EFORWOOD
Sustainability Impact Assessment of the Forestry - Wood Chain

Project no. 518128

EFORWOOD

Tools for Sustainability Impact Assessment

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D 4.3.11.
Final report on the Interdependence between the Agents within the Forestry-Wood Chain
or
Forest Industry Value Chain Dynamics

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PU	Public	
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RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Summary

This is the *Final Report on the Interdependence between the Agents within the Forestry-Wood Chain* or "Forest Industry Value Chain Dynamics". The report is Deliverable D4.3.11. of the EFORWOOD project. This report is based on PD4.3.3. *First Report on the Interdependence between the Agents within the Forestry-Wood Chain.*

The first chapters of the report describe value chain theory in general. Chapter 2 explains what a value chain is. In Chapters 3, 4, and 5 different types of value chains and networks are described and the concepts of value creation and migration in the chain are discussed. The final chapters, Chapters 6-8, show from the forest industry point of view what the value chain theory and migration mean in practice. Each Chapter includes a section "Link to EFORWOOD" where the chapter content is linked to EFORWOOD. The main conclusion of the report can be summarised as: *the forest industry has become even more complex than before. At the same time it faces hard competition both on the raw material sourcing and on the markets. In order to succeed the whole value network must be optimised. The economic optimisation should be in line with corporate responsibility and sustainable development.*

The purpose of this report is to give information to other Eforwood partners on the nature of different forest based products from the value chain dynamics point of view. This report is strongly linked to PD 4.3.10. *"Final report on the industry's competitiveness and its impact on the industry dynamics,* and also in some extent to PD 4.3.4. *"Trade projections forest products by country and product"*. Together with PD4.3.10 and PD4.3.4. this study reports about the comprehensive picture of the industry dynamics.

The author of this report is Pöyry Forest Industry Consulting.

Summary

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1 INTRODUCTION

This report belongs to European Commission's EFORWOOD project, contract number 518128-2. Module 4, who is responsible for this report, is a partnership of European companies focusing on the manufacturing and processing ("gate to gate") stage of the Forestry Wood Chain (FWC) in Europe. This document is a deliverable D 4.3.11. - *Final Report on the Interdependence between the Agents within the Forestry-Wood Chain* or "Forest Industry Value Chain Dynamics" and its purpose is to give information to other Eforwood partners on the nature of different forest based products from the value chain dynamics point of view.

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This report covers mainly economical variables as the focus of the industry has for a long time been in them. Lately the situation has changed and the industry has become more interested in social, economical and ecological sustainability. Sustainability issues have started to affect outside the juridical individuals and affect more to the whole value chain.

This report is based on PD4.3.3. *First Report on the Interdependence between the Agents within the Forestry-Wood Chain.* This means that the report is based on the situation in 2005, the base year of the Eforwood project. However, even now, in May 2009 it gives a good perspective of the economic situation of the time of date.

As stated in PD 4.3.10: "Current economic climate has however, increased the down side of the industry leading to increased competition between players. The financial crises initiated in the last quarter of the second half of 2008, has hit hard the traditional pulp and paper industry. It is fair to expect that the coming year will speed up the structural changes in this mature industry described in the report. This means also that the position of bioenergy will in future be quite different from what it was in 2005. What comes to solid wood industry, it is doomed to suffer hard from the rapidly collapsing building sector. Historically hard crushes of several European and American housing markets, such as in Spain, UK and the Denmark do not anticipate a fast recovery. This is why it may happen that some trends breaks differing from the traditional demand and supply development curves are quite possible in the near term future to occur. In addition it is fair to estimate that the impact of changes will certainly hit quite differently of different products.

Trends presented in the report point out the right development on a general level. No major changes are currently in sight which would change the described longer term trends.

One positive sign, however, which the industry could profit more from than the report let's to understand is the sharply increasing demand for bio originating and recyclable materials based products."

Another thing that has changed is the importance of bio-energy, which has grown rapidly during the EFORWOOD project. Bio-energy and it's interconnections bring totally new perspective to the forestry wood chain. It has a complex structure and connections within and outside forest industry. Unfortunately forest based bio-energy could not be taken into account in it's whole complexity in EFORWOOD.

The author of this report is Pöyry Forest Industry Consulting.

2 WHAT IS A VALUE CHAIN

The concept *value chain* was introduced by Michael Porter in 1985 in a seminar work on competitive advantage[1]. In this work Porter defined value as the amount buyers are willing to pay for what a company provides, and he saw the "*value chain*" as the combination of nine generic value added activities operating within a company.

Initially Porter, however, defined the value chain for a company as ***a chain containing the following generic activities*** which are common for most companies. The value chain drawn by Michael Porter is presented in Figure 2-1.

Figure 2-1
Primary Value Chain Activities

Source: Michael E. Porter, Competitive Advantage, Creating and Sustaining Superior Performance

[1] Michael E. Porter, Competitive Advantage, Creating and Sustaining Superior Performance

In Porter's value chain the activities for the different parts in the chain were defined as follows:

- **Inbound logistics** include the receiving, warehousing, and inventory control of input materials.

- **Operations** are the value-creating activities that transform the inputs into the final product.

- **Outbound logistics** are the activities required to get the finished product to the customer, including warehousing, order fulfilment, etc.

- **Marketing & Sales** are the activities associated with getting buyers to purchase the product, including channel selection, advertising, pricing, etc.

- **Service** activities are those that maintain and enhance the product's value including customer support, repair services, etc.

In addition to these central activities there are support functions which are according to Porter tightly bound to the central value chain. These activities cannot be seen directly as creating value. However, activity in these functions will determine how well the value chain is functioning in a company. These activities include

- **Procurement:** This function is responsible for all purchasing of goods, services and materials. The aim is to secure the lowest possible price for purchases of the highest possible quality. Procurement is responsible for outsourcing (components or operations that would normally be done in-house are done by other organisations), and ePurchasing (using IT and web-based technologies to achieve procurement aims).

- **Technology Development**: Technology is an important source of competitive advantage. Companies need to innovate to reduce costs and to protect and sustain competitive advantage. This could include production technology, Internet marketing activities, lean manufacturing, Customer Relationship Management (CRM), and many other technological developments.

- **Human Resource Management (HRM):** Employees are an expensive and vital resource. An organisation would manage recruitment; selection, training and development, and finally rewards and remuneration. The mission and objectives of the organisation would be the driving force behind the HRM strategy.

- **Company Infrastructure:** This activity includes and is driven by corporate or strategic planning. It includes the Management Information System (MIS), and other mechanisms for planning and control such as the accounting department.

A value chain contains all the different parts of processes in a company between which a transaction point is identified. Value chains can therefore be used in analysing the profitability of a company or a single product but also in creating a competitive advantage for both. The main purpose of a value chain can simply be said to be in defining the profit margin. Here, the aim is that value created by the product or a service exceeds the cost of providing the product or service. The concept can be used for analysing both how value is transferred inside a company or through a product chain containing several companies. In other words, the concept of a value chain can be used to analyse the profitability of a whole business cluster.

2.1 How to determine the profit margin by using Michael Porter's model

By adopting Michael Porter's value chain model, a profit margin analysis can be conducted as described Figure 2-2. Here, a cost benefit analysis is conducted to highlight which parts of the value chain have negative or positive revenue. The analysis is, hence, very effective in red-lighting the cost-inefficiency of parts of the value chain.

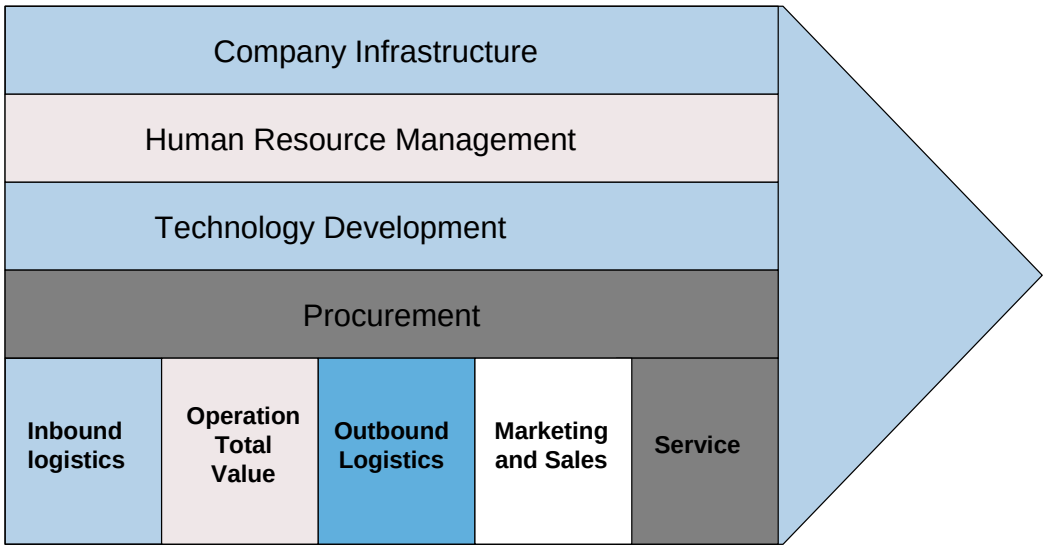
Figure 2-2
Cost/Benefit Analysis Model and Porter's Value Chain

A cost benefit analysis is conducted as described below:

- To begin with, the company infrastructure is mapped to represent all operations in the value chain. All points where a transaction occurs are mapped separately.

- The vertical pillars show the central functions of the company whereas the horizontally added functions illustrate support activities.

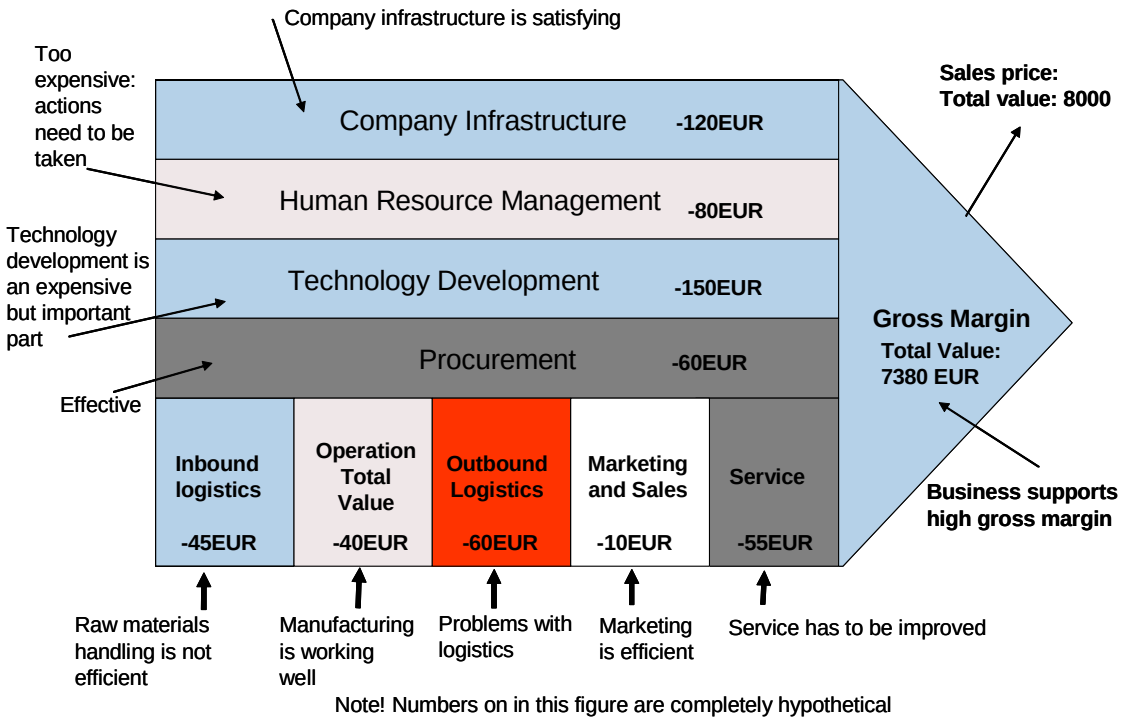
Figure 2-1-1
Cost/Benefit Analysis Model and Porter's Value Chain



- Costs of different activities are inserted into the *cost pool*. The gross margin is then calculated by adding up all costs and then comparing them to the sales revenues. The gross profit margin is a measurement of a company's manufacturing and distribution efficiency during the production process. The gross profit tells an investor the **percentage of revenue / sales** left after subtracting the cost of goods sold. A company that boasts a higher gross profit margin than its competitors and reference industry is more efficient. Investors tend to pay more for businesses that have higher efficiency ratings than their competitors, as these businesses should be able to make a decent profit as long as overhead costs are controlled (overhead refers to rent, utilities, etc). Hence, the gross margin is calculated as the **gross profit** divided by the **gross revenue**.

- A possible outcome of a cost benefit analysis is presented in Figure 2-1-2. Here, the different parts are analysed by placing comments on each cost pool. The figure illustrates clearly the areas of concern in the company.

Figure 2-1-2
Cost/Benefit Analysis Model and Porter's Value Chain Case Example



Source: Pöyry Forest Industry, Drawn from Porter's Value Chain Model

In order to better understand the activities leading to competitive advantage, one can begin with defining a generic value chain for the company by identifying the relevant company-specific activities. This can be done by mapping process flows where these are then used to isolate the individual value-creating activities. Once the discrete activities are defined, linkages between activities can be identified. A linkage exists if the performance or cost of one activity affects that of another. Competitive advantage may be obtained by optimising and coordinating linked activities.

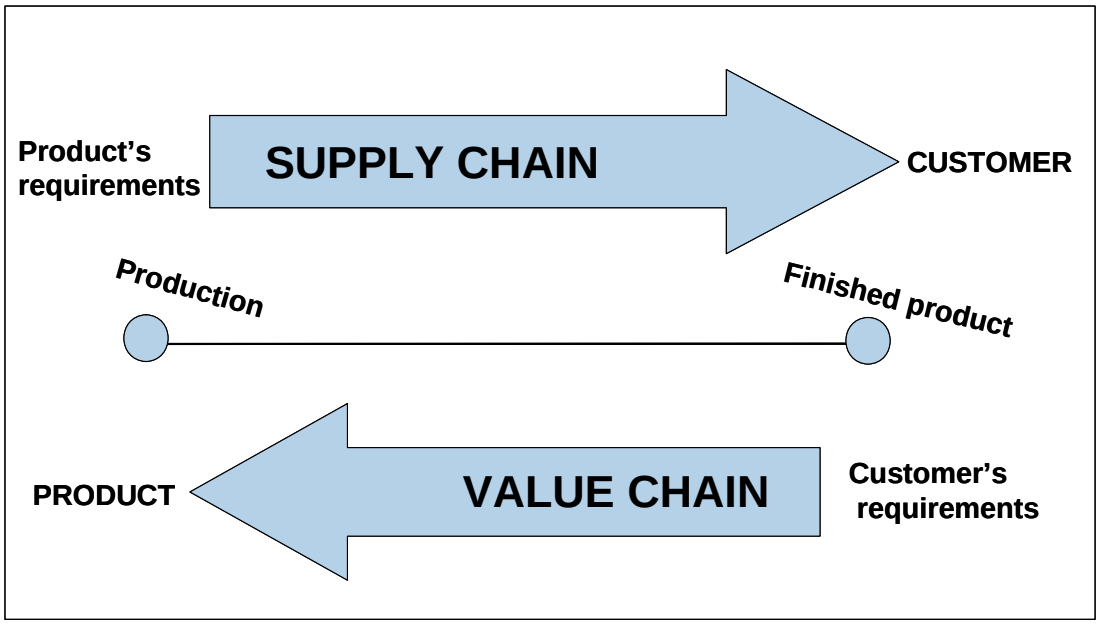
This type of value chain analysis is also often used in determining outsourcing decisions. Understanding the linkages between activities can lead to more optimal make-or-buy decisions that can result in either a cost advantage or a differentiation advantage.

2.2 Supply Chain Management

Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. SCM contains all processes and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. The term *supply chain management* was introduced by Keith Oliver, a consultant at Booz Allen Hamilton in 1982.

n other words SCM can be said to be a tool not only for improving the interaction between the different processes in a company but also for improving value creation in a chain. Figure 2-3 describes briefly the difference between the analogy of a value chain and a supply chain. The *value chain* measures the *value calculated from the customer's point of view* whereas *supply chain management starts from the requirements of the product* and analyses the efficiency of being able to deliver a finished product.

Figure 2-3
Difference between Value Chain and Supply Chain



Source: Pöyry Forest Industry Consulting

SCM does not only contain the process of producing the product inside one's own company. It also contains the product distribution through a chain of retailers, distributors, wholesalers, manufacturers, and component suppliers. The basic idea of SCM is to speed up the flow of products and goods between the different distribution points – hence, to secure that the product reaches the end customer as fast as possible. This is secured by monitoring information and capital in both directions, along the chain's entire length. Because the costs of managing the supply chain – the inventory, the warehouse and distribution centres, and freight – can represent 10-15 % of sales in most industries, the savings that B2B (business-to-business) exchanges have long promised would have a big impact. During the last few years internet technology has made it much easier and cheaper for customers and suppliers to exchange data. The management of this process is called *orchestration*. The orchestration process is an in essence infinite loop of collaborations, interactions and specific actions among demand/supply-chain players i.e. customers, outsourced parties etc.

Hence, the critical issues with which SCM deals with

- **Distribution Network Configuration**: Number and location of suppliers, production facilities, distribution centres, warehouses and customers.

- **Distribution Strategy**: Centralised versus decentralised, direct shipment, cross docking, pull or push strategies, third party logistics.

- **Information**: Integrate systems and processes through the supply chain to share valuable information, including demand signals, forecasts, inventory and transportation.

- **Inventory Management**: Quantity and location of inventory including raw materials, work-in-process and finished goods.

Especially for start up companies entering a rapid growth phase, SCM is a hard but important issue to deal with[2]. This becomes evident particularly when companies reach the fast growth phase. A good example is Amazon.com that had difficulties in controlling its supply chain in the fast growing phase: Amazon's sales grew by 170 % from 1998 to 1999. However, at the same time, inventories ballooned by 650 % and inventory turnover plummeted from 8.5 times to 2.9 times (Hof et al. 2000).

Examples from the automotive industry have shown that effective SCM and close co-operation with customers generates profitable business. Yet, close partnerships of this kind are still not at all common, largely because, until quite recently, integrating the information systems of two or more companies was a lengthy, expensive, and technically difficult process.[3] The development of internet technology during recent years has, however, offered new efficient types of solutions improving enterprise resource-planning (ERP). Supply chain innovations enabled by the Internet have for example made it easier for customers and suppliers to exchange data.

In a recent display study assessing the management of supply chain risks conducted by McKinsey & Co, it is shown that companies feel that the importance of adequate SCM is rising. According to this study which contained interviews with 3172 executives at publicly and privately held businesses across a full range of industries almost two thirds of the respondents felt that risks to their supply chain have increased over the past five years. The most frequently cited concern was the availability of high-quality labour. A significant number of executives also felt that their company did not spend enough time or resources on mitigating risk. Moreover, nearly one-quarter of the interviewed said that their company does not perform formal risk assessment, and almost half lack company-wide standards to help mitigate risk.[4]

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[2] Auramo, J. and Kämäräinen V. Fast Growing High-Tech Start-ups: Efficient Network Operations Require Knowledgeable Governance, TAI Research Center

[3] The other end of the supply chain, Mc Kinsey
Holmström, J., Hoover, W. E. Jr., Louhiluoto, P. and Vasara. A., 2000 Number 1

[4] Understanding supply chain risk: A McKinsey Global Survey, 2006

2.3 Link to EFORWOOD

Value is analysed in the EFORWOOD in the indicators 1.1 Gross value added and 2.1 Production cost. The costs from the Porter's value chain model like inbound logistics, marketing, sales and services are included in the production cost and thus reflected also to gross value added of each product. Changes analysed in the different reference futures and scenarios shown in Table 2-1 have an influence also in the value added due to changes in e.g. energy price, wood price and product value.

Table 2-1
Chains, Reference Futures and Scenarios Analysed in EFORWOOD

Chain	A1 2015	A1 2025	B2 2015	B2 1015	Scenario
EU	X	X	X	X	Natura 2000
Baden-Württenberg	X	X	X	X	Bio-energy
Scandinavia	X	X			Technology
Iberia	X	X			Consumption

Though EFORWOOD and ToSIA depict an extensive chain of forest and wood related agents, they are a simplification of reality. The interdependencies in reality are much more extensive that what is or could be described in the forestry wood chain for ToSIA. Because of the simplifications some of the Porters value chain blocks are integrated in one indicator figure. This means that to be able to do specific value analyses of one product, it would be necessary to produce a separate case study.

From the supporting functions of Porters value chain model technology development is considered in the Scandinavian case scenario where the technology of sawmills change and affect to the whole forestry wood chain flows. The affect of technology development to value added can be analysed through the scenario calculations.

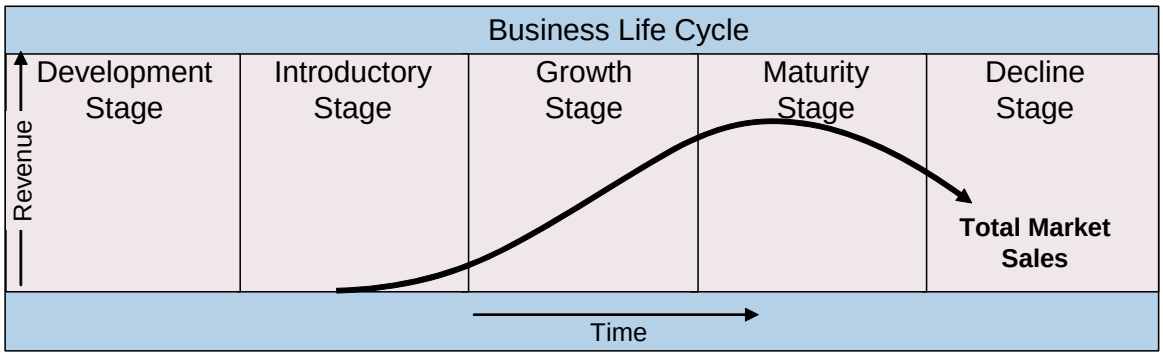
Both gross value added and supply chain changes are considered in the reference futures and scenarios of different cases. For example some processes which do not exist in the chain in 2005 are added to the chains in scenarios or in the reference futures. Although some changes are considered in the forestry wood chain there might be difficulties of analysing supply chain management changes or the affects of orchestration regarding flows. This is due to the fact that forestry wood chain does not include all existing loops and interactions between the agents in the chain because ToSIA is not able to analyse loops (except paper recycling). In addition ToSIA is quite inflexible regarding indicator values. It's not able to change any indicator values automatically even if some of the scenarios would require it.

Supply chain risks can be analysed in the scale of the whole forestry wood chain level comparing different reference future and scenario runs. It should be possible to see if the environmental, social or economical indicators change if the material flows change e.g. how additional bio-energy production affects employment in the whole chain.

3 MAXIMISING VALUE AND VALUE MIGRATION

In order to be able keep a company profitable i.e. to understand how to capture value, the business lifecycle as well as the design has to be well understood. The business life cycle describes the lifetime of the company from the development stage to the decline stage. Figure 3-1 illustrates a typical life cycle of a company or its products.

Figure 3-1
Business Life Cycle



Source: Pöyry Forest Industry Consulting

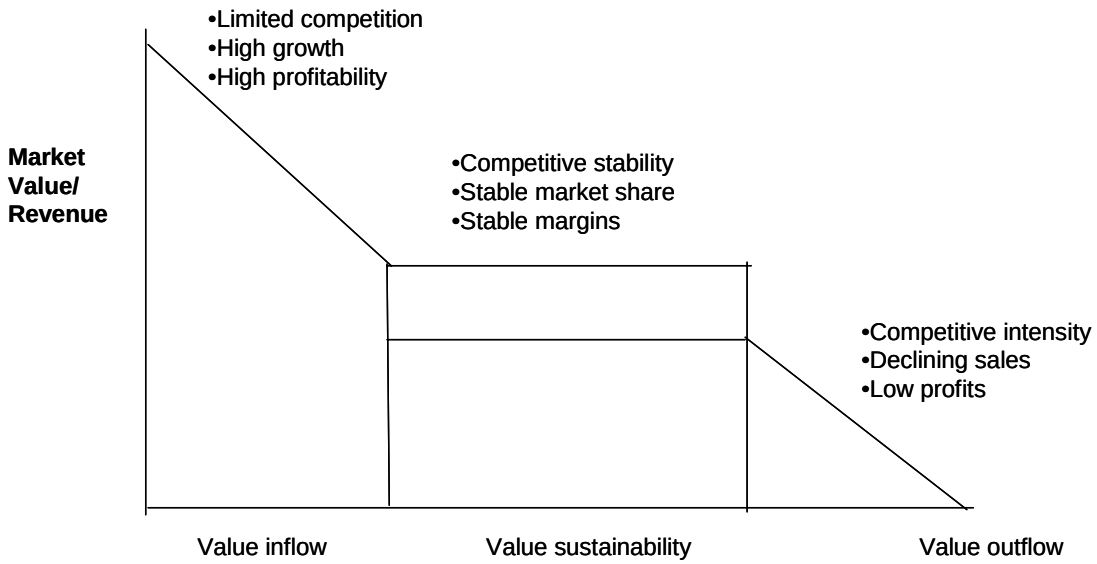
A "business design", in turn, is defined as the *totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and which it will outsource, configures its resources, goes to market, creates utility for customers, and captures profit from that activity.*[5] The total offerings of the company may they be products or services are included in the company's total business design. One of the most classical examples of capturing value through innovative business designs is the pioneer of business design, Toyota, which has managed to capture value in changing ways through three decades. Other examples of companies becoming profitable by innovative business designs are Mc Donald's and Carrefour.

3.1 Value Migration

A business design can be divided into three different stages as shown in Figure 3-2; the value can be *flowing in*, it can be *stable*, or the value can be *flowing out*. In the inflow stage a company, which is aggressive, starts capturing value very fast. It is common that the value in this respect is channelled to this company from the other parts of the industry. In the stable part of the value curve, the business design is well matched to the customers' expectations and most of the companies in the field are making profit. In the outflow phase, value starts to migrate towards new business designs that are more accurately meeting customer priorities. In this phase, companies often start to cut prices in order to retain market share and stay in the game.

[5] Adrian J. Slywotzky, Value Migration, Harvard Business School Press, 1996, p. 3

Figure 3-2
Value Migration



Source: Adrian J. Slywotzky, Value Migration

The model explained above can be used in describing value migration between companies, within a single industry or in one company. Mapping value migration at industry level gives a good picture of current stage of one's own company or the whole industry in comparison to competitors. It is obvious that a company located in the value outflow stage has to change its business design in order to stay in the game.

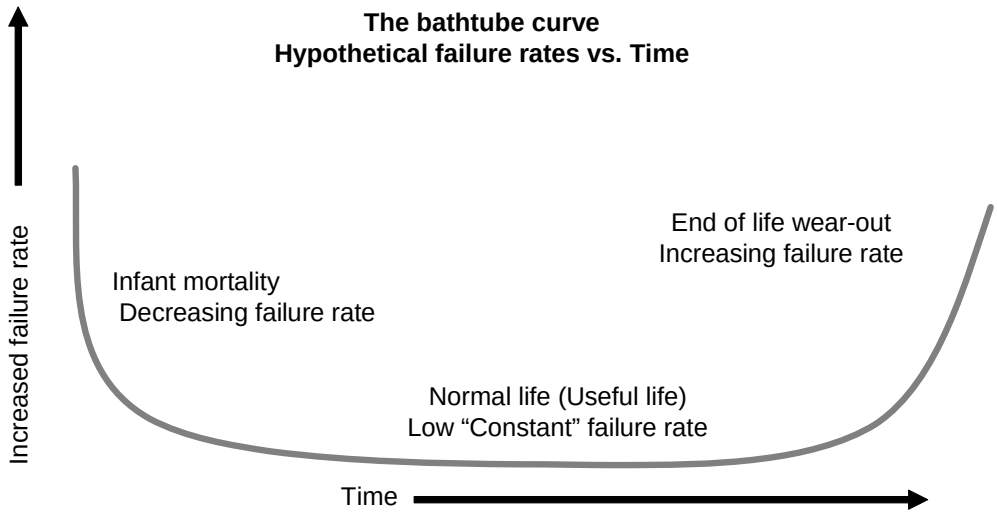
If the value chain of an industry, containing several companies, is considered, the development of the value curve is not as obviously linear. Development of value creation might happen at diverse speeds among companies belonging to the value chain. This means that different parts of the value chain are in a different stage in the value migration process. Situations are hard to manage, if the centre part of the value chain enters a value outflow stage. This situation is in the literature defined as the bathtub curve. It describes a particular form of a hazard function, which comprises three parts:

- The first part is a decreasing failure rate.
- The second part is a constant failure rate, known as random failures.
- The third part is an increasing failure rate, known as wear-out failures.

The bathtub curve is generated by mapping the rate of early "infant mortality" failures when first introduced, the rate of random failures with constant failure rate during its "useful life", and finally the rate of "wear out" failures as the product exceeds its design lifetime.[6] This bathtub curve can also be applied in value chain development. Figure 3-3 illustrates the different phases of the curve and describes the effects on it.

[6] Dennis J. Wilkins, The Bathtub Curve and Product Failure Behavior
Part One - The Bathtub Curve, Infant Mortality and Burn-in

Figure 3-3
The Bathtub curve



Source: Pöyry Forest Industry Consulting

In less technical terms, in the early life of a product adhering to the bathtub curve, the failure rate is high but quickly decreasing as defective products are identified and discarded, and early sources of potential failure such as handling and installation error are surmounted. In the mid-life of a product – generally, once it reaches consumers – the failure rate is low and constant.

In the late life of the product, the failure rate increases, as age and wear take its toll on the product. Many consumer products strongly reflect the bathtub curve, such as computer hard drives or processors.

In addition to the bath tube curve there are several different other theories which can be used in describing the phenomena of late markets. One which could be interesting to study is the so called catastrophe theory. Catastrophe theory, originated by the French mathematician René Thom (1923-) mainly in the 60's, is a special branch of dynamical systems theory. Whether the "Cusp" which is the simplest one f the elementary catastrophes in this theory could be applied in describing sudden changes in the market arena would be interesting to study. The focus could for example be to find out the initiating factor causing the whole market to fail. A catastrophe implies, namely, any discontinuous transition which occurs when a system can have more than one stable state or can follow more than one stable pathway of change. The cusp is eminently suited for illustrating nonlinearities where e.g. using different systems control methods gives completely different end results. Therefore this theory could be applied to, finding out the initiating factors in different paths of the whole supply chain. A further study topic could of course be to see whether these factors are the same in the different parts of the supply chain.

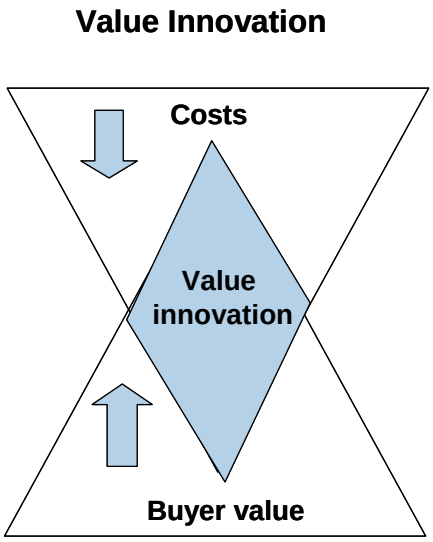
3.2 Recapturing Value by Value Innovation

Value innovation describes a process where a company tries to create a new business design in order to be able to generate profit again – i.e. jump back to the value inflow part of the value migration curve.

Value innovation is described by W. Chan et al. in "Blue Ocean Strategy" as the region of the company's activities, which has the *most positive impact on its cost structure and its value for the customers*. Here cost savings are made by reducing or eliminating factors, which have been destructive for the company's cost competitiveness. New offerings are created, which results in increasing buyer value. This results in further reduced costs as the scale of economics works with increased sales volumes.

Value innovation can in a broader sense be seen as a complete strategy process where all company activities are considered. Value innovation, hence, requires companies to orient the whole system towards achieving a leap in value for both buyers and themselves.[7] Figure 3-4 illustrates the concept of value innovations. According to the authors of the Blue Ocean Strategy, equilibrium exists where cost competitiveness and buyer value can be maximised at the same time.

Figure 3-4
Value Innovation



The simultaneous pursuit and low cost

Source: Pöyry Forest Industry Consulting, Drawn from, W Chan Kim, Renée Mauborgne, Blue Ocean Strategy, Harvard Business School Press, 2005

[7] W Chan Kim, Renée Mauborgne, Blue Ocean Strategy, Harvard Business School Press, 2005, p. 17

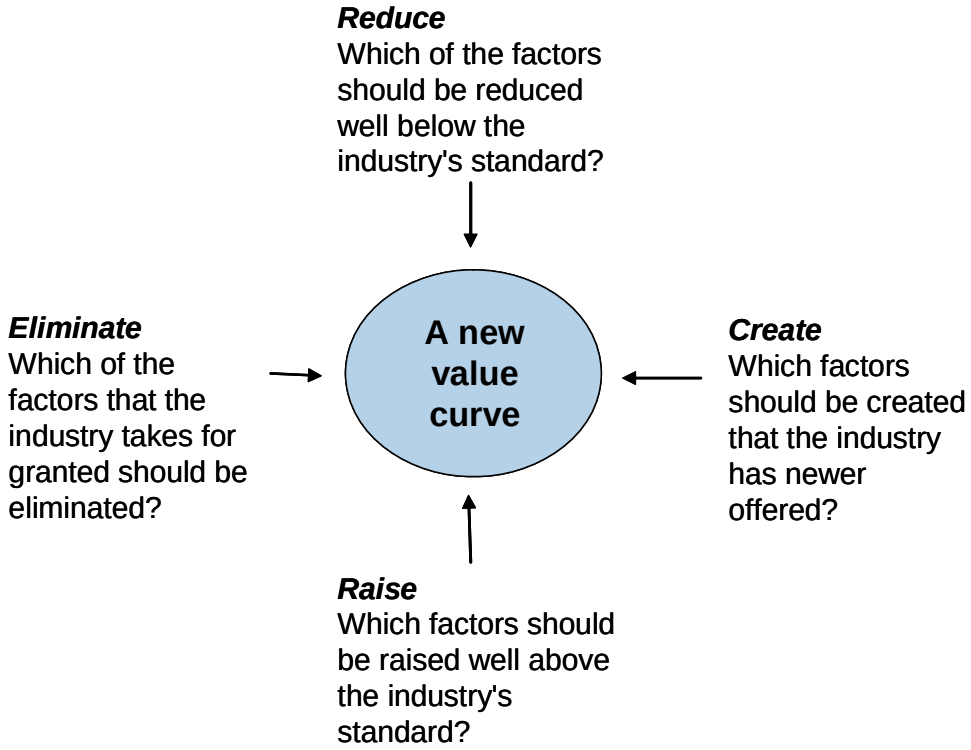
3.2.1 Creating a New Value Curve: Blue Ocean Strategy

One way to determine the equilibrium of value innovation is by defining a four-action framework, which can be used in creating a new value curve. These definitions give the basics for the so called "blue ocean strategy", which aims at lifting a company from the value outflow process straight to the value generation process through a quantum leap in business design. According to the creators of the "blue ocean strategy", the key questions to challenge an industry's strategic logic and business model are:

- Which are the factors that the industry takes for granted that should be eliminated?
- Which factors should be reduced well below the industry's standard?
- Which factors should be raised well above the industry's standard?
- Which factors should be created that the industry has never offered?

The big picture evolves hence, into the chart in Figure 3-5.

Figure 3-5
Rules for Creating a New Value Curve



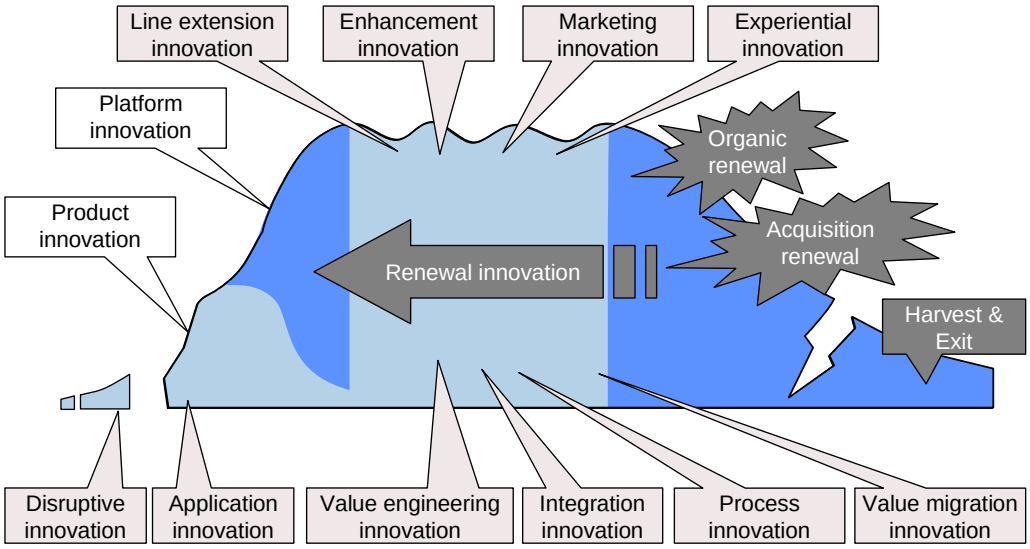
Source: Pöyry Forest Industry Consulting, Drawn from, W Chan Kim, Renée Mauborgne, Blue Ocean Strategy, Harvard Business School Press, 2005

According to the authors of the Blue Ocean strategy companies can efficiently use the concept of *eliminate, raise, create and reduce* to move the company to a new position on the value curve. The outcome of this analysis is profitable if it is ultimately designed and implemented in practice – assuming the analysis was correct in the first place.

3.2.2 Recapturing Value: Dealing with Darwin

Another analogy for determining how a company should process in trying to renew its business was presented by Geoffrey A. Moore in "Dealing with Darwin". Moore stresses that it is important to take into account in which phase of the product life cycle one's products are. Depending on the phase different types of strategies are to be applied. Figure 3-6 presents the author's view of how to process in recapturing value.

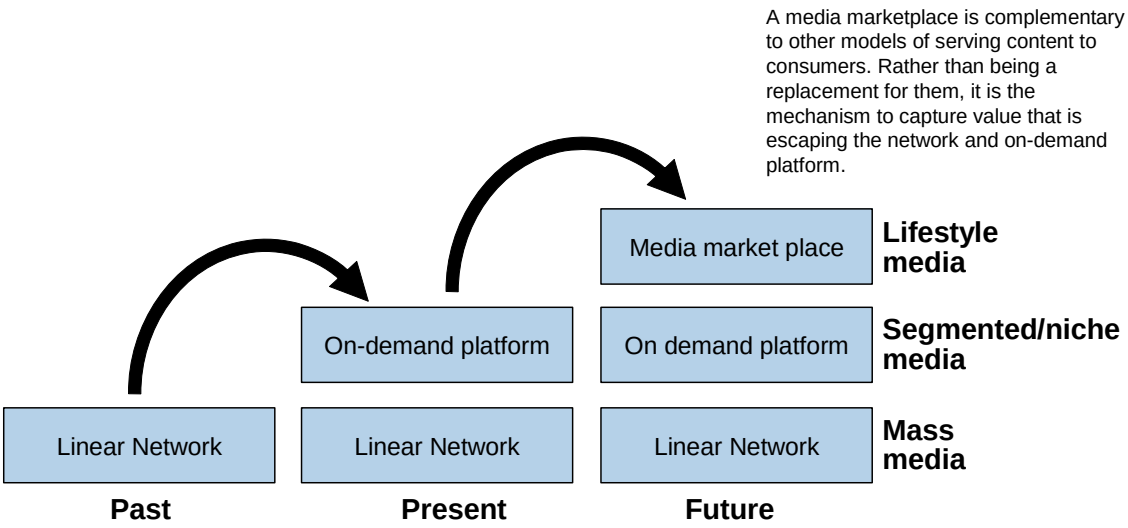
Figure 3-6
A Broad Universe of Innovation Types



Source: Pöyry Forest Industry Consulting, Drawn from Geofrey A. Moore, Dealing with Darvin, Capstone, 2006

An example of a business area, which is currently under great evolution, is the media market (Figure 3-7). This market was previously characterised by a linear network between producers, suppliers and end-users. Currently this network has evolved into a two-phased network with an integrated on-demand function steering demand and production functions. In the future, it is foreseen that this market place will evolve even further into containing a third platform called the "media market place". In this function, operations are no more based on conventional production templates but rather on complementary models of serving content to consumers.

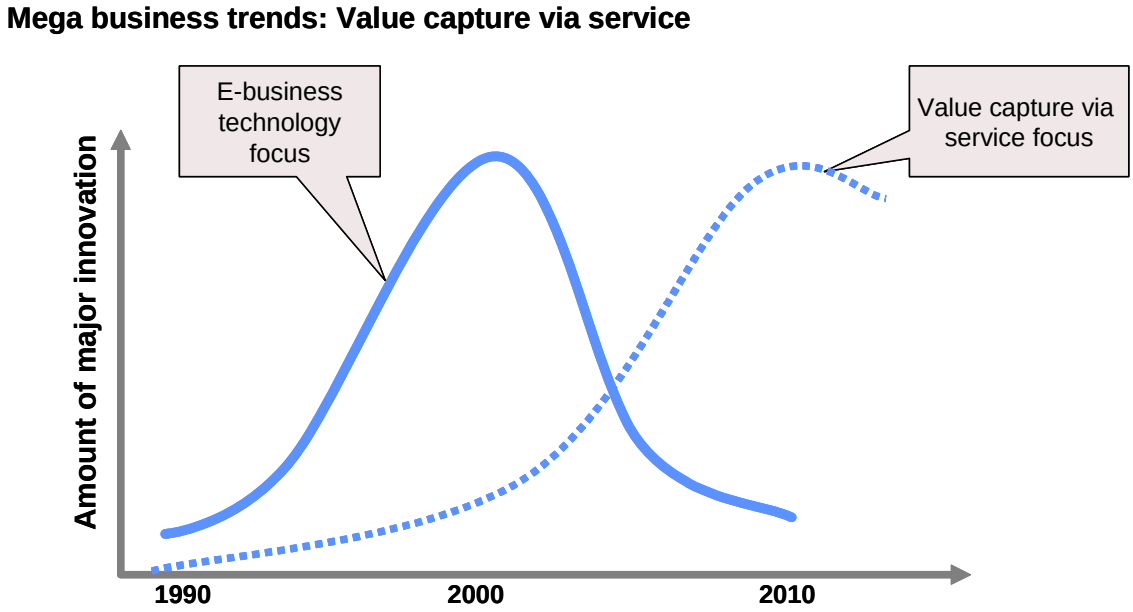
Figure 3-7
Media Market Place



Source: Pöyry Forest Industry Consulting, Drawn from Price Waterhouse Coopers, The Rise of Lifestyle Media, 2006

Creating new services has lately been seen as one option for creating added value on current or existing technology platforms. Several scenarios predict that such a value capture process can be done as shown in Figure 3-8. This opportunity has been noticed by many actors, instances in the industry and the race for developing the next generation services is high.

Figure 3-8
Value Capture via Services



Source: Pöyry Forest Industry Consulting

3.3 Link to EFORWOOD

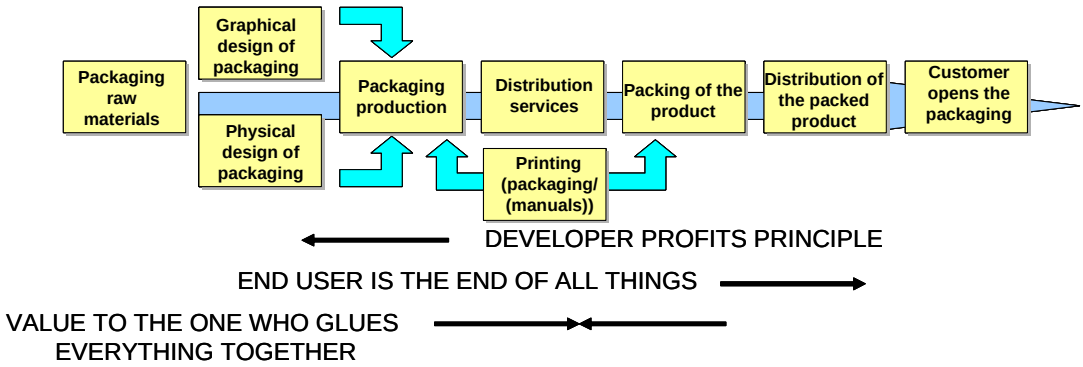
Value migration mapping is not possible with EFORWOOD tools. It requires much more detailed information on industry or company than the one inserted into the forestry wood chain model. Some estimation can be made analysing reference future data and gross value added changes in the future projections. This information might indicate the state of different forest and wood products in the value migration curve as well as the bath tub curve. Please note that the reference future projections are based on EFI-GTM data and are not official Pöyry forecasts.

“Innovations” is listed as one of the Eforwood’s indicators. However, this indicator is neither collected nor analysed in the forestry wood chain, because of the lack of uniformly defined and even tolerable quality data. The value-effect of one innovation is analysed in the technology scenario where sawmill technology changes because of innovations.

4 DIFFERENT TYPES OF SUPPLY AND VALUE CHAINS

The supply chain looks very different in different industries. Generally speaking there are two different base types of value chains – a buyer driven or a producer driven one. As Figure 4-1 illustrates there is, however, also a third dimension where value creation is concerned. The third driver in the chain can also be the integrator, the party that "glues all pieces" together, which means that the chain is dominated by the player in the middle of it. E.g. the packaging supply chain in Figure 4-1 is a good example of such a chain where the players in the middle, converters, might be very well positioned in the value creation process.

Figure 4-1
Value Chain for Packaging Products



Block 1: "DEVELOPER PROFITS PRINCIPLE"
Value moves towards suppliers (chemicals etc.), who do R&D and provide the competitive edge

Block 2: "END USER IS THE END OF ALL THINGS"
After e.g. supermarket wars, the value and power moves even more to the ones closest to the consumer

Block 3: "VALUE TO THE ONE WHO GLUES EVERYTHING TOGETHER"
The paper industry links to suppliers and clients for joint R&D, with paper being the combining link.

Source: Pöyry Forest Industry Consulting

Depending on what product is produced, different types of supply chains can be discovered. Table 4-1 presents one way of categorising different supply chains. According to this table, product characteristics determine the way a supply chain looks. Here, the products are divided into four different types of supply chains; a *fashion*, *engineered*, *stable* and *commodity* one.

Table 4-1
Supply Chains Categorised by Products

Product segment	Examples	Product characteristics
Fashion	• Trendy cell phones • Portable music devices	• Unpredictable demand, marketed by rapid change and steep decline • Short life cycle • Competitive, multichannel mass market • Design and demand both driven by consumer
Engineered	• High-end routers • Main frames	• Unpredictable demand • Long life cycle > 2 years • Evolves over time through reengineering • Configurable • Made-to-order
Stable	• Automotive electronics • White goods	• Predictable demand • Long life cycle>2 years • Design is configured to product and not easily substituted
Commodity	• PCs • TV tubes	• Unpredictable demand • Long life cycle >2 years • Competitive market, driven by price • Industry standards allow easy substitution of one for another

Source: Pöyry Forest Industry Consulting, Drawn from, Aditya Pande, Ramesh Raman, and Vats Srivatsan, Recapturing your supply chain data, McKinsey 2006

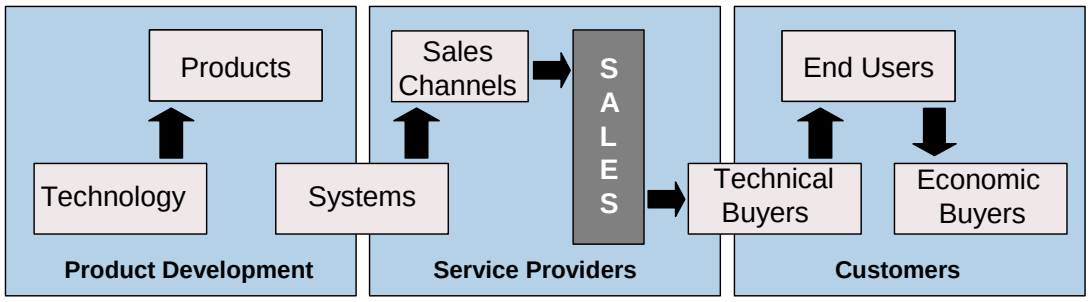
Many multinational companies have different types of products and therefore also different supply chains to manage. Supply chain and inventory management in these companies become a management of a portfolio of different product strategies.

4.1 Fashion Products

Characteristics for the *fashion* supply chain are that the demand is hard to predict. Since the demand is based on consumer mindsets on design, this unpredictability is to be expected. In these types of products effective supply chains are of the utmost importance. Companies must be able to deal with rapid changes with steep declines in demand and very short product life cycles, which are a result of changes in consumer mindsets. Here, effective companies master the business environment by multi-channel mass-marketing. Iterative product design changes effective marketing in ways that flatten steep demand changes. On the one hand, knowledge of the availability of components and manufacturing capabilities of a subcontractor is important to master whereas on the other hand, information flows and good feed-back mechanisms from retailers and end-consumers have to be very effective to enable rapid responses to upcoming changes in the market. The Bullwhip Effect (or Whiplash Effect) is an observed phenomenon in forecast-driven distribution channels. Monitoring and mining of point-of-sale (POS) data is used as an aid in managing rapidly changing demand. Examples of typical fashion products are high technology products such as mobile phones or portable music devices.

An example of a typical value chain for fashion products is shown in Figure 4-2. Here, the value chain is divided into three major parts: product development, service providers and customers. The most critical parts in the value chain become, obviously, the transaction points between these three areas.

Figure 4-2
A Typical High Technology Value Chain



Source: Pöyry Forest Industry Consulting, Drawn from Geoffrey A. Moore, Gorilla Game

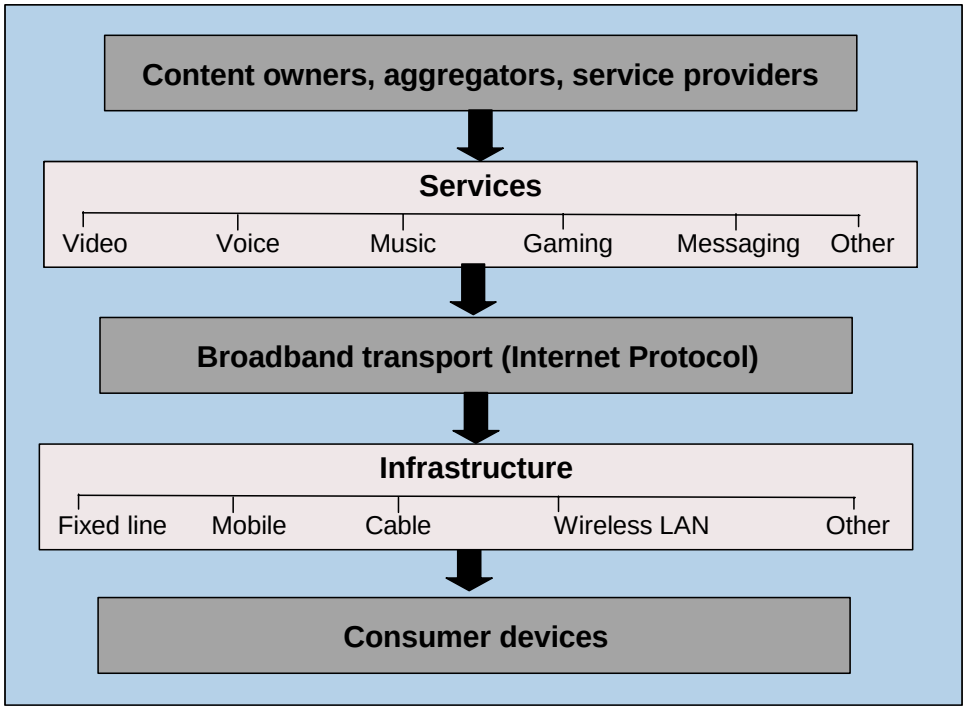
As a new type of fashion products, we have internet services, which have dramatically redefined conventional business environments. Traditionally, media has been funded by advertisers and consumers. The Internet has, however, introduced the (illusory) concept of "free". It is no more obvious that consumers are willing to pay for content. Companies have been forced to think about new ways of generating profit. The value chain has in some cases changed completely. Currently many Internet sites are offering the main content for free and having customers pay for additional services. "Fifa 07", a video online game for soccer fans, is an example of such an internet service. It was introduced in Asia as a completely free-of-charge online multiplayer game. The business logic is built on "addiction". When the player is once "hooked" on the game he is offered ways to gain advantages – an edge on opponents. These are, however, not free of charge. According to a recent survey conducted by PriceWaterhouseCoopers and Accenture based on face-to-face and telephone interviews with more than 130 executives from different types of media and advertising companies around the world, the role of advertisers will grow in funding media content, which will be offered for free for consumers on internet sites[8].

Development of new devices and tools to share and utilise information will expand utilisation of business logic where some parts of products are distributed for free. Moreover, this development will be facilitated by the fact that different media tools are converging. Convergence in this sense means that different platforms carrying information (broadcast, satellite, cable, telecommunication) can offer similar kinds of services on different consumer devices such as telephones, televisions and PCs.

Hence, development of open interface protocols for communication enables access to content more independent of networks and devices[9]. Figure 4-3 gives an example of the development of services and how these will result in convergence in the media offerings value chain. This means that it will become harder to put a price on content.

[8] For media companies, "free is the new paid", International Herald tribune, January 18th, 2007
[9] PriceWaterhouseCoopers, The Rise of Lifestyle Media, Achieving Success in the Digital Convergence Era

Figure 4-3
Development of Media



Source: PriceWaterhouseCoopers, The Rise of Lifestyle Media

4.2 High Engineered Products

The value chain for high *engineered products* has a longer life cycle than the products described in the fashion supply chain. Here, the life cycle can be up to 5 years. For these types of companies, effective SCM is also of the utmost importance. Since the demand is hard to predict, the supply chain has to run as efficiently as possible. The critical issues to manage are different information flows, which feed order configuration management, assembly, re-engineering and product configuration as well as design functions.

The products in this category are developed in small steps over time. Critical issues for these products are order configuration management and selection of materials and assembly. As time goes by and these products go further on the life-cycle, the importance of design changes becomes more essential. Other important issues not to forget are visibility into supply and capacity across product lines, and the effective coordination of change-management information and decisions among designers, assemblers, and components suppliers (roles often undertaken by different players in the technology supply chain).

Examples of products belonging to this group are high-end routers and storage equipment.

4.3 Stable Products

Stable products are, as their name indicates, less volatile. They are produced under a longer contract time and therefore remain unchanged over a number of years. Typical examples of such products are electronic components for automobiles. These products are, however, very cost sensitive, which is why important parts in the supply chain include distribution, costs and the management of the logistics chain.

4.4 Commodity Products

Commodity products, e.g. PCs or TV tubes are products with an unpredictable demand. The lifecycle of these products is however longer than for those belonging to fashion products. The main driver on the commodity product market is price, which is why cost becomes the most important issue in the supply chain. Transparency into all costs along the whole supply chain starting from subcontractors, partners to distribution and retail is of the essence.

4.5 Link to EFORWOOD

The only fast moving consumer products included in the forestry wood chain are some of the paper products. Paper itself is not considered as fashion product, but the printed content in it or the value as a package can be it. All other products included in the forestry wood chain analyses are long lasting products like furniture, houses and joinery. Different products of the value chain can be segmented and the value added of the product segments analysed.

In EFORWOOD the analysis of a single product is not feasible because of the structure of the total forestry wood chain. The chain describes the forestry wood chain as a one big chain and the accuracy of data is not sufficient to analyse just one or two products

5 VALUE NETWORKS

In literature, value networks are defined as complex sets, which contain information on both technical and social data. Interlinkages are defined between different activities, which form complex networks with information flowing in different magnitudes between nodes in the network. The information in these networks is quantified as the value. The value can take different forms. It can assume the guise of knowledge, intelligence, a product (business), services or social good. Included in a company's value networks are research, development, design, production, marketing, sales, and distribution (business). In economic terms, the aim with value networks is to be able to define the total value of products and services. Companies have both internal and external value networks. External networks include customers or recipients, intermediaries, stakeholders, complementors and suppliers. Internal value networks focus on key activities, processes and relationships that cut across internal boundaries, such as order fulfilment, lead processing, or customer support. Value is created through exchange and the relationships between roles. Value networks can be found operating on many levels in our society. Public agencies, civil society, an enterprise, institutional settings, and all forms of organisation are examples of such networks. Value networks can be used to analyse and improve issues not only in the economic sphere but also in the domain of social good and environmental well-being.

5.1 Tangible Value

Value can be quantified (where it can be quantified) in different ways. When defining value in economic quantities, the value is defined as a tangible value. This concept includes all exchanges of goods, services or revenue, including all transactions involving contracts, invoices, return receipt of orders, request for proposals, confirmations and payments. The tangible value flow of goods, services, and revenue include also products and services that generate revenue or are likely to generate some. In government agencies, these would be mandated activities. In civil society organisations, these would be formal commitments to provide resources or services.[10]

5.2 Intangible Value

Intangible value can be divided into two different sub-categories: *knowledge* and *benefits*. Intangible knowledge exchanges contain strategic information, planning knowledge, process knowledge, technical know-how, collaborative design and policy development. This knowledge change supports the product and service tangible value network. Favours that can be offered from one person to another are also considered as intangible benefits. Offering political or emotional support to someone are examples of such. Another example of intangible value is when a research organisation asks someone to volunteer their time and expertise to a project in exchange for the intangible benefit of prestige by affiliation.[11]

[10] Wikipedia, www.wikipedia.org/
[11] Wikipedia

Biological matter (including humans), work in a self-organised mode in order to keep going. They are built of cells and DNA, which are assembled together with large interactive networks. In these, there is, however, no central "boss", which would steer and control the activity. Relationships between individuals also progress through comparable circular free-flowing processes. For example, in searching outcomes, which support our necessities, such behaviour is used. Under the right conditions these social exchanges can be extremely unselfish. Conversely, they can also be quite self-centred and even aggressive. The context of the immediate environment and the people involved dictate what type of behavioural manners are adopted.[12]

5.3 Relationship Management

Focusing on managing information about customers, suppliers, and business partners is called relationship management. A value network approach considers relationships as two-way value-creating interactions, which focus on realising value as well as providing value. A network of relationships may also evolve brokers – nodes in a key position between groups of relationships.[13]

Studies on network relationships include e.g.

1. Network Externalities (Katz &Shapiro 1985)

In this analysis of industrial standards, it was stated e.g. that a product's value increases as its use increases, i.e. the more users, the greater the value for each.

- If there are barriers to entry, one can start by giving the first products for free
- A direct effect is to be seen in e.g. phone lines, faxes, SMS's, emails: the more people that use these services, the greater the value for each.

- An indirect effect is seen in e.g. PCs, VHS-recorders, DVD-players, digital TVs and cars: the greater the amount of users, the better the equipment and services. For example Volkswagen and Toyota as major global brands can offer an advantage in post-sales service.

That is: new buyers buy themselves a place in a network of existing users. Sometimes, a product that dominates the market or is expected to dominate it fetches a higher price (e.g. Microsoft Office). Other products have a pressure to conform to the dominant.

2. First-Mover Advantage (Lieberman & Montgomery 1988)

First-mover-advantage describes an advantage in market entrance a company gains by doing a fast entry to the market. As it the fist to introduce its product to a market it will immediately occupy some share of the market. Especially in markets with short product cycles such as telecommunication and electronics companies which will introduce their products after the first mover are perceived as followers. Sometimes the first mover is, however, not able to capitalise on its advantage, leaving the opportunity for another company to gain second-mover advantage.

[12] Wikipedia
[13] Wikipedia

5.4 Examples of Value Networks in Industry

Many researchers have recognised these kinds of supply network structures as a new organisation form, using terms such as "Extended Enterprise", "Virtual Corporation", Global Production Network", and "Next Generation Manufacturing System"[14]. In general, such structures can be defined as "a group of semi-independent organisations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration"[15].

5.4.1 Case 1: Industry Clusters

Cluster analysis of industries is a relatively new approach (see Figure 5-1), though the phenomenon itself may be said to be much older. Finnish research into clusters is extensive and the resulting literature rich. For example Hazley, 2000, gives three differently focused broad definitions of clusters, which are:

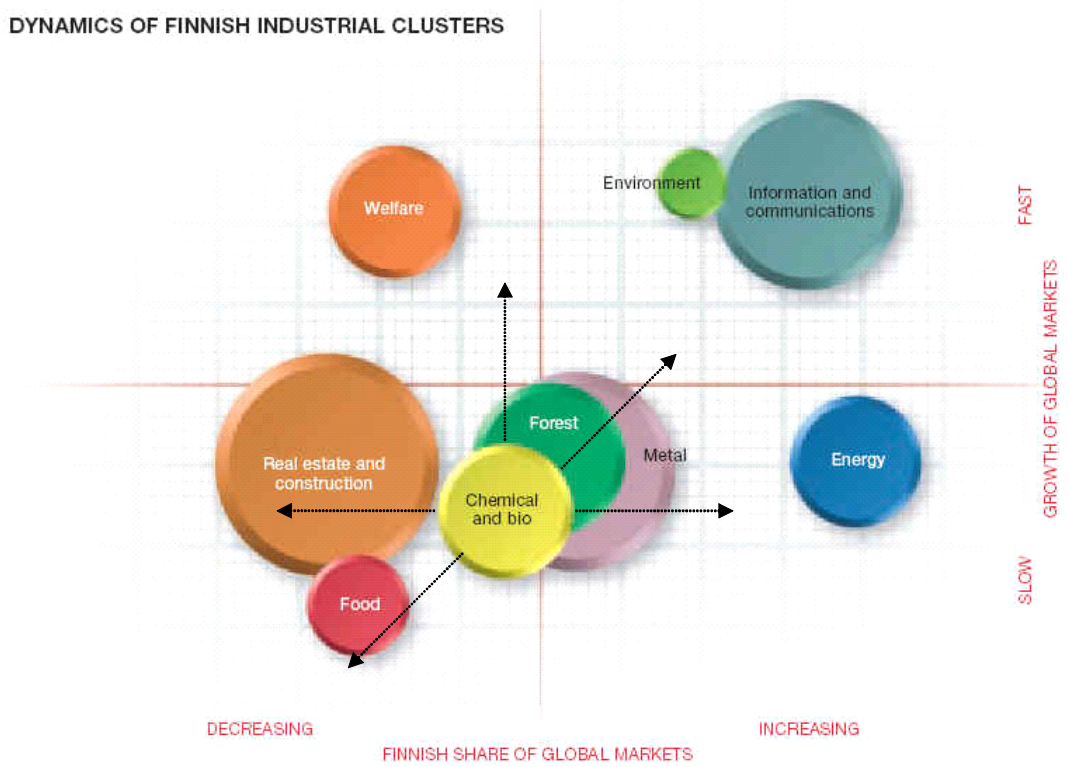
- *Regionally concentrated* forms of economic activity within related sectors, usually connected through shared information, education or R&D
- *Vertical production chains*, where companies from the different production stages form the core of the cluster
- *Sectors defined at high level of aggregation* e.g. the chemical cluster or even higher levels of aggregation

The Hazley effort is an outcome of the Forest Cluster Project that was carried out by the Research Institute of the Finnish Economy (ETLA) in 1997-1999. The project was among other things an attempt to raise the profile of Finnish (and generic) forest cluster thinking in ever wider circles and improve the attractiveness and the image of the forest cluster.

Clusters have also been defined as: *geographical, horizontal, vertical*, *lateral, technological, focal and quality of network*. The first three are perhaps the most familiar and best understood. In a *lateral* cluster capabilities can be shared between different sectors and economics of scope can thus be achieved. A *technological* cluster is characterised by its sharing of basic technology. A cluster of companies around a central actor can be described a *focal* cluster. *Quality of network* refers to the way in which clusters co-operate, which can be innovative or quite the opposite.

[14] Drucker, 1998; Tapscott, 1996; Dilts, 1999
[15] Akkermans, 2001

Figure 5-1
Dynamics of Finnish Industry Clusters

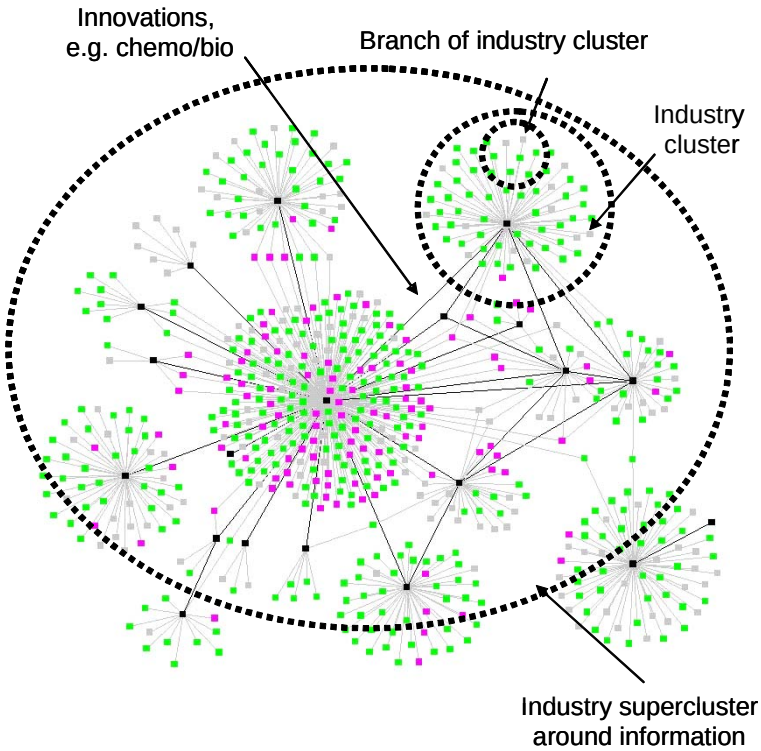


Source: TEKES

Figure 5-2 gives an example of an industry cluster. This figure goes even further into illustrating a super cluster containing several smaller clusters.

Figure 5-2
Industry Cluster

Not pulled by gravity or black holes but by enabling technologies linking clusters, we can envision the industry clusters drifting together into superclusters around e.g. communication and the processing of information – with chemical and biotechnological innovations as examples of connectors.



Source: Pöyry Forest Industry Consulting

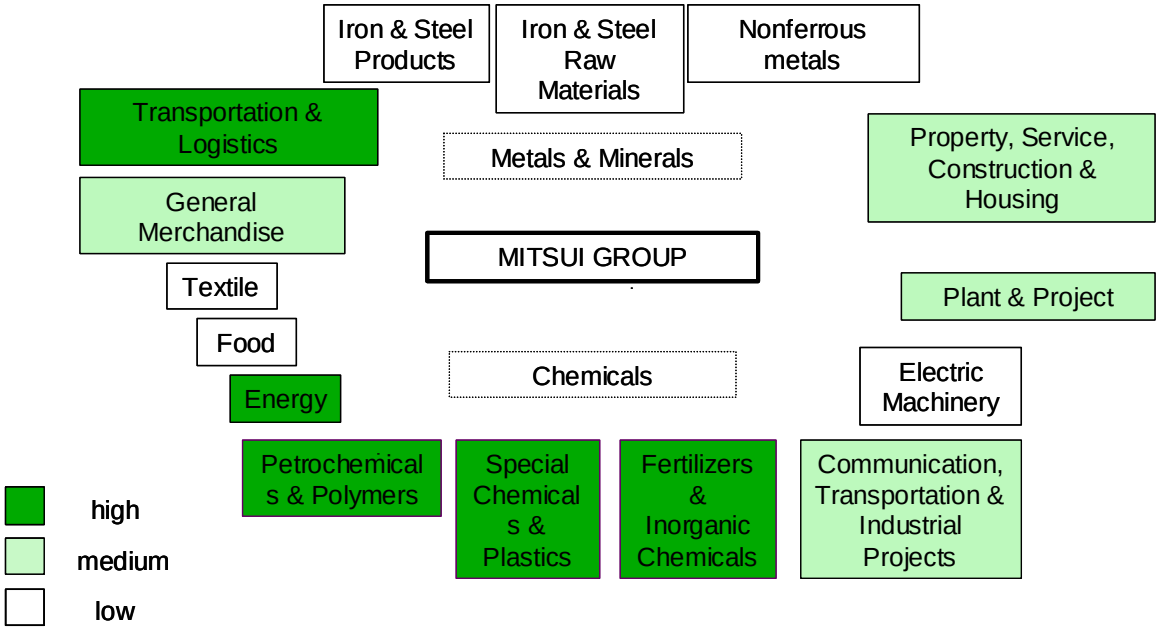
5.4.2 Case 2: Japanese Keiretsus

The Japanese have a tradition of clusters. This has been their way of organising business for centuries. The names of Japanese company clusters are world-famous but few know how wide their range of products and services actually can be. Individual companies may belong to a larger trading-house-centred group, but they may also form a net of subsidiaries and affiliates around themselves. The spectrum of products marketed under e.g. the name of Mitsubishi ranges from heavy machinery and cars to pencils or from daily food products to financial assets. The name "vertical keiretsu" better describes companies that have a common name on the top and form a hierarchical organisation with numerous subsidiaries.

Around the main company in a *keiretsu*, there are affiliated companies and subsidiaries. A typical group includes at least some sort of industrial activity (usually heavy industry, construction etc.), logistics (a transportation network) and finance (banks, insurance companies). The ownership and power structures within and outside a *keiretsu* are very complicated. Cross-holdings of shares, holding positions in the decisive organs of another group company (board of directors) and joint-venture-activities are among the most frequently used ways to stick together.

Cross-holdings are among the more visible forms of keiretsu organisation. Of course there are all kinds of mutual more or less unofficial agreements, behind which can be discerned the concept of loyalty (a persistent, mainly neo-Confucian influence in the Japanese culture). These are very discrete and confidential and it is next to impossible to find any research on the mental side of. Figure 5-3 demonstrates Mitsui group Keiretsu. Mitsui is a trading house. The colour corresponds to the relevance of a particular operations group to the forest sector. A dark green coloured box indicates high relevance, light green some relevance and uncoloured boxes low relevance or nothing at all.

Figure 5-3
Mitsui Group – a Keiretsu – and its relevance to the forest sector



Source: Pöyry Forest Industry Consulting

5.5 Link to EFORWOOD

As the forestry wood chain includes only a simplified chain and does not include the forest cluster as a whole e.g. chemical industry and information and technology industry are not included in the analysis. This means that the ToSIA analysis does not include any other industries than forest industry. The analysis of different reference futures or scenarios is not able to take forest industry related industries into consideration. This means that e.g. the consequences of the diminishing of European raw material in Natura 2000 scenario for the chemical industry are not assessed.

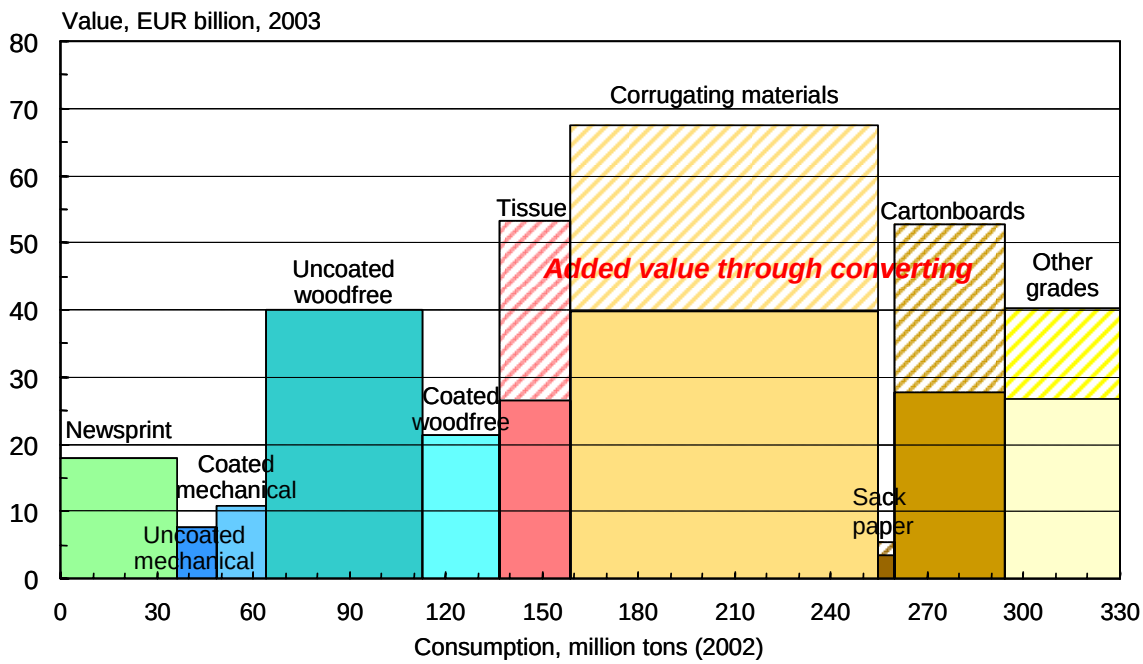
6 VALUE OF FOREST INDUSTRY PRODUCTS

The global forest industry offers a wide spectrum of different products. This diversity is also reflected in the value chains, value networks, value formation and value chain dynamics of the forest industry products.

6.1 Pulp and Paper Products

The value of the different pulp and paper products is as diverse as the range of possible end uses. **Error! Reference source not found.** shows examples of values of forest products. Value can be added through converting in all product groups.

Figure 6-1
Value of Forest Products



Source: Pöyry Forest Industry Consulting

The differing value of these is due to not only different production processes but also varying value chain structures.

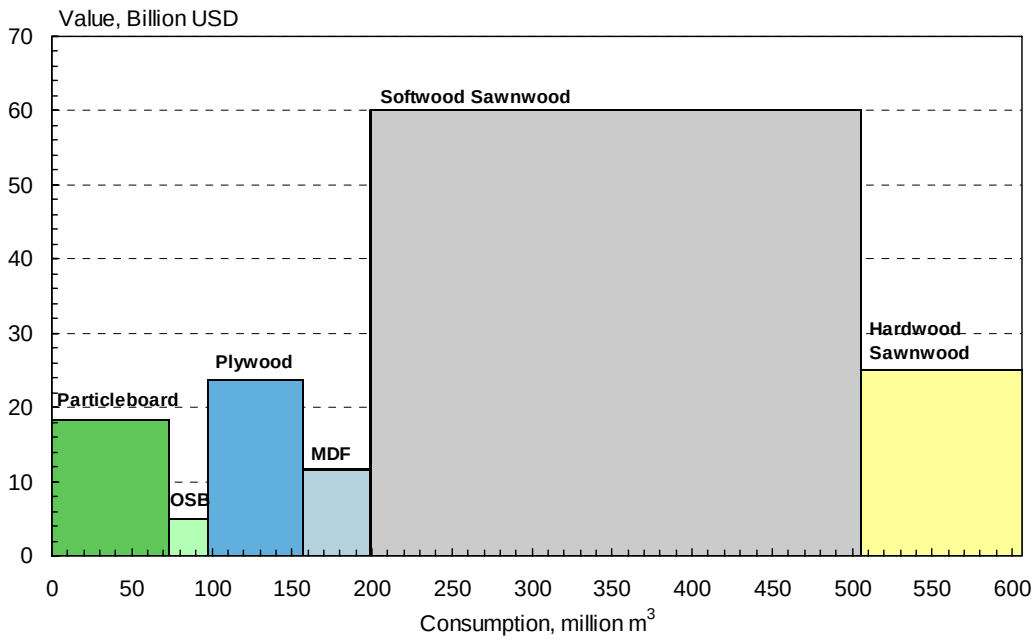
Only very few of the products produced in the pulp and paper industry are "final products" for the end-consumer. Most of them are so called intermediates or carriers of the "real product". They are either packaging materials protecting or carrying for example food products or they serve as carriers of content e.g. news. Only tissue products can be distinguished as "the final products" themselves. Moreover, the products differ greatly in the sense of how much of their value is produced during the initial production step. Figure 6-1 indicates quite clearly that the final product value is in many cases obtained in the secondary production step also known as converting. The packaging grades and tissue are often converted in these stages into higher value added materials.

6.2 Solid Wood Products

The mechanical wood products industry follows similarly with pulp and paper products a division into high and low value products. The degree of converting and length of value chain can be used as an indicator for measuring the value of the product.

As Figure 6-2 demonstrates, softwood sawn wood products constitute the largest amount of value created in this area. This group is by far the largest measured both by value and amount. The second largest product group contains hardwood sawnwood. The other product groups are quite small in comparison especially to the dominating soft wood sawnwood group. The complexity of the value chains and end uses are not necessarily reflected in Figure 6-2.

Figure 6-2
Value of Solid Wood Products 2006



Source: Pöyry Forest Industry Consulting

6.3 Link to EFORWOOD

In the forestry wood chain module 4 it has been decided to adopt a simplified chain. In reality, the production facilities in the pulp, paper and wood products industries tend to be highly individual. That's why module 4 has adopted a model mill concept. In addition, it was decided not to analyse everything in the forestry wood chain, but to cover 60-80 % of it. This means that for example tissue paper is not included in the analysis. This causes some uncertainty in the analyses of the chain. For example more wood is consumed actually by the forest industry that is shown in the current version (May 2009) of ToSIA analysis.

To be able to analyse the value differences in a more specific way e.g. which part of the value are due different production processes and which are due different value chains it's necessary to develop separate case studies with much more accurate chain with interconnections and loops and more specific indicator information.

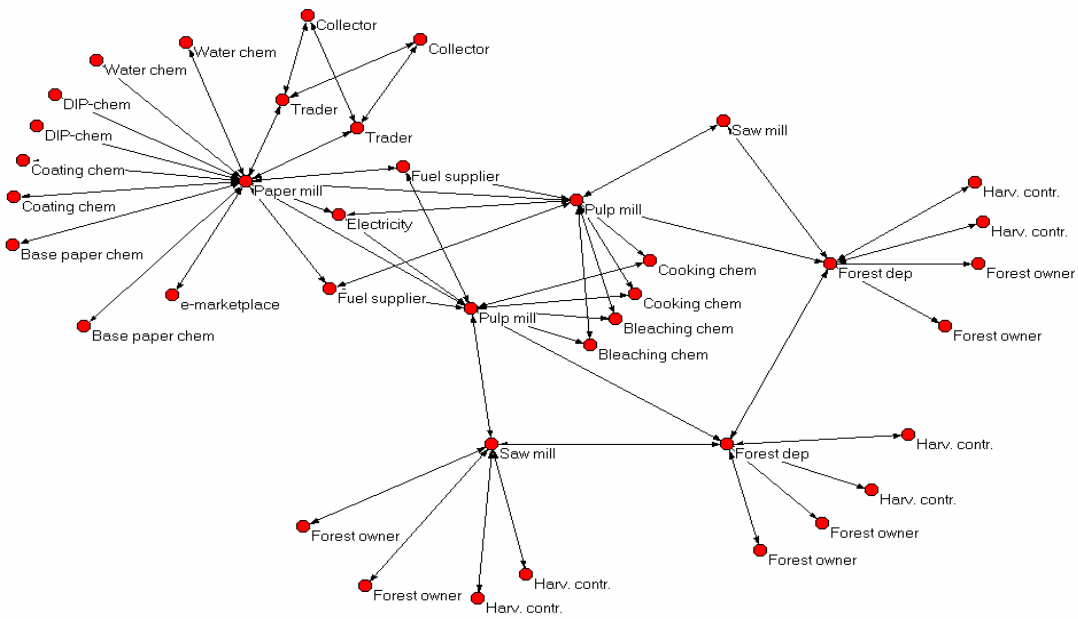
7 FOREST PRODUCTS VALUE CHAIN

As described in Chapter 3.3, there are different types of value chains and we would really be more justified in talking about value networks instead of chains. However, taking the chain perspective, the forest industry value chain can be seen as part of the segment of *value chains of commodity products* (Section 4.4) and *value chains of engineered products (*Section 4.2*) for very specialised products*.

The forest value chain is long with many different types of players involved. The chain starts from forest and depending on the end-products there are various intermediate steps involved. The value chain includes, in addition to the central production functions, most commonly players from the chemicals industry and energy as well as printer, publishers or retailers. If the end products are furniture made of solid wood there are of course also designers involved in the chain. Moreover, in some products there are players such as advertising agencies which might seem at a first glance not to have a major significance for value generation in the chain but which in reality have much to say in the final value creation process.

Figure 7-1 illustrates one value network in the forest industry. This network, illustrates, however, only the initial part of the process, which goes from forest owners to a paper mill and an e-marketplace (which is at least for the time being a totally insignificant distribution channel). It is interesting to point out, though, that already in this first part of the paper chain a vast number of different players is involved.

Figure 7-1
Communication Network or Value Chain from Forestry to Paper Mill



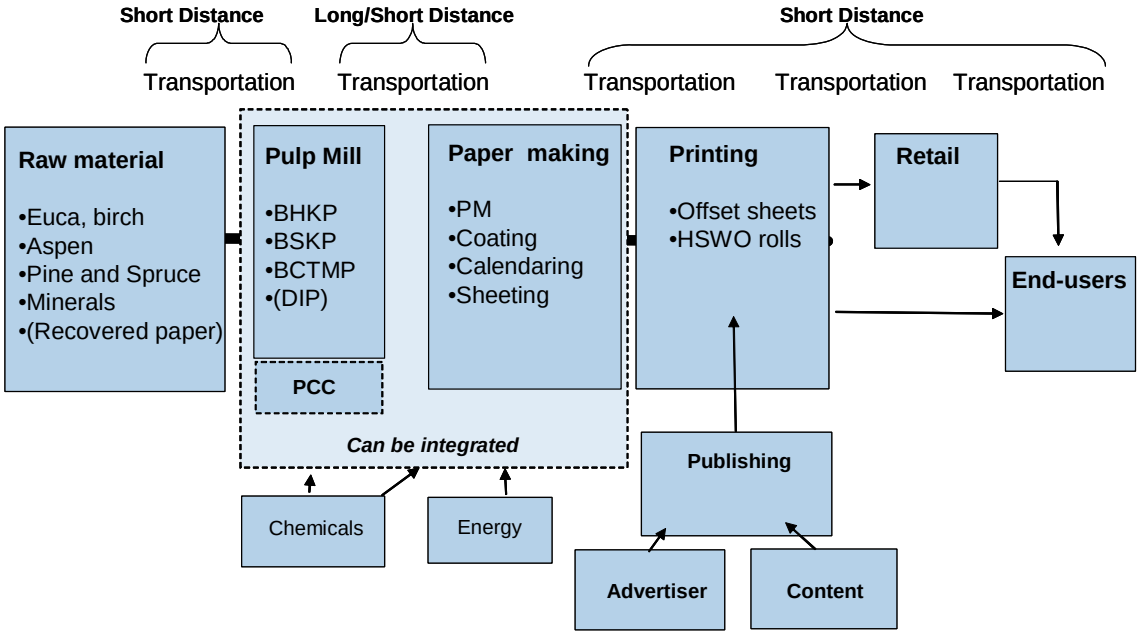
Source: Pöyry Forest Industry Consulting

As Figure 7-1 illustrates quite clearly, there are three dominating nodes in the network; *the paper mill*, *the pulp mill* and *forestry sourcing function*. These functions manage information between several different players.

7.1 Case: Magazine Papers

An example describing the chemical forest products industry is the magazine paper value chain (Figure 7-2). This value chain or network has several important input areas, which have an effect on value creation in the chain.

Figure 7-2
Magazine Paper Value Network



Source: Pöyry Forest Industry Consulting

The chain starts from the forests where a choice between raw materials can be made. The options are euca, birch and aspen for generation of chemical hardwood pulp, pine and spruce for generation of chemical softwood pulp or BCTMP, TMP or PGW. In some cases recovered fibres can be used. Moreover, an important factor in raw material sourcing is the choice of minerals, which vary heavily between different types of paper products.

The second part of the value chain consists of pulp processing with several different input values determining the profitability of this function. In addition to fibre, energy and chemicals are the most important parameters. Depending on the location of the production facility, logistics costs can become another important cost parameter (water and waste treatment in some places).

Paper making is followed by printing and publishing. The two last mentioned can be run either by the same operator or separate ones. Here, important players are also advertisers and other content providers who decide on the content to be printed on the papers. Important parties not to be forgotten are advertising agencies who have a lot to say about planning and design of the printed advertisements – or whether printed media are used at all as an advertising channel.

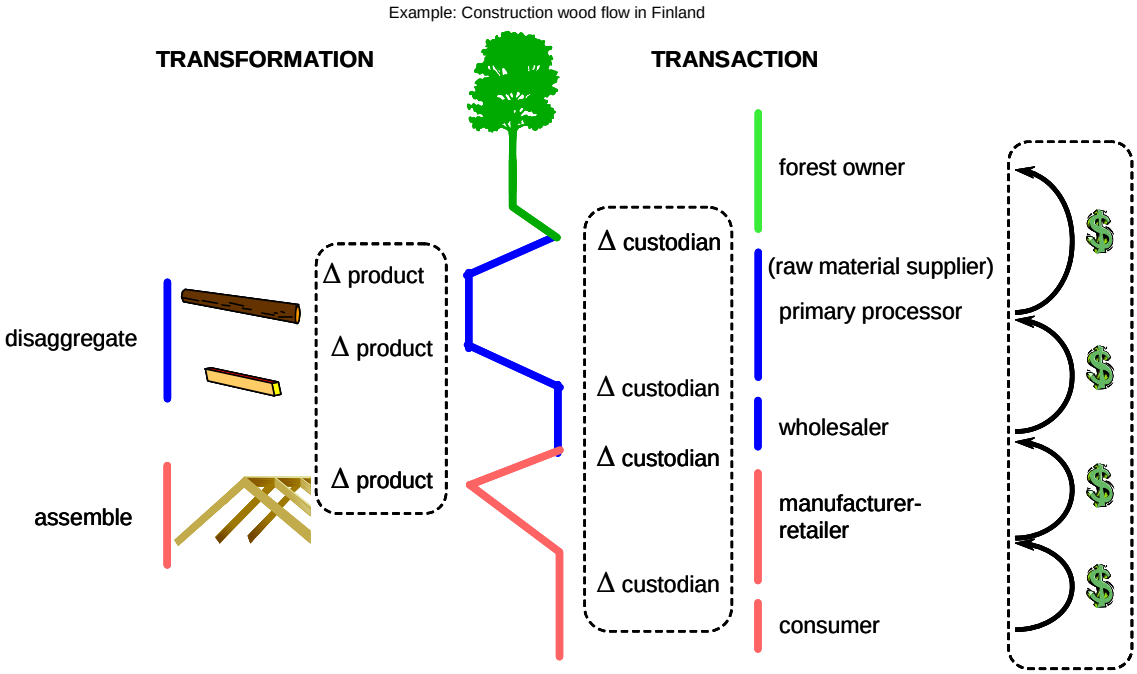
Finally this value chain ends with, the end-user who receives the products straight as a mail order product or through a retailer.

Depending on market, technology and political and competitiveness related issues, this chain is structured differently, if seen from e.g. ownership or raw materials related aspects. Traditionally, the pulp and paper industry companies have tried to reduce the risks by keeping a good control on the first part of the chain; i.e. resources and pulp making. However, since the impact of other cost components such as chemicals and energy has risen, the importance of only mastering the starting functions in the chain is not enough. The end of the chain is, however, also facing problems of same type. Lately, developments in new technologies have brought new types of digital distribution technologies, which will probably result in changes in the network structure (see e.g. Section 3.2.2).

7.2 Case: Solid Wood

The solid wood value chain in a construction material flow can typically be divided into two different major production phases. The primary phase, the transformation flow, contains the disaggregating of solid wood in suitable form by raw material suppliers – also called primary processors – and a wholesaler. The secondary step of the value chain consists of product assembly by manufacturers and retailers. Figure 7-3 illustrates both the transformation and the transaction flows in a solid wood chain. The bars on the right in the figure show the points where transactions take place.

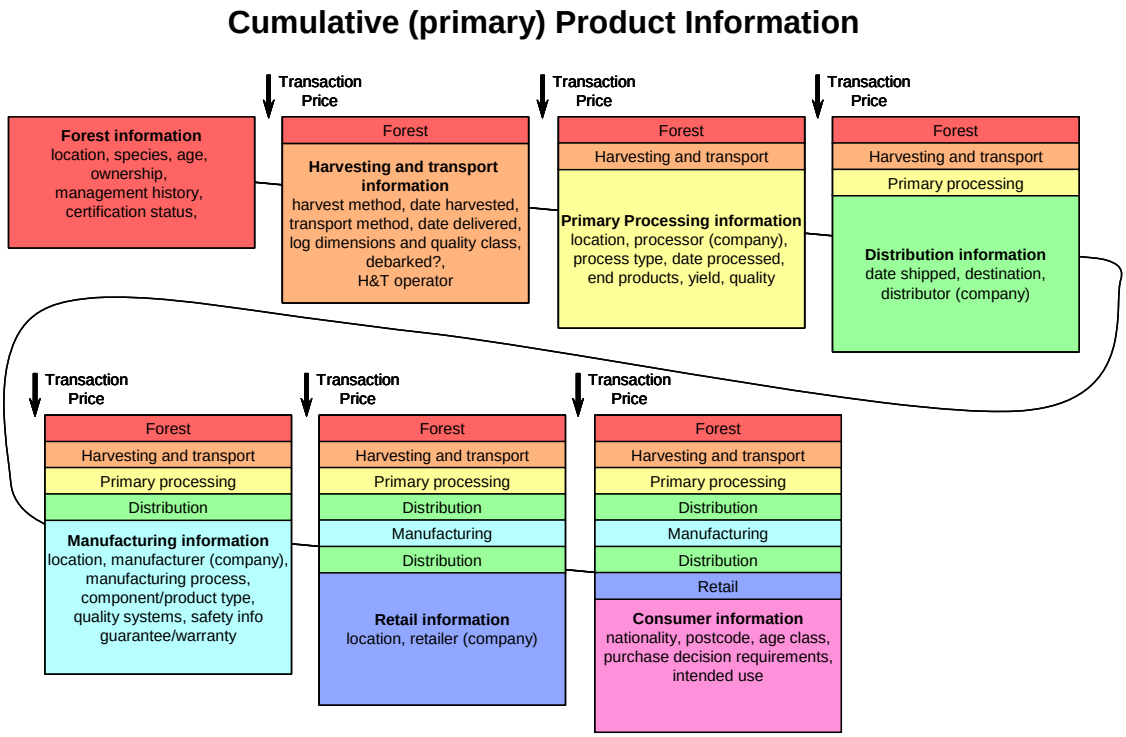
Figure 7-3
Solid Wood Value Chain



Source: Pöyry Forest Industry Consulting

The same process can be illustrated more in detail in Figure 7-4. Here, the different information flows are shown as *a cumulative information flow chart.*

Figure 7-4
Product Information Value Chain: Cumulative View



Source: Pöyry Forest Industry Consulting

7.2.1 Value chain example: Sawmill industry in Finland 1990's

In the beginning of 1990's Finnish sawmill industry was in crisis. Traditional business concept with bulk sawnwood, long distribution chain from forest to end users and poor transparency both into forests and to product markets, had to be changed. Prices of the products had to be increased and costs decreased. Higher sales prices could be obtained only by creating added value for the end users. That would be impossible without better transparency and possibility to steer material flow from forest to end users. Lower costs would require adoption of new technologies and increased effectiveness in logistics. All this required new ways of making business, new business concepts.

First steps in the development of new business concepts, was to find out most important end user segments/end users and their requirements on each market. In many cases traditional dimension, lengths and qualities, or even species, were not optimal from the end user point of view. New product specifications had to be derived from the end user requirements. Based on new product specifications also new raw material specifications had to be derived.

End users required also faster reaction in their needs as well as better scheduled and more precise deliveries. Deliveries through whole chain had to be developed. Sawmills had to transport products closer the markets by them selves.

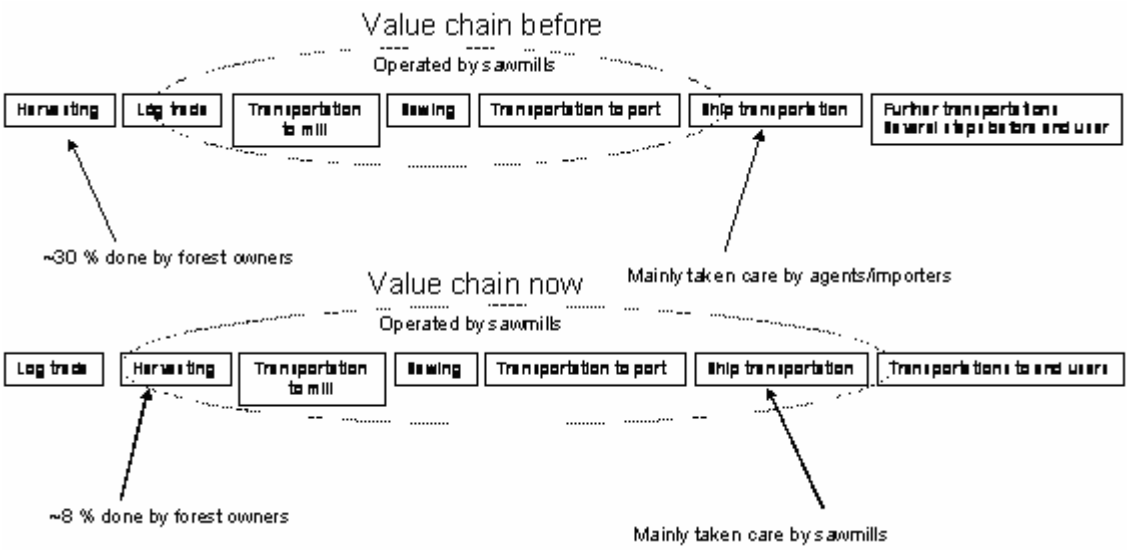
To be able to react fast in end user needs, harvesting is crucial part in the value chain. System to steer harvesters based on sawmills orders was developed. In practice that meant better data exchange between harvester and sawmill as well as more sophisticated stem optimisation based on new raw material specifications. These improvements minimized volume of unwanted log qualities, top diameters and lengths. This resulted in lower working capital in stocks in the value chain.

Sawnwood grading had been based on visual grading done by human being. Different segments and different end users had different quality requirements. Number of sawn wood grades increased due new product specifications. Human eye couldn't grade sawn wood accurately enough with required speed. Automated grading was developed to be able to grade specific products for clients. New grading technology enabled in many cases increase of the production volumes in the other departments as well.

For the sawmills changes mentioned above resulted more stable demand and cash flow. Adoption of new technology in harvesting and in sawing resulted higher productivity and lower costs. The competitiveness of Finnish sawmills increased significantly as well as wood paying capability.

From the end user point of view sawmills were able to provide optimum dimensions, lengths and qualities. Due to more accurate deliveries material flow became more stable and predictable resulting smaller working capital in processes.

Figure 7-5
Finnish Sawmill Industry Value Chains before and now



7.3 Link to EFORWOOD

As an example we have analysed some processes which are modelled in the forestry wood chain like magazine paper mills and sawmills.

Like several other tools, ToSIA is highly dependent of the data quality. The analysis made in EORWOOD is highly dependant on the indicator data quality inserted in to the data base client by different partners. During the data collection it has become clear that not all assumptions have been discussed in the early phase of the project. This has resulted to a situation where different partners use different assumptions in their data calculations. We have done a lot of re-calculating of data because of later updated calculation assumptions, but it's possible that some assumptions are still different. This risks to result to a poor data quality. There have also been some issues to provide the required data: Some missing data might results to a situation where some parts of the chain can't be analysed at all.

Thus, as mentioned Chapters above: in the Eforwood project, good and well documented work has been carried out. ToSIA is a completely new system, and it is able to analyse a substantial amount of data. The data quality in ToSIA is acceptable for demonstration purposes. However, there is no universal tool that would be able to analyse all the imaginable problems and thus in some cases other tools should be used instead of ToSIA.

8 VALUE MIGRATION IN FOREST INDUSTRY

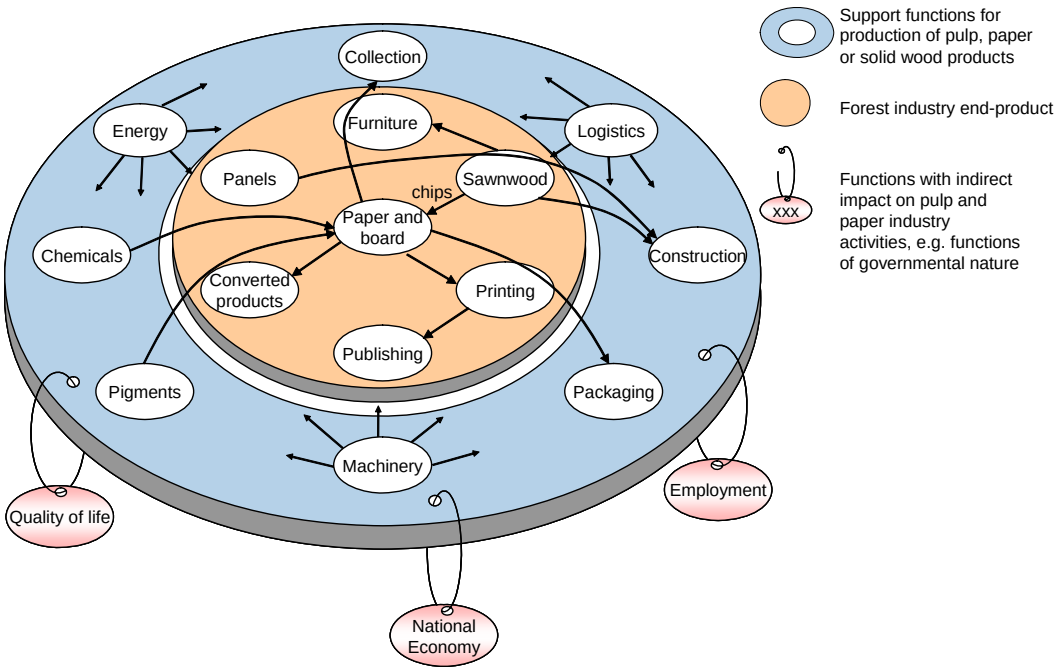
As shown previously, the forest products value chain is actually a network between a number of various players with different interests. It is not always evident in which part of the network the largest amount of value is created and how the whole network responds to changes induced by external factors. The interdependencies between these different components are so numerous that it is hard in real life to see or even measure the final impact on the value creation in this network.

One matter is, however, evident: when one cost position is changed, the final value creation effect in the network shifts. The different pieces of the network have different cost dependencies. These cost dependencies can be used to describe how value is transferred from one post to another. The key cost resulting in direct effects on value creation or destruction in the pulp and paper industry value network are

- Fibre price (including price of wood, pulp or recycled fibre)
- Price of chemicals
- Electricity price
- Fuel oil price
- Logistics costs
- Capital charges
- Labour costs

These cost components and their effects are illustrated in an *interrelationship diagram* in Figure 8-1. This figure describes one possible interrelationship network in the forest industry. The bubbles here illustrate the functions and arrows explain how these different functions are linked with each other. The core of the disc shows the central functions with a large direct impact on the value of the end-product whereas the outer ring contains issues, which will have an indirect impact on value of the final end-product. Costs of logistics, chemicals and energy can be seen as examples of such. The suppliers of these utilities will try to transfer increases in their production costs to their product prices, which will lead to increased costs in the following part of the value chain. Finally, this process will have an impact on the value generation opportunities of the final end-product. At the edge of the outer ring we have some examples of functions where changes can be made that might, however, have a severe impact on value generation in the whole value chain. These issues are for example related to national economy or laws and policies decreed both on national or international levels.

Figure 8-1
Interrelationship Diagram in the Pulp and Paper Industry

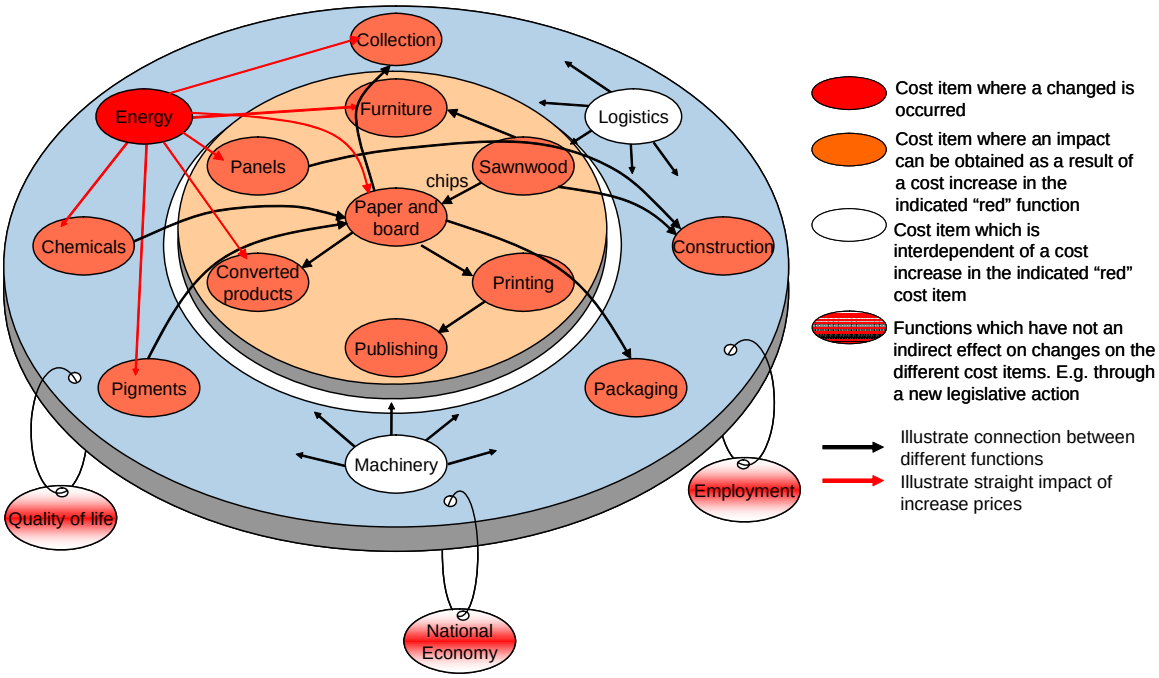


Source: Pöyry Forest Industry Consulting

If for example the price of energy rises, it is clear that the whole value network will face increased costs either through direct energy costs or by the fact that players in the previous part of the value chain will try to transfer their risen costs to the following step in the chain. Figure 8-2 illustrates how the impact of increased energy costs will affect the whole network both directly and through intermediate steps.

The total costs of raised energy prices will, hence, be higher than direct impact on a single step in the network. What is left unnoticed in this diagram is of course the fact that increased energy costs will also have an impact on such issues as quality of life and national economy and in some cases also on employment figures. Here, the linkages are, however, seen to be part of a greater spectrum, in mapping the total perspective of the national economy which falls outside the scope of this study.

Figure 8-2
Impact of Increased Energy Pieces in Pulp and Paper Industry Interrelationship Diagram



Source: Pöyry Forest Industry Consulting

8.1 Cost Dependency Model

The analysis described above can also be mapped to a cost dependency calculation. Hence, the cost dependency model can be applied in finding impacts of sudden changes of costs in a chain or a network containing several interlinkages between functions.

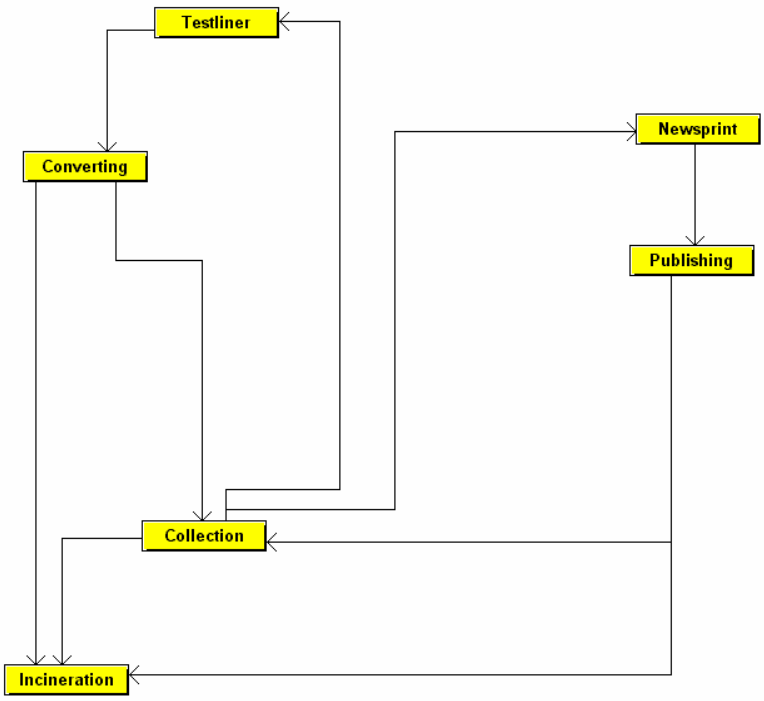
When an analysis is done according to the cost dependency model, the following logic can be applied:

Logic of cost dependency model:

- **Cost-A**: Identify the cluster components whose cost impacts need the closest watch
- **Cost-B**: Identify typical cost structures for those cluster components
- **Cost-C**: Identify the cost components that are modified in a significant way by the change.
- **Cost-D**: Calculate the propagated cost impacts and the changes in cost structure
- **Cost-E**: Calculate the changes in profit margins
- **Cost-F**: Depending on case definition, project the change in profit margin for a typical installation to the whole area being surveyed

Hence, a network is drawn where the most important value chain or transaction points or cost components are identified. A change is done in one of these components, and the places where this has an impact are identified. In some cases, it might be hard to evaluate the final impact and it has to be done by iterative methods where a balance is finally defined by the most powerful bidder. This is the case where the value net work is a closed loop. One example of a difficult value network is the production of newsprint with collection of recycled fibre, incineration and production of testliner – with the EU Packaging Directive as external input (Figure 8-3). The network is hard to manage and an equilibrium where all parties could be notably profitable i.e. create value is hard to find.

Figure 8-3
Newsprint and Testliner Production Chain: External Impact from Packaging Directive



Source: Pöyry Forest Industry Consulting and KCL Eco

The different cost items in the case above are defined as follows:

- Incineration with energy recovery: an alternative destination for the fibre
- Collection: the basic activity around changing waste to fibre. In many definitions, collection is not included in the cluster. Here, it is added due to its importance for the case
- Testliner production: an example grade of high significance for the European board industry, with a high recovered paper content
- Converting: transforming board (e.g. testliner) to packaging
- Newsprint production: including a part of the cluster which is not directly affected by the Packaging Directive but which has indirect connections
- Publishing: including a part of the cluster which is not directly affected by the Packaging Directive but which has indirect connections

Examples of other components affected could have been printing – more specifically printing on high-quality packaging – and forestry.

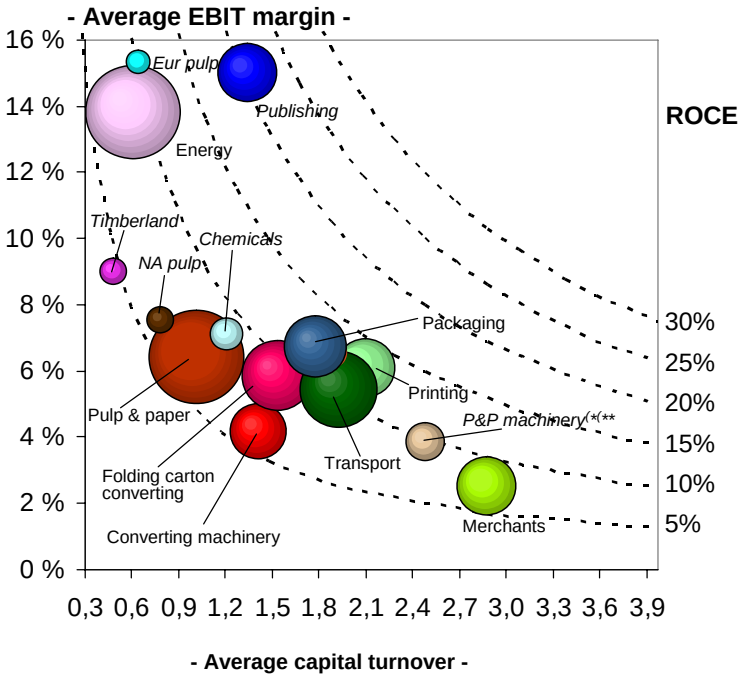
8.2 Value Chain Development in the Pulp and Paper Cluster Industry

The forest product chain is a sensitive value chain. As defined in the previous chapter, this chain contains a large number of players, which makes it hard to see all the interlinkages between them and therefore also to describe the impacts of changes on different cost items. Moreover, the production facilities in the pulp and paper industries tend to be highly individual, meaning it is hard to find two similar production facilities. The cost components also vary between different cluster parts. In addition, costs are not always transferred straight to the following part of the chain. Therefore, some item(s) in the chain will tend to become the cost carrier(s) showing low profitability.

This is illustrated in a case example below. A cluster profitability analysis was conducted containing companies from different parts of the value chain. The analysis is based on data gathered from annual reports of the companies in question. This data is, however, gathered from company divisional reporting and is thus subject to company specific reporting customs. In some cases, the capital employed used in the analyses is estimated from reported total assets due to missing data.

The outcome of the analysis is presented in Figure 8-4, which shows that the most profitable companies with the highest EBIT (earnings before interest and taxes) in the value network can be found among the Latin American pulp producers. If also ROCE (return of capital employed) is considered, the most profitable part of the industry becomes the publishers. On the contrary, the least profitable parts of the cluster are the paper producers with low EBIT and ROCE.

Figure 8-4
Cluster Profitability



- Publishing, 8 companies, division data (high variation)
- Pulp&Paper manuf, top 22 companies
- Folding carton converting, 6 companies
- Converting machinery manuf, 3 companies
- Pulp&Paper machinery, 4 comps, division data. Data for Aker Kvaerner Pulp&Power only from years 2003 and 2004 and Voith Paper from years 2002-2004.
- Merchants, 4 companies
- Chemical suppliers, top 11 comps, division data
- Energy suppliers, 3 companies
- Printers, 9 companies, high variation
- Timberland, 6 companies, division data (due to a couple outliers, median used instead of average)
- Packaging, 7 companies
- Transport, 2 companies
- Eur pulp, 6 companies, division data
- NA pulp, 5 companies, division data

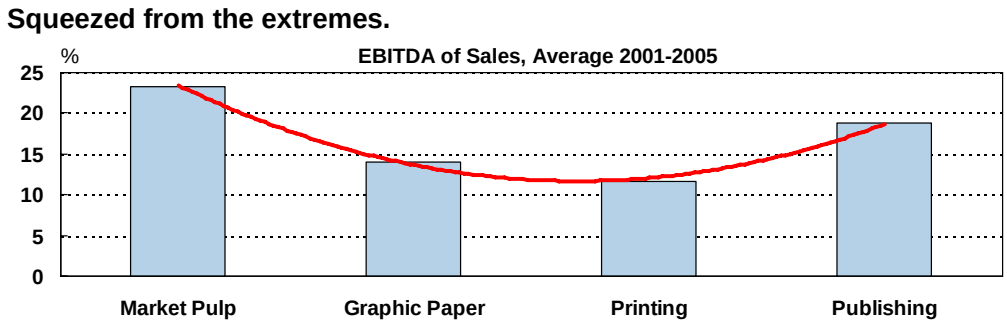
-The size of the bubble reflects the average sales of the biggest players in each group
-For companies included in each group, see Annex1
*Aker Kvaerner Pulp&Power ROCE% estimated to be at group level
**Metso Paper capital employed estimated to be at avg 2003 & 2004 level for 2000-2002

Source: Pöyry Forest Industry Consulting

Figure 8-4 gives the reasons for introducing the so called **bathtub curve**. The bathtub curve shows that the value revenues are generated in the beginning and end of the value chain whereas the middle of the chain is less profitable. This concept was defined in greater detail in Section 3.1.

During recent years the development in this direction has been ever more visible. Increases on the cost side have not been successfully transferred to paper product prices. Figure 8-5 shows how value is reduced in the middle of the chain in order to again increase at the end.

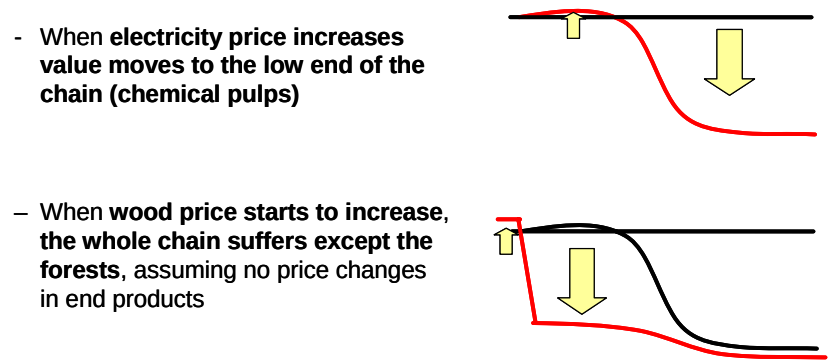
Figure 8-5
EBITDA (Earnings Before Interest, Depreciation And Amortization) of Sales for Seleted Parts in Graphic Paper Value Chain



Source: Pöyry Forest Industry Consulting

When conducting a concurrent sensitivity analysis of various central cost items in the value chain, this becomes even clearer. Doing an analysis of wood, fuel and energy costs, with both independent and interdependent changes, is a very enlightening exercise (Figure 8-6).

Figure 8-6
Impact on Cluster Profitability through Increased Electricity and Wood Prices

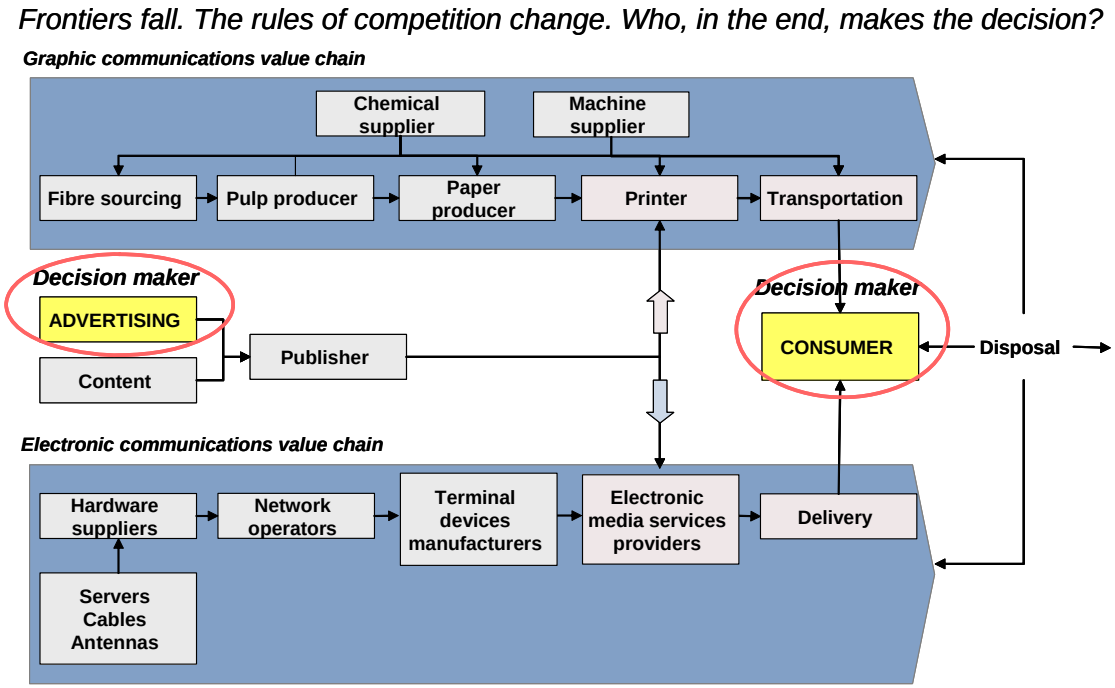


Source: Pöyry Forest Industry Consulting

8.3 Convergence

The convergence of different value chains described in Chapter 5.1 is also an issue, which will in all likelihood have an effect on the pulp and paper industry value chain. New media platforms enabling development of new types of advertising and use of content are trying to attract the same customers as the pulp and paper industry. Figure 8-7 illustrates the current value chain and how it will face competition through convergence from development in the new media value chain.

Figure 8-7
Convergence in the Pulp and Paper Value Chain versus New Media Value Chain

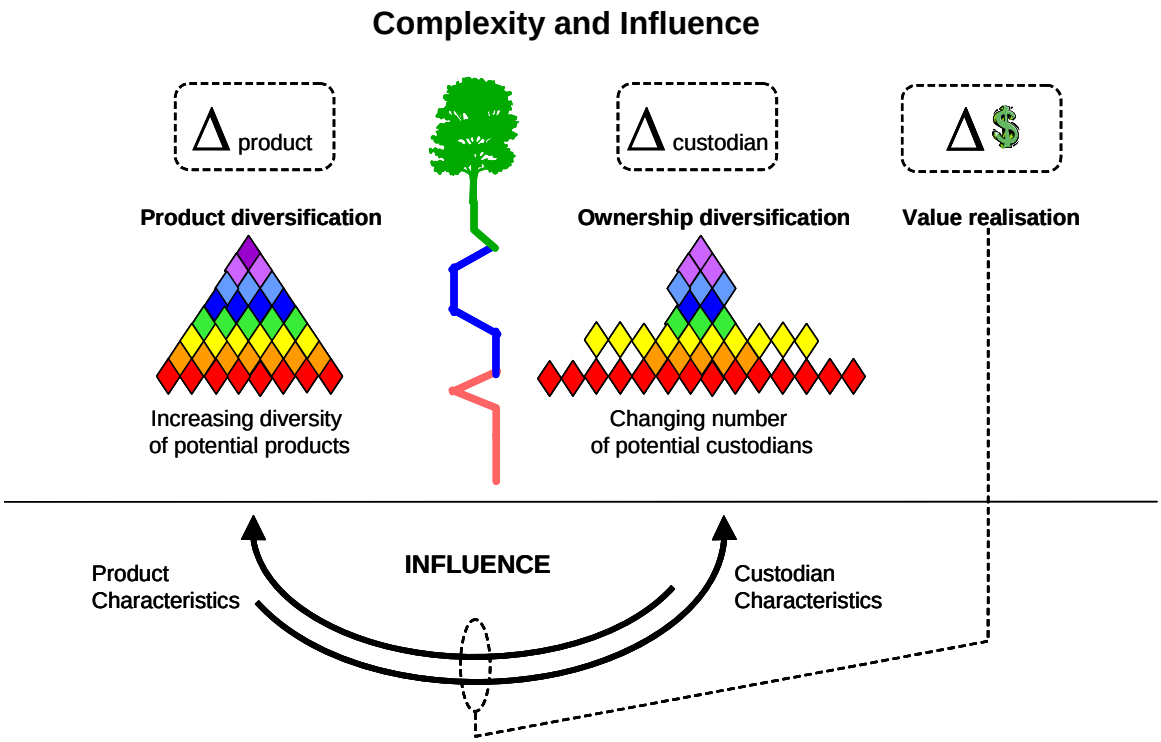


Source: Pöyry Forest Industry Consulting

8.4 Solid Wood Dynamics

For solid wood, the new competition between construction materials for properties is an example of a change driver. Materials science advances have created hitherto unimaginable products such as transparent concrete. Steel, plastics, glass, concrete and wood compete in acquiring new properties through e.g. nanotechnology. The amount of potential products diversifies (wood becomes more popular even e.g. in consumer electronics and the chain becomes more complicated (Figure 8-8) – not necessarily to the detriment of solid wood products, once the initial confusion settles.

Figure 8-8
Fear and Confusion in the Solid Wood Chain



Source: Pöyry Forest Industry Consulting

8.5 Link to EFORWOOD

The cost dependency impact can be analysed by comparing the 2005 data to the reference future data where e.g. the price of energy rises. Because in the reference future projections energy price changes are just one of the several other changes it is not possible to separate the change of rising energy costs from other changes in the reference futures. In calculating the reference future values for indicators we have a similar base for the reference future and some scenario calculations as we have been able to use EFI-GTM model runs. The drivers of reference futures are provided by module 1 using the EFI-GTM model. The impacts of the changes in the reference future calculations for each process are assessed by different partners and experts. This might result to a situation where some parts of the chain react more to e.g. rising energy costs than other parts of the chain. At this point of the Eforwood project it has not been verified that a similar approach has been used for the calculations of reference futures and scenarios in each process.

The possible changes in legislation, subsidization, or other similar political changes coming outside forest industry are not taken consideration in the reference future calculations. It has been assumed that the situation stays as it was in 2005. In addition it has been agreed that the influence of carbon trade has been excluded from the reference future calculations. One exception is in the bio-energy scenario of Baden-Württenberg case study where it has been assumed that the additional bio-energy production is possible because of political changes.

In the forestry wood chain it has been decided to adopt a simplified chain. The production facilities in the pulp and paper industries which tend to be highly individual have been averaged to a “model mill” concept. This means that an average model mill represents all the mills producing similar products. Even that the forestry wood chain is a massive chain containing a huge amount of information; the interlinkages between the agents are restricted.

The analysis of cost carriers can be done by analysing the reference futures and scenarios. It might be possible to find the parts of the forestry wood chain where costs accumulate in the future projections and find the “cost-carriers” of the forestry wood chain.

The current forestry wood chain - tool gives no possibilities of analysing new media platforms. One consumption change is analysed in the Iberian case scenario where it’s assumed that the value chain of newspaper changes because of the consumption of smaller, more individual newspapers. The consumption shifts from store sales to home scale consumption. This gives a possibility to analyse the affects of changing consumption to the industry. But as the interlinkages are not extensively modelled, the results might be misleading.

9 CONCLUSIONS

The main conclusion of the report can be summarised as: *the forest industry has become even more complex than before. At the same time it faces hard competition both on the raw material sourcing and on the markets – it is in the middle of the bathtub curve, squeezed on both ends. In order to break out of this predicament, the industry must succeed in optimising its whole value network. The economic optimisation should be in line with corporate responsibility and sustainable development.*

The forest industry faces severe competition in different parts of its value chain. Especially in the paper business, the value curve of the business has during recent years entered a "bathtub mode" with paper makers on the one hand facing increased costs on the raw material side and on the other hand struggling with sales price reductions. This development is a result of a trend of increased raw material prices, such as wood and energy prices and over-capacity on a global scale. Even though the industry would be successful in its cost-cutting operations, it will face severe challenges at the end of its value chain. On the paper side, the development of new media solutions and convergence of platforms and content in addition to new business models such as the (illusory) concept of "free" (described in Section 4.1) are often seen as declarations of war. If that is indeed the case, the paper sector is in trouble – fighting a two-front war, against both ends of the chain, is never to be advised. However, the truth is not that simple. The ends of the chain are linked to the middle in a myriad of ways. Pulling one down changes the other in innumerable ways. What the forest sector must do is to understand the dynamics of its value chains, and find ways to co-operate that create value for the whole, and increasingly for all players. Sustainability is a key issue in this.

EFORWOOD is not able to handle forest industry in its whole complexity because of the interconnections and loops that are too extensive in reality for ToSIA to analyse. Competition from the raw materials can be analysed only partially because some products are not analysed in the forestry wood chain. EFORWOOD might help to analyse some points of the whole value network, but it can't produce comprehensive value network optimisation. On the other hand the changes outside forestry wood chain are not introduced in EFORWOOD at all and can't be analysed.

However, these same problems face every attempt to model the sector, and EFORWOOD is a bold new attempt. In the EFORWOOD project, good and well documented work has been carried out. ToSIA is a completely new system, and it is able to analyse a substantial amount of data. What is in ToSIA can form a platform for further development. The data quality in ToSIA is acceptable for demonstration purposes. However, there is no universal tool that would be able to analyse all the imaginable problems and thus in some cases other tools should be used instead of ToSIA.

ABBREVIATIONS AND DEFINITIONS

B2B: Business-to-business

Cartonboards: Generic term for stiff paper usually made in several layers, widely used for packaging (e.g. folding cartons) and graphic applications.

Coated fine paper (or coated woodfree paper):**:** Fine papers are printing and writing papers, which are made of chemical pulp and may also contain recycled fibers. Coated fine paper grades use uncoated fine paper (jumbo) reels as the base material, upon which one or more thin mineral coatings are added to smooth the surface and improve printability. CWF is used for printing for instance high quality books, e.g. art books, and also high quality magazines, annual reports, company magazines, catalogues and brochures. (Source: CepiFine)

Coated mechanical paper: This group can be split into two sub-categories - Lightweight Coated (LWC) and Medium Weight Coated (MWC). These papers can have either a glossy or matt finish, and are used mostly for catalogues, magazines and advertising material using rotogravure or offset printing. They are made from a blend of chemical and mechanical pulp with a content of fillers and are mineral coated on both sides, either on or off machine. LWC has a basis weight of up to 72 g/m² and anything above 72 g/m² is classed as either MWC or Heavy Weight Coated (HWC). (Source: CepiPrint)

CRM: Customer relationship management

EE: see Eastern Europe

Eastern Europe (EE) Baltic countries, Czech Republic, Slovakia, Hungary, Poland, Romania, Russia (unless otherwise defined), Other CIS than Russia, Slovenia

EBIT: Earnings before interest and taxes

EBITDA: Earnings Before Interest, Depreciation And Amortization

ERP: enterprise resource-planning

ETLA: Research Institute of the Finnish Economy

HRM: Human Resource Management

Kraft liner: Board generally made from bleached or unbleached sulphate pulp and used as an outer ply or as facing for corrugated board.

Kraft pulp: or sulphate pulp is chemical pulp produced by cooking wood in a liquor containing sodium hydroxide and sodium sulphide as active chemicals. Originally a strong, unbleached coniferous pulp for packaging papers, kraft pulp covers today also bleached pulps from both coniferous and deciduous woods used in manufacturing of e.g. printing and writing papers.

MIS: Management Information System

Newsprint: an uncoated paper that is mainly used for printing newspapers. In the past, it has been made largely from mechanical pulp, but today, an increasing amount of recovered paper, mainly old newspapers (ONP) and old magazines (OMG), also goes into the production. The weight of a sheet of newsprint usually ranges from 40 g/m² to 52 g/m², but can be as high as 65 g/m². Newsprint is white or slightly coloured (eg, pink Financial Times), and is supplied in reels for rotogravure, offset or flexo printing. (Source: CepiPrint)

POS: point-of-sale

Recovered paper: Used paper that can be collected and re-used. Does not include e.g. tissue or paper recycled internally by the paper industry

ROCE: Return on capital employed

ROI: Return on investment

SCM: Supply Chain Management

TEKES: Finnish Funding Agency for Technology and Innovation

Test liner Board mainly produced from recovered paper and used as even facing for corrugated board or as liner of solid board.

Uncoated fine paper (or uncoated woodfree paper): Fine papers are printing and writing papers, which are made of chemical pulp and may also contain recycled fibers. The majority of the *UWF cut-size paper* is A4, which is used in offices at work and home for printing and copying purposes. *UWF folio sheets* are used for printing books, direct mailings and materials for corporate communications. *UWF reels* are used for producing writing pads, envelopes, books or business forms, for instance. (Source: CepiFine)

Uncoated mechanical paper: This category covers a wide a range of publication paper grades, including directory paper, thin printing grades and book paper. The basic furnish is the same as for newsprint, but the basis weight starts at 28 g/m². *Supercalendered Magazine Paper (SC)* is primarily used for the publication of consumer magazines, catalogues and advertising material using rotogravure, offset or letterpress printing. It is made from mechanical pulp with a large content of mineral filler. This grade is split into sub-categories based on brightness: SC-A+, SC-A, SC-B. (Source: CepiPrint)

WE: see Western Europe

Western Europe (WE): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK

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