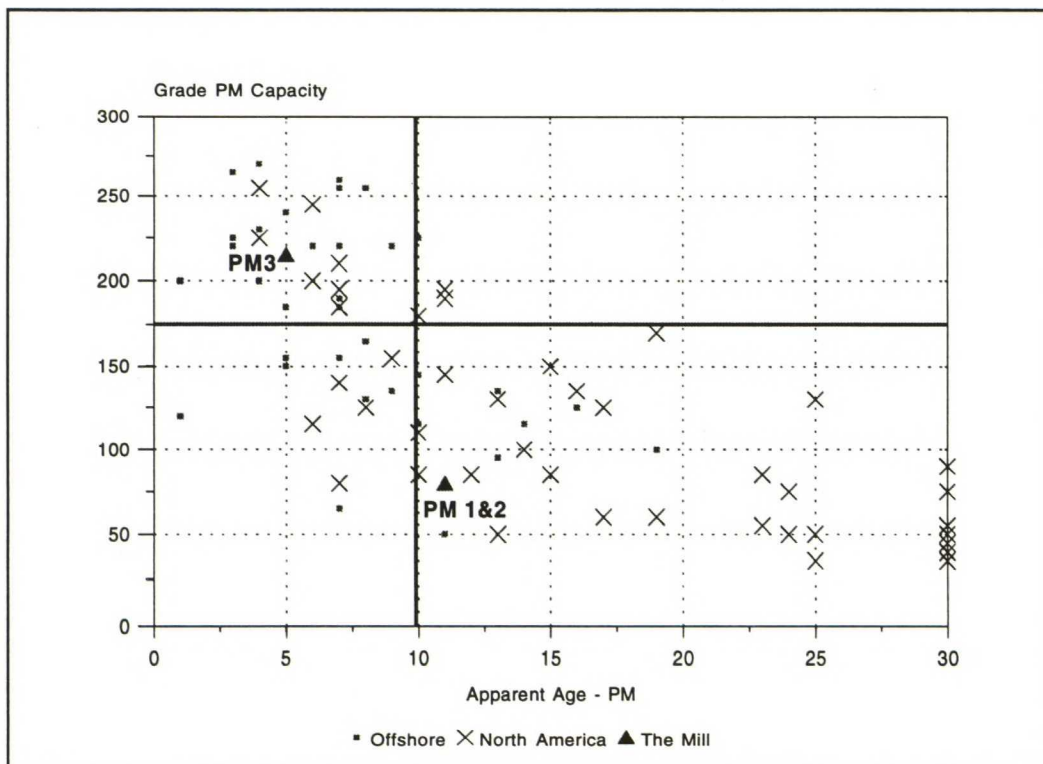


Figure 29. CGW - Strategic capacity evaluation - Grade PM capacity versus apparent age for PM1 & PM2 and PM3 //

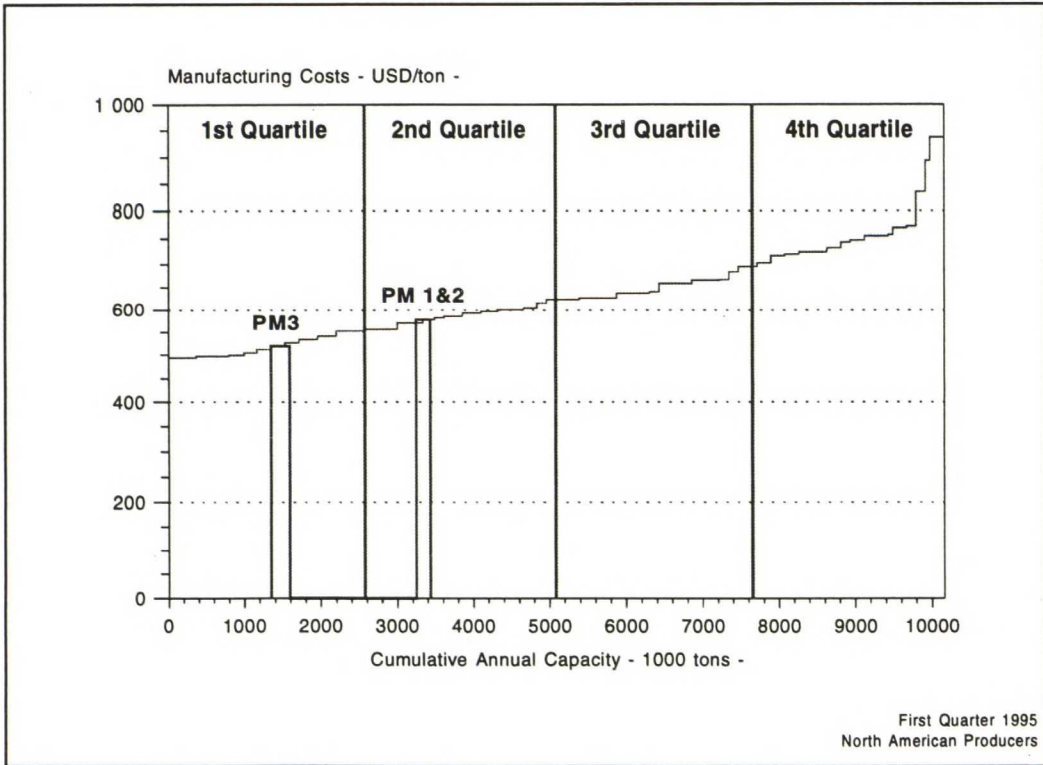


Figure 30. CGW - Cash manufacturing costs for PM1 & PM2 and PM3 //

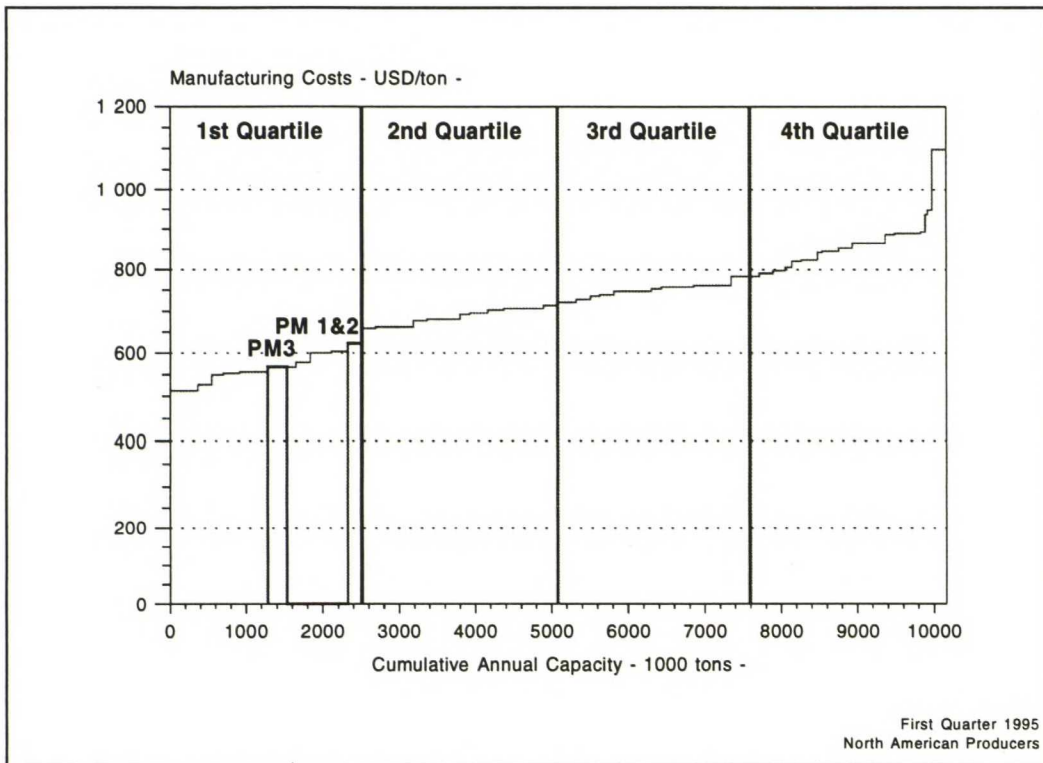


Figure 31. CGW - Cash manufacturing costs for PM1 & PM2 and PM3 -
Delivered to Chicago //

7.2.4 Cost Competitive Position for SC-A

PM3 would have slightly larger capacity and lower apparent age than the average producers of SC-A.

In terms of manufacturing costs PM3 would become the clear cost leader compared to the North American producers. The spread of the following producers would grow even wider if distribution costs to Chicago were taken into account.

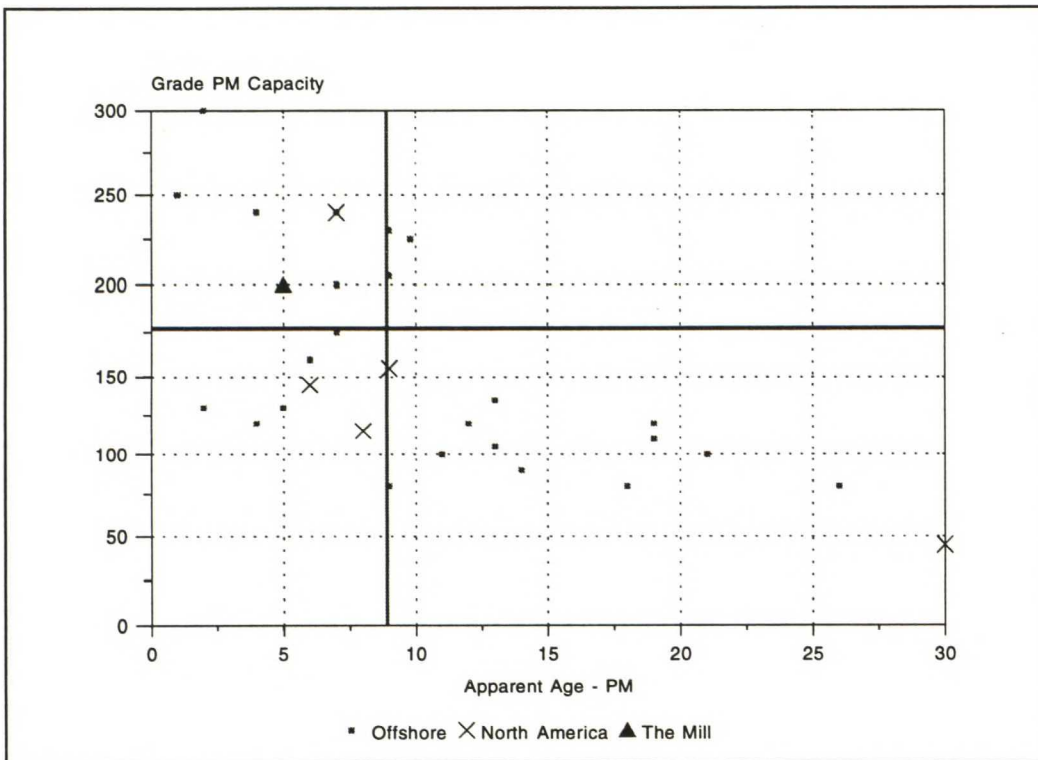


Figure 32. SC-A - Strategic capacity evaluation - Grade PM capacity versus apparent age for PM3 //

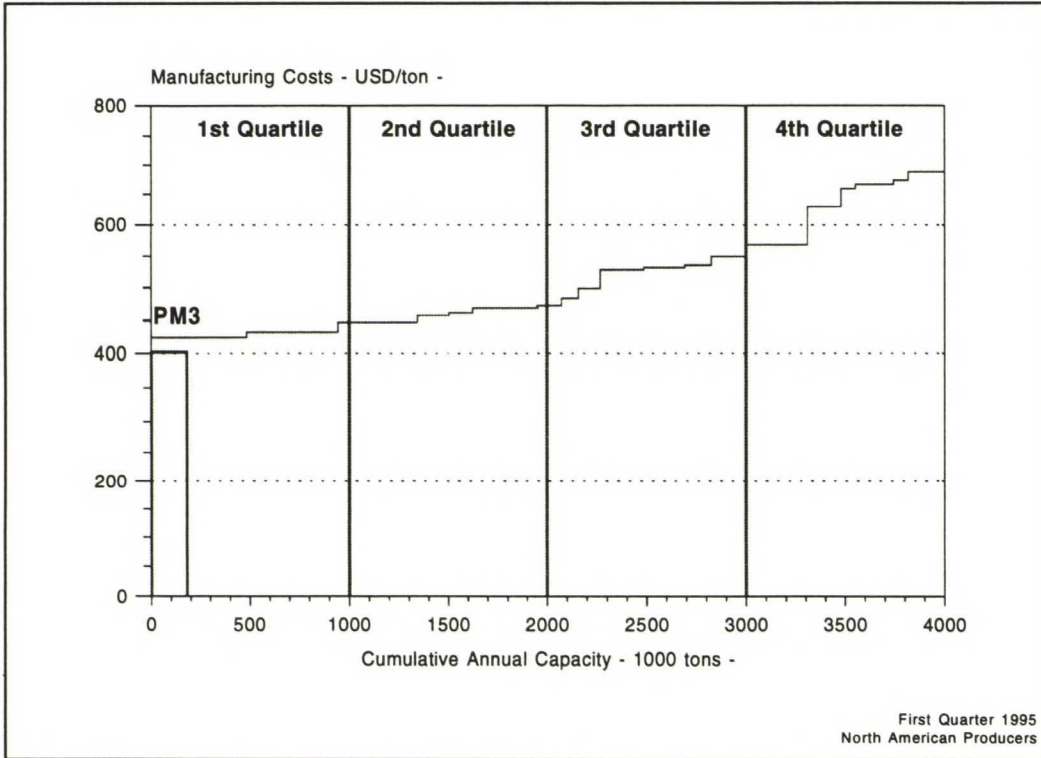


Figure 33. SC-A - Cash manufacturing costs for PM3 //

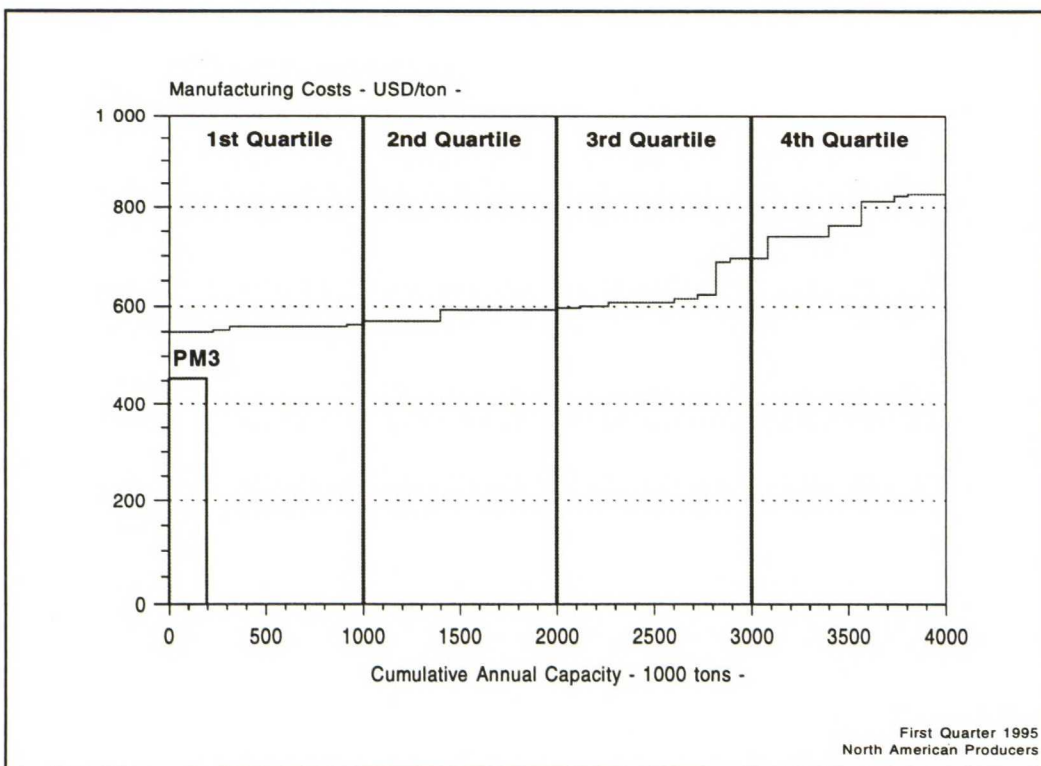


Figure 34. SC-A - Cash manufacturing costs for PM3 - Delivered to Chicago //

7.2.5 Net Change in Mill Net Present Value

Mill net present value (NPV) calculations are based on the present value (1995) of the investment, which is negative, and 10 years' non-inflationary cash flows, which are calculated for pricing at 1995 levels. Then the value of investment and cash flows are combined. If the result, net present value, is positive then the investment is profitable.

For PM3 net change in NPV is best for SC-A, but also coated grades give a quite good change in positive direction. For PM1 & PM2 coated grades give a negative change in NPV and with Hi Brite the change is positive but very small.

In terms of NPV the best grade for PM3 is SC-A and for PM1 & PM2 the present grade, directory paper, is good.

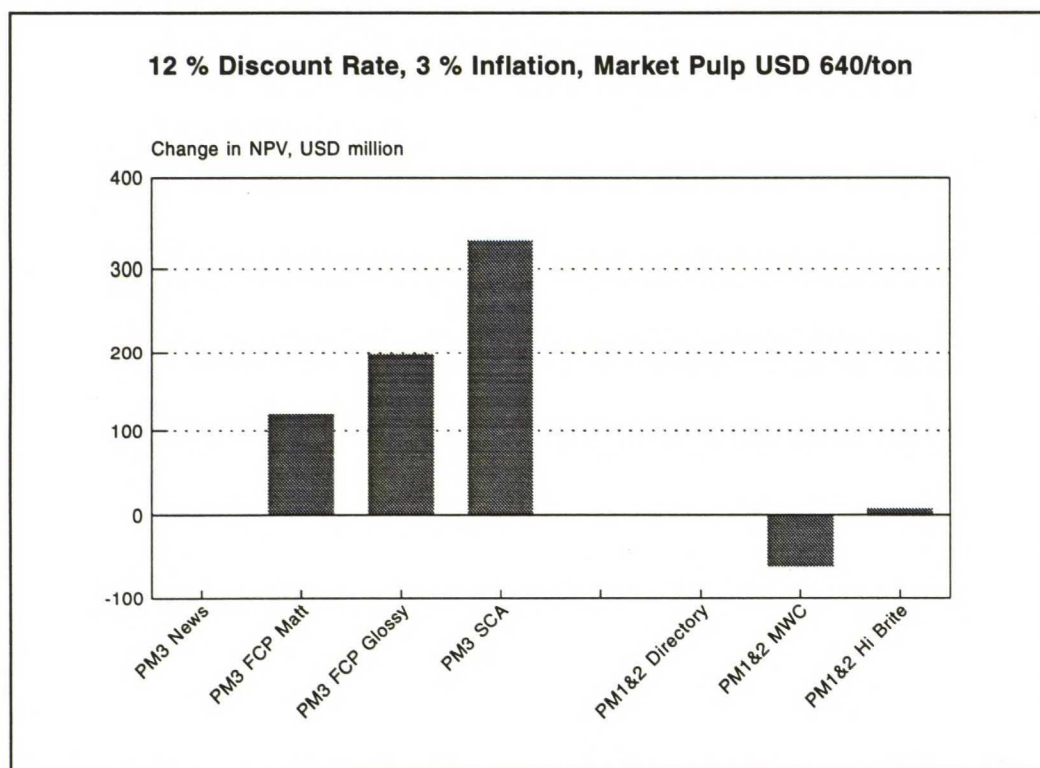


Figure 35. Net change in mill net present value for different grades //

7.2.6 Operating Margin

Operating margin is in principle net sales minus manufacturing costs. In this case it is shown as % of net sales.

For PM3, production of coated and SC-A grades gives better operating margin than newsprint production. The best operating margin is achieved with SC-A production.

For PM1 & PM2, production of coated grades gives smaller operation margin than with directory paper. Hi Brite production increases it a little. These calculations do not encourage any changes in the grades of PM1 & PM2.

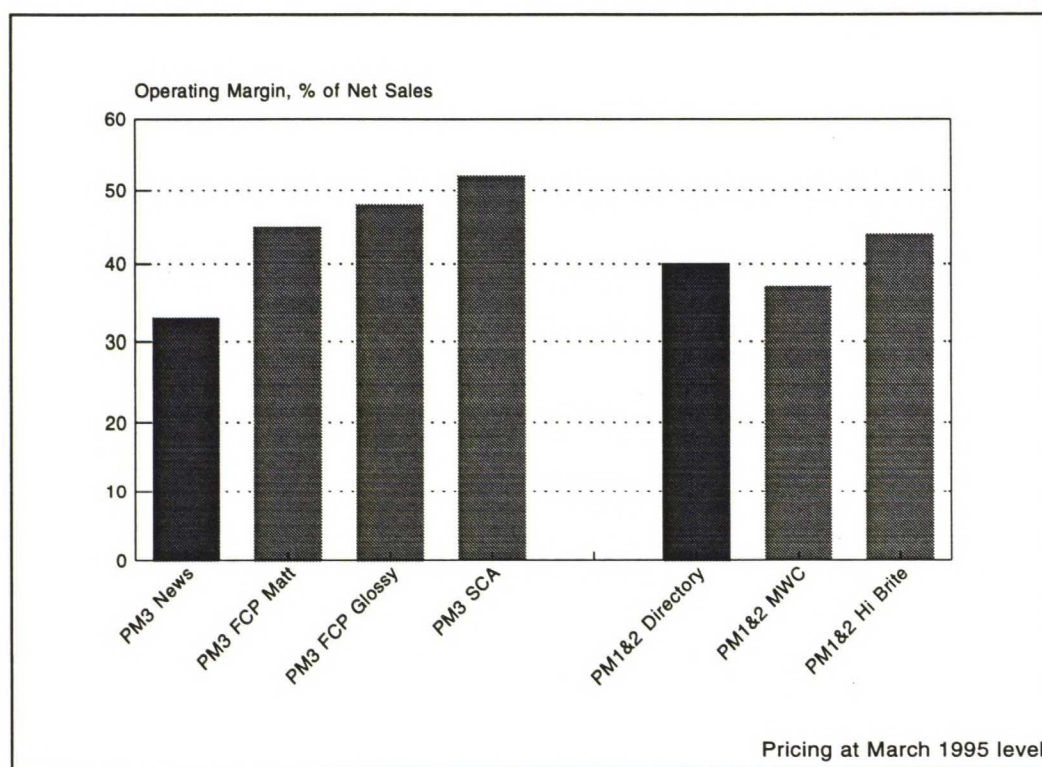


Figure 36. Operating margin for different grades //

7.2.7 Cash Manufacturing Costs

Manufacturing costs do not include the capital costs, only variable, fixed and freight costs.

In terms of cash manufacturing costs the most expensive grades for PM3 are coated grades. The costs of SC-A are about USD 100/t cheaper than for coated ones. Newsprint has the cheapest costs.

For PM1 & PM2 coated grades are most expensive. Hi Brite is a little bit cheaper to produce than directory paper.

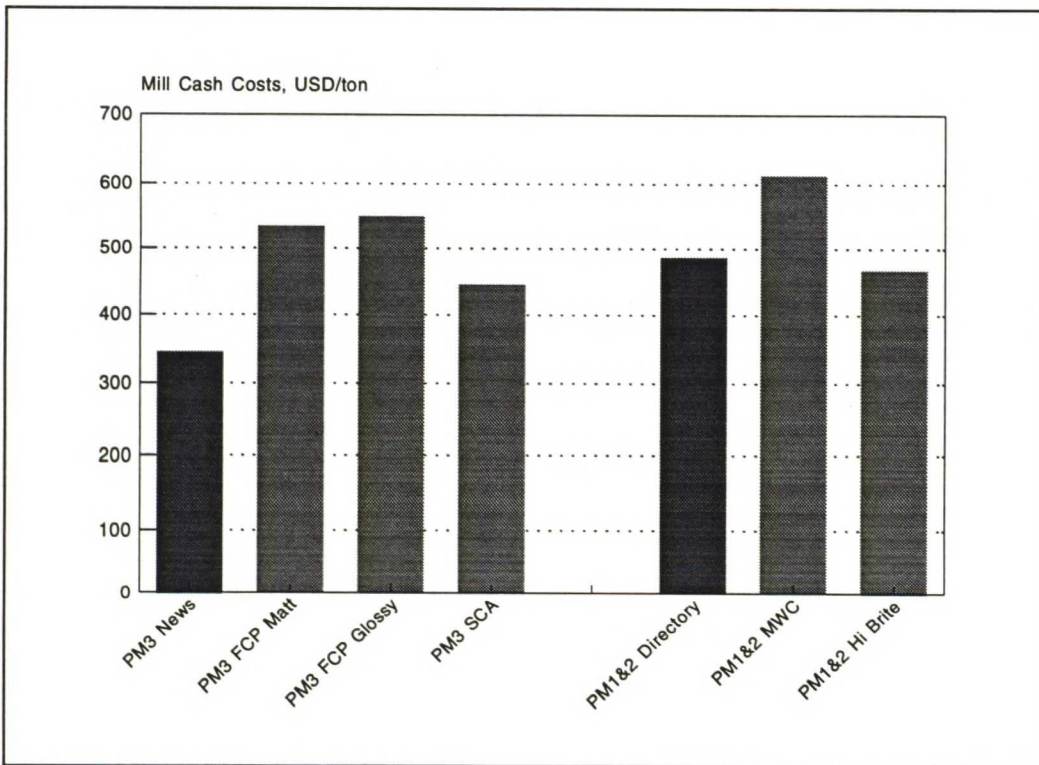


Figure 37. Cash manufacturing costs for different grades //

7.3 Preliminary Investment Cost Estimates

The estimated investment costs of rebuilding paper machines 1 and 2 to produce coated groundwood paper are about USD 160 000. The investment includes one off-machine coater, two supercalenders and two winders, which make almost 70 % of the investment costs.

The estimated investment costs of rebuilding PM3 to produce SC-paper are about USD 160 000. The costs include rebuilding of the paper machine, warehouse, filler preparation, groundwood mill and power distribution. It also includes finishing equipment, i.e. 3 supercalenders and 2 winders. The rebuilding of the finishing area is the most expensive part of the investment.

The estimated investment costs for rebuilding PM3 to produce FCP are almost USD 200 000. The costs include rebuilding of the groundwood mill and PM3, which includes coating station, the most expensive part of the investment. Also the investment includes finishing area (soft calender and 2 winders), warehouse, filler preparation, coating colour kitchen and power distribution rebuilds.

The estimated investment costs for rebuilding PM3 to produce FCP glossy (LWC paper/Coated #5) are over USD 220 000, almost USD 230 000. The investment includes rebuilding of PM3 and finishing area, which are the most expensive parts of the investment. The investment also includes the groundwood mill, warehouse, filler preparation, coating colour kitchen and power distribution rebuilds.

The investment costs are estimated by a computer program called COCOE by Jaakko Pöyry Consulting Oy.

More detailed information about the investment costs is presented in Appendix 4.

7.4 Summary of Analysis

7.4.1 Summary of PM1 and PM2 Products

Possible grades for PM1 & PM2 are directory, coated groundwood and Hi Brite papers.

Operating margin does not change much between the three grades. Investment costs for coated grades are very high and the net present value change is negative. The manufacturing costs of coated grades increase a lot compared to the present state. For Hi Brite investment costs are low and the NPV change is small. The manufacturing costs decrease a little. See Table 5.

From the economical point of view, the coated groundwood paper production with PM1 & PM2 would decrease profitability of the Mill. Production of Hi Brite does not bring enough value added. So the best product would be directory paper at this moment.

7.4.2 Summary of PM3 Products

Possible products for PM3 are newsprint, FCP matt, FCP glossy and SC-A papers.

SC-A production would give the best operating margin and NPV increase. Investment and manufacturing costs are lowest compared to the other grades. FCP glossy gives the highest investment but also manufacturing costs, although the NPV change and operating margin for it are the second best. For FCP matt the operating margin and NPV change are the lowest. Investment costs and manufacturing costs are more than with SC-A. See Table 5.

Table 5. Summary of different paper grades, NBSK at 640 USD/ton

	PM1 and PM2			PM3			
	Directory	LWC/ MWC	Hi Brite	News	FCP matt	FCP glossy	SC-A
Production capacity, 1000 t/a	155	155	155	217	217	217	217
Operating margin, %	40	37	44	33	43	48	52
Cost position quartile	1-2	2	n.a.	1	1	1	1
Investments, million USD	-	162	15	-	198	226	162
NPV increase, million USD	-	-60	7	-	120	198	330
Cash manufacturing costs, USD/t	486	612	466	345	534	549	444

From the economical point of view, the production of SC-A would give the best profit increase at this moment. The second best alternative would be FCP matt production. Production of FCP glossy could be eliminated because the investment and manufacturing costs are very high.

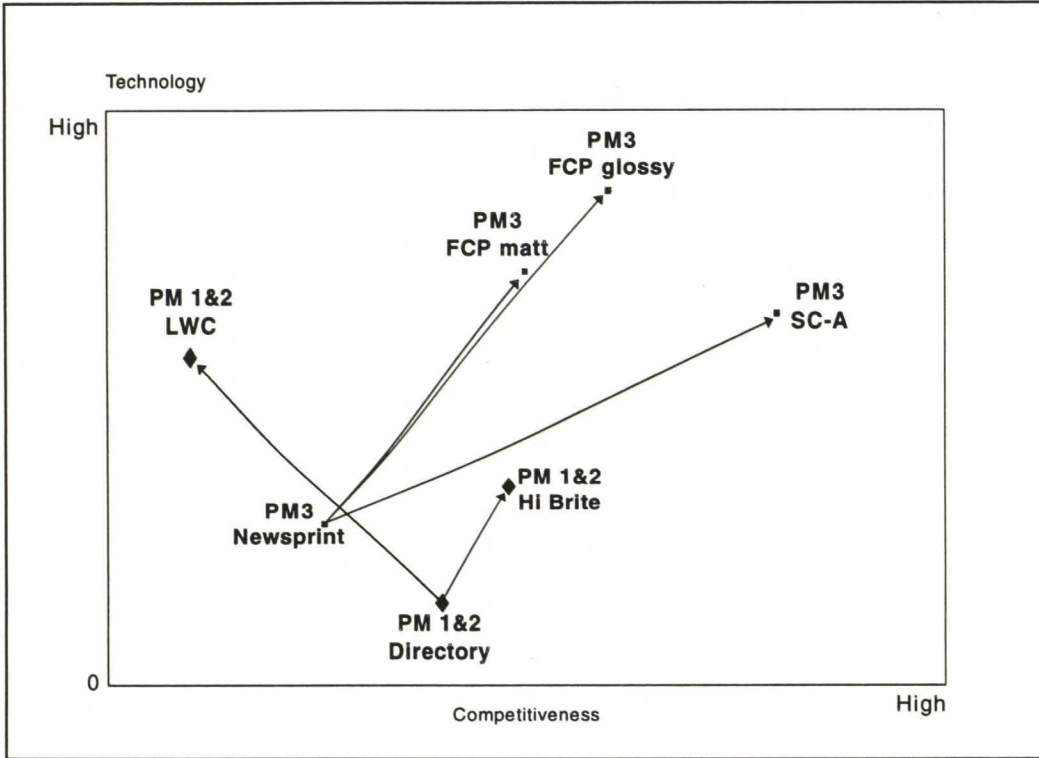


Figure 38. Effect of different possibilities on competitiveness and technology

8 RECOMMENDATIONS

8.1 New Product Options for PM1 and PM2

PM1 and PM2 are already upgraded from standard newsprint to more valuable directory paper production. Other newsprint type value added grades, like Hi Brite, would not give significant improvement to present situation. The market position of directory paper is good and the customer base is ready.

To continue the current directory paper production will be a viable option at least for the next five years, which will allow the Mill to consider the order of investments.

8.2 New Product Options for PM3

PM3 has to be modernised in the near future for newsprint or some other product to maintain competitiveness.

The possible products for PM3 are FCP matt and SC papers. Both grades improve the competitiveness of the Mill, SC paper more than FCP matt. The market situation for both grades is promising.

From the technical point of view, FCP matt would be a better product because it is easier to produce than SC paper. SC paper is a demanding grade and the manufacturers need a few years' training to produce the high quality grades like SC-A and SC-A+.

Because FCP matt production allows changes in the paper properties, it has a wide range of different kinds of papers which can be produced with the same production machinery. The production can be started with newsprint as a base paper and by product development the base paper quality and properties can be improved more towards LWC and then SC base paper.

Based on this study the FCP matt production would be the best choice for PM3. It has good development possibilities in the future and constitutes the basis for a wide range of different paper grades.

8.3 Future Options for the Mill

Future options could be closing the two small paper machines and building a new modern machine to produce for example coated groundwood grades or SC paper depending the market situation at the time when the decisions are made.

9 THE COMPANY'S PRODUCT DEVELOPMENT IN THE FUTURE

At the moment the Company has not any kind of product development facilities. It has to form a Product Development Policy and create a Product Development Culture for the whole Company.

There are two options to arrange the product development in the Company and at the Mill in the future.

The first option is a centralised model where the company has one big research and development centre. At the centre there are laboratories and other equipment and facilities for planning and researching. The Company's mills can suggest different research subjects but they are prioritised by the Company. Mainly the research ideas come from the markets like customers and competitors.

Most of the paper companies are aiming to the centralised model with one centrally managed laboratory. Besides usually every mill has its own laboratory which is concentrated in developing their own product lines.

The other option is a decentralised model in which the mills have their own research and development laboratories. There may be a small centralized research department, which controls the research work to avoid overlapping. In this model the mills are more independent and therefore they have more responsibilities.

In both models there should be a research and development network, which includes the company's centre laboratory, every mill's laboratories, universities, different research centres, equipment, chemical and wire/felt suppliers and of course customers. This network will help the company and its mills to co-operate with those outside the company and to get new information and ideas for product and development work. See Figure 39.

The Figure 39 describes for both centralised and decentralised models. In decentralised model the company's research and development laboratory is small and the mill's laboratories are larger.

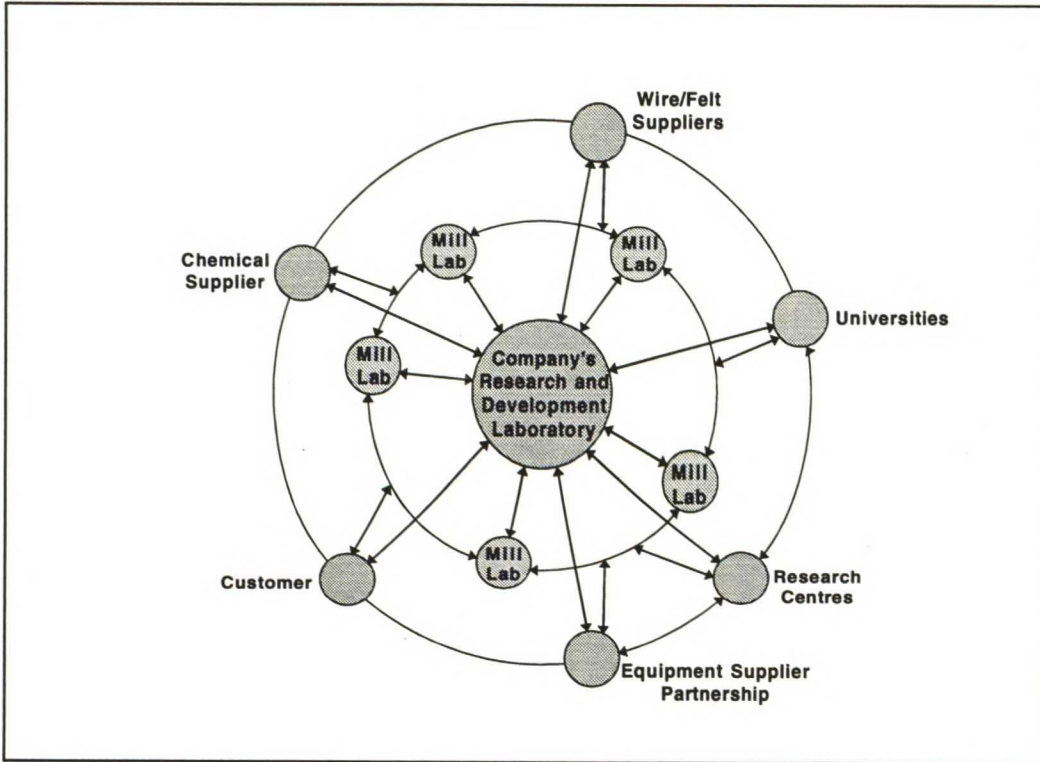


Figure 39. Research and development network

10 CONCLUSIONS

When the profitable product development ideas have been found, they must be prioritised inside the company and the mill. All the ideas cannot usually be implemented, because in many cases money is a limiting factor. Product development alternatives can be divided into three categories:

- 1 Maintenance-type small investments
- 2 Low capital investments
- 3 High capital investments

The company must choose the most profitable ideas and realise them step by step. In the case of the analysed North American paper mill, the first step is to invest in the biggest machine and later in the smaller ones.

Conclusions of the analysis are that the mill should continue to produce directory paper with the two small paper machines and start the FCP matt paper production with the biggest machine. The production of FCP matt paper changes the strategy and the culture of the Company. Until now it has produced only uncoated groundwood papers. Starting the coating process increases the needed level of the skills at the Company, which means training and development of the present employees and hiring of new professionals.

The product development strategy is based on a vision: a vision of the company and its future. The product development strategy is the way to make the vision come true. The process starts with analysing the risks and opportunities of the company, which are based on availability of raw materials, skills of people, company culture, state of technology, customer base and availability of capital. The strategy suggests products which increase the competitiveness of the company.

The only way to increase the company's profit and competitiveness in the long term is through product development. In practice product development needs constant and rigorous work in researching the company, products, markets, competitors etc.

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Production Cost Data for the Mill in 1994

Production	(1000 t/a)		
- Directory		110	
- Newsprint		<u>129</u>	
Total		239	
Paper prices	(year average, USD/MT)		
- Directory		795	
- Newsprint		485	
Sales income	(mill. USD)		
- Directory		64	
- Newsprint		<u>50</u>	
Total		114	
Variable production costs		48	
Contribution margin		66	(Sales - Variable costs)
- of sales income		58 %	
Fixed production costs		43	
Total manufacturing costs		91	(Variable + Fixed costs)
Operating profit		23	(Sales - Total costs)
- of sales income		20 %	

Grade Definitions of Potential Products for the Mill

	Fibre content	Basis weight g/m ²	Brightness ISO %	Specialties	Main end-uses
Directory	Mechanical pulp 70-80 %, chemical pulp 20-30 %, waste paper up to 40 %	30-50	55-65	May be coloured	Directories
Newsprint	Mechanical pulp 70-100 %, chemical pulp 0-20 %, waste paper up to 100 %	40, 42.5, 45, 52	50-60	Machine finished or slightly calendered, can be coloured	Newspapers
Hi-Brite news	Mechanical pulp 70-100 %, chemical pulp 0-30 %, waste paper up to 40-50 %	40, 42.5, 45	67-74	Machine finished or slightly calendered, can be coloured	Inserts, flyers, supplements, comic books
SC-C, SC-B	Mechanical pulp 70-90 %, chemical pulp 10-25 %, waste paper up to 2.5-30 %	40-70, normally 52-60	62-66	Super/soft calendered	Commercial printing, inserts, supplements, catalogues
SC-A, SC-A+	Mechanical pulp 70-90 %, chemical pulp 10-30 %	40-80, normally 52-60	66-70, offset up to 74	Supercalendered	Magazines, catalogues, commercial printing

	Fibre content	Basis weight g/m²	Brightness ISO %	Specialties	Main end-uses
MFC	Mechanical pulp 60-85 %, chemical pulp 15-40 %, waste paper up to 5 %	50-80	<73	Coated normally by on-line blade coater, pigmented also in size press or gate roll coater, soft calendered	Specialty magazines, supplements, commercial printing, books, catalogues
LWC (Coated #5)	Mechanical pulp 50-70 %, chemical pulp 30-50 %, waste paper up to 5 %	51-57, in future 48-54, lowest 32	68-79	Coated by on- or off-machine, may be supercalendered	Magazines, mail orders catalogues, commercial printing
MWC/HWC	Mechanical pulp 40-55 %, chemical pulp 40-60 %, waste paper up to 5 %	73-140	74-80	Coated by on- or off-machine, may be supercalendered, often double coated	Commercial printing, magazines, periodicals, special supplements, magazine covers
FCP - offset	Mechanical pulp 70 %, chemical pulp 30 %	(45) 50-60	71-74	Soft/supercalendered	Magazines, catalogues, commercial printing
FCP - gravure	Mechanical pulp 70-75 %, chemical pulp 25-30 %	45-60	68-72	Supercalendered	Magazines, catalogues, commercial printing
Wallpaper base	Mechanical pulp 70-75 %, semibleached kraft 25-30 %	60-150		Coated sometimes	Wallpapers

Screening of Potential Products for the Mill

	Market size 1993 1000 MT	Growth 1993-2000 %/a	Market size in 2000 1000 MT	Current price premium over newsprint USD/ST	Long term trend price USD/ST	Main end-uses	Attractiveness for the Mill
MACHINE FINISHED GRADES							
Hi Brite news	1200	0.5-1	1290	+90	500	Inserts, flyers, supplements, comic books	Competition from standard newsprint. Intermediate grade, low price premium. Not bringing enough added value.
Premium Hi Brite	30-50	5-10	100	100-300	?	Free sheet replacements in offset	Attractive low cost alternative.
Business directory - uncoated grwd	140	2.3	165			Directories	Small additional market for directory grades.
Telephone directory - uncoated grwd - White 36.6-g - Yellow 36.6-g	800 670 300 370	2.2 2.4	930 790	+240 +280	750	Telephone directories	Viable market for the next five years for PMs 1&2. Stable or slightly increasing volume. Prices expected to increase considerably.

	Market size 1993 1000 MT	Growth 1993-2000 %/a	Market size in 2000 1000 MT	Current price premium over newsprint USD/ST	Long term trend price USD/ST	Main end-uses	Attractiveness for the Mill
Groundwood forms bond	300	-4	225	+120	650	Business forms	Fall back grade for FCP. Niche market.
Std. book	200	0	200	+50-100	550	Pocket books	Very low price premium. Small market, slow growth. Potential market as several producers are getting out.
SUPERCALENDERED GRADES							
SC-C	250	0-1	260	+90	620	Inserts, flyers, supplements	Intermediate grade, low price premium over newsprint. Investment in supercalenders not justified. Current supply satisfying the market.
SC-B	300	1	320	+180	710	Inserts, flyers, supplements, (magazines)	As above. Insert market will remain the main end use sector where the Company already has good market position.

	Market size 1993 1000 MT	Growth 1993-2000 %/a	Market size in 2000 1000 MT	Current price premium over newsprint USD/ST	Long term trend price USD/ST	Main end-uses	Attractiveness for the Mill
SC-A	1100	4	1450	+275	810	Inserts, flyers, magazines, catalogues	Growth market. Threat form SC-A+. Break through in Sunday supplements could increase market dramatically.
SC-A+	50	26	250	+375	820	Magazines, catalogues	Potential in magazines and catalogues. Potential in rotogravure.
Total SC-paper	1750	4.3	2280				Qualitywise competing with CTD GRWD in gravure.
COATED GRADES							
MFC (Machine Finished Coated)	100	3	125	+275	750	Specialty magazines, inserts	Niche market supplied by current producers.

	Market size 1993 1000 MT	Growth 1993-2000 %/a	Market size in 2000 1000 MT	Current price premium over newsprint USD/ST	Long term trend price USD/ST	Main end-uses	Attractiveness for the Mill
FCP (Film Coated Paper) - with soft nip calender	*	*	(600)	+350	830	Offset: magazines, catalogues, commercial printing	Future technology. Good growth in offset in matte and glossy finish. Possible savings in kraft pulp consumption, investment cost. Ability to compete in lower basis weights.
FCP (Film Coated Paper) - with supercalenders	*	*	(400)	+350	830	Gravure: magazines, catalogues, commercial printing	Future technology. Potential in gravure. Low basis weights a competitive edge in volume products.
LWC (Coated #5)	5000	3	6150	+450	830	Magazines, catalogues, commercial printing	High investment costs.
ULWC	995	5.0	1400	+620	1000	Catalogues, magazines	Potential grade for PM3 in the long run. Good growth makes market attractive for all producers.

	Market size 1993 1000 MT	Growth 1993-2000 %/a	Market size in 2000 1000 MT	Current price premium over newsprint USD/ST	Long term trend price USD/ST	Main end-uses	Attractiveness for the Mill
MWC/HWC (Medium/heavy weight coated)	1440	1.5	1600	+370	900	Magazines, catalogues, commercial printing	Heavy competition from low cost southern producers.
SPECIALTIES							
Wallpaper base (not posted)	80	2-3	100	+500-600	1000	Wallpaper boarders	Good still growing market. Technically very demanding and requires strong product development.

Used Prices and Other Values

Prices	Year 1994 average		
	- Directory	721 USD/ST	795 USD/MT
	- Newsprint		485 USD/MT

Short ton vs. metric ton

$$1 \text{ ST} = 0.90718 \text{ MT}$$

Exchange rates

$$1 \text{ USD} = 1.3657 \text{ CAD}$$

LUKUSÄZIKPL

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Puunjalostustekniikan laitos
Kirjasto~~

PK