



Erkki Hämäläinen

EVOLVING LOGISTIC ROLES OF STEEL DISTRIBUTORS

HELSINKI SCHOOL OF ECONOMICS

ACTA UNIVERSITATIS OECONOMICAE HELSINGIENSIS

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Abstract

There are several intermediaries in an industrial supply channel from the mill to the product producer (original equipment manufacturer, OEM) that may hold title or process the material, or both. Traditionally, wholesalers and importers hold inventories of different items while OEMs, component suppliers or contract manufacturers do the processing. Steel service centers (SSCs) are relative newcomers that combine the stockholding and processing activities. The tremendous growth of the international SSC industry during the late nineteenth hundreds has coincided with several structural changes in most steel-using industries.

The research problem of this thesis is the transformation of the logistic roles of the operators excluding, however, some service providers such as transport companies, carriers, forwarders and consultants, as they do not own, stock or process the products. Empirical analysis is guided by the choice of a theoretical framework consisting of three models. The first is the Distribution Service model of Shapiro and Heskett that relates the extent of stockholding to the speed of delivery. The second model of Production Capabilities is by Hayes and Wheelwright, and it provides normative advice on the matching of the desired product-mix with the required automation in processing facilities. The third model considers the physical characteristics of products as potential determinants of the appropriate type of intermediation. In the case of bulky products such as steel and paper, one would expect the logistics capabilities of operators to affect the choice operational units and intermediary roles of companies despite the different forms of financing, customer relationships or vertical integration. To that end, a framework for classifying the intermediate products in terms of size, weight and design complexity was developed here to trace the footsteps of logistic operations.

The objective is to analyze the logistic capabilities in terms of distribution services and manufacturing processes of the operators in any industry, and to determine the evolution of the logistic roles of the operators in steel distribution with special focus on the Finnish market. For comparison, some general trends are proposed from literature for finding the direction of evolution. These trends point towards higher levels of service, investment in automated processing, and more complicated designs of products. A historical review of the steel markets in several countries is then used to elaborate the logistics roles that the different operators have taken on during the transformation of markets and distribution channels.

The evidence for these trends is sought in steel distribution in the US and Europe. The findings indicate that transformation from ordinary stockholding to value-added processing and specialization in local and international steel distribution has taken place. The differentiation of the logistics roles has created a competitive market of regional, multi-location SSCs with a full-line availability and versatile processing service and stockists each specialized on a narrow range of product lines.

Finally, the evolution of Finnish steel distribution is described from a historical perspective with three periods determined by the business environment of imports, domestic production, and open markets. The steel industry in Finland has followed, by and large, the international trends with the exception of lesser role of independent steel

service centers and considerable time lag. The key roles for coordination have changed from entrepreneurial importer or trading house to producers closely associated with the steel mills, balanced by consolidation of stockists and steel service centers. Eventually vertical integration and international trade have dominated the operations especially in Scandinavia. The applicability of the framework was explored also in the cases of paper and sawn goods industries resulting in satisfactory results concerning the identification and separation of the roles of operators in heavy logistics.

To conclude, the framework used in the thesis proves applicable for the analysis of logistic operations and corporate roles in distribution. The diffusion of the roles of intermediary companies from the early days of industry seems to reflect the type of integrative strategy fashionable at that time rather than too low a resolution of the matrices. Especially the new model of Product Characteristics succeeds in separating the roles of most operators in any industry whereas the models of Distribution Services and Processing Capabilities run into difficulties in proper estimation of channels dealing with assembled goods and pure stocking operations, respectively. The recent development in steel industry does indicate that suppliers and service centers are differentiating and expanding their logistic roles further, thereby narrowing down the domain of mills and OEMs within the distribution channel. Hence, it remains an intriguing question for the managers and scholars alike whether the results that synthesize the history of heavy logistics also illustrate the basic principles of networking for modern supply chain management.

Key words: distribution, intermediary roles, logistic service, processing, product characteristics, bulkiness, complexity, steel industry

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Espoo, October 2003.

Erkki Hämäläinen

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1. Introduction

There are several intermediaries in an industrial supply channel from the mill to the product producer (original equipment manufacturer, OEM) that may hold title or process the material, or both. Traditionally, wholesalers and importers hold inventories of different items while OEMs, component suppliers or contract manufacturers do the processing. Stockholding intermediaries, or stockists, emerged in Finland in the middle of eighteen hundreds when some entrepreneurs started importing from foreign mills and trading houses to local customers. They coordinated the logistics of channel including also sourcing and transportation, for a good hundred years.

Today, OEM customers increasingly tend to focus on core competencies and outsource manufacturing and logistics to third parties. In addition, the dynamics of the steel industry involve globalization of both sourcing and of distribution and, despite the replacement of steel with new materials, a rather steady growth of consumption. The industry is, however, bound also by several conservative forces. Governments have recognized the contribution of the steel industry to the nation's employment and have supported domestic steel production in various ways. More recently, environmental protection has forced re-evaluation of national and corporate strategies on production and utilization of steel. Considering the structure of distribution channels, nearly given fact is that more than one-half of the steel volume is delivered mill-direct to the customer. Moreover, steel products have remained rather standardized and heavy which has limited the the stocking regions.

In this arena of producers and stockist, steel service centers (SSCs) have been relative newcomers that combine the stockholding and processing activities. The tremendous growth of the SSC industry during the last thirty years has coincided with steep structural changes in most steel-using industries. How, then, has this mixture of conservative and dynamic forces shaped the supply channels of metal products, and what has been the role of each of the operators contributing to the process from coils to fabricated components.

1.1. Intermediaries in Heavy Logistics Distribution Channels

Intermediaries provide the services between mills (upstream) and OEMs (downstream). Such intermediaries are service centers, stockists, contract manufacturers and component suppliers. Intermediaries add value to the product by stockholding or processing standardized raw materials to the specific sizes, shapes and tolerances required by customers. Products are often heavy and lifting or moving requires specific machine or infrastructure. In many cases, investments are high and fixed for years ahead. The following comment describes the problems of transporting a bulky product:

”Steel is difficult to transport,” states Erik Yrjölä, Managing Director of JIT Trans Ltd. The company is a new type of 3PL logistics operator focusing on steel logistics. He refuses to accept the common belief that steel is one of the easiest products to transport.”

“The reality is different. Steel products must be shipped very carefully due to many exceptional characteristics. For example, a long tube with a diameter of 120 cm seems simple in logistics. One of the most difficult things is how to stow this kind of tube so that it is in good condition at the OEM. Steel cannot be moved during transportation. Transportation uses specific platforms and containers (Yrjölä 1989).”

Such heavy operations add to the cost of logistics which, in general, is an expensive business process. The logistic costs in manufacturing and trade in Finland in 1999 were estimated at 10,2% of total revenues, totaling €18 billion or 14-15% of GNP, and somewhat higher than in West-European countries in general (MITC 2001).

The research problem of this thesis is the transformation of the logistic roles of the operators excluding, however, some service providers such as transport companies, carriers, forwarders and consultants, as they do not own, stock or process the products. In sourcing, OEMs have four principal choices among direct and multi-echelon channels (Figure 1-1). Alternative 1 is mill-direct, or a direct delivery from the mill to the manufacturer stocking, processing and assembling the items. Alternative 2 involves importers or stockists who keep a selection of items available. The manufacturer may, in alternative 3, purchase some processing services from service centers or a component supplier, or both. Finally, outsourcing may be extended by the OEM to assembly operations, perhaps adding a contract manufacturer into the channel (alternative 4).

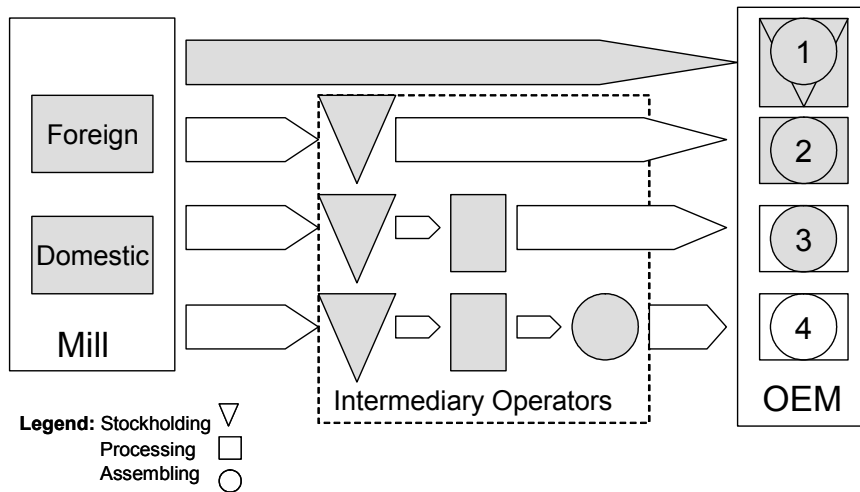


Figure 1-1 Alternative Supply Channels in Sourcing, Stockholding and Production.

Wholesalers and retailers are the intermediary operators that are closest to the OEMs. Key business processes include stockholding, delivery and related services. Products are available at arms length, directly from stock. Ordinary stockists normally act as co-coordinators of communication, financing and deliveries between the mill and OEMs.

This provides motivation for the research problem, which deals with the transformation of value-added services and roles of intermediaries. Where should these be offered, in what form, and what kind of capabilities are required for operation? Hamel and Prahalad (1994) claim that firms should focus their resources on core competencies, or the business activities in which the company is the best in the market, and outsource other processes. Harmon (1993) discusses of the future of stockholding and the need for re-engineering or revitalizing traditional stockholding services through consolidation in stockholding, integration in supply channels, Third-party logistics (3PL), and the information systems that enable coordination in logistics. The motives of stockholding are discussed by Ballou (1992), Aschner (1990), and Gattorna and Walters (1996), for example, in terms of delivery process, value for price, performance and risk.

The division of roles among different firms has been of interest to many researchers. Coase (1937) has explained how firms are created and what is the optimal scope of the firm considering a definition of a firm and why a firm emerges at all in a specialized

exchange economy. Williamson (1993) has studied the extent of vertical integration by means of transaction cost theory, addressing the strategic problem of make or buy in the context of manufacturing firms as well as services. In the design of marketing and distribution channels the question is if a direct company-owned sales operation should be preferred to an indirect independent distributor. The theory indicates that the total cost of going-to-market, inclusive of both distribution and administration, is likely to be lower for the direct option when the sales transactions require investments in unique assets for effectively serving the end customer. Transaction Cost Theory is currently an accepted paradigm that guides the subject of forward vertical integration in marketing channels (Rangan et al. 1993).

Lambert et al. (1998) describe a useful schema for structuring the roles of supply participants in terms of a focal firm and the supplier hierarchy, including 1st, 2nd and 3rd tier suppliers and customers (Figure 1-2). Traditionally, channel is structured into multi-echelon and mill-direct distribution channels. Inkiläinen (1998, 56-59), among others, refers to the concept of value-added logistics (VAL) that helps an operator to meet customer requirements. Value-added activities are transferred often from production sites forward in the supply chain, closer to the customer. Operationally, the intermediary may take the form of a distribution center (DC) with standard warehousing functions such as receiving, inspecting, putting away, order receiving, picking, packing and dispatching, or a DC may have additional production capabilities such as final assembly or other value-added operations ordered by the customer (VAL Center). The analysis pays attention to how and by whom value is created in the supply system. Stevens (1989) brings up the concept of an integrated supply chain as means for reducing inventories. Individual operators establish a close relationship with their communication and logistic processes. The analysis refers to Porter's (1985) ideas of value chain and Timmer's (1999) and Mentzer's (2001) ideas on networking.

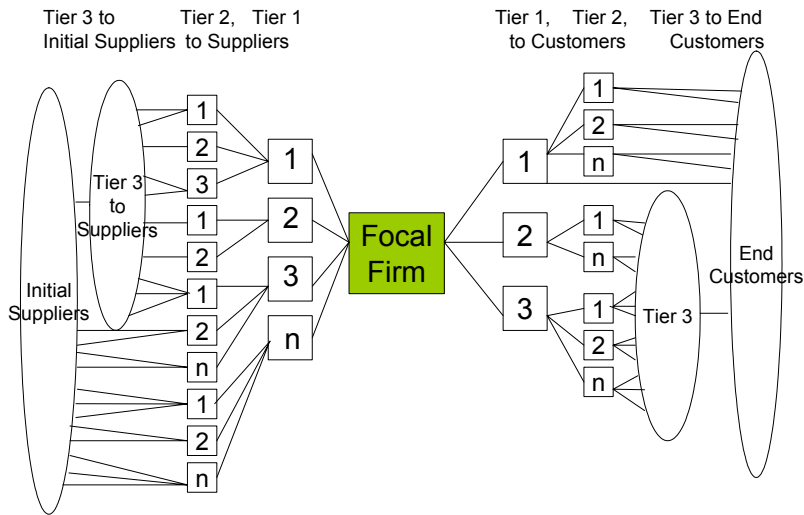


Figure 1-2 Focal Firm in a Supplier Network (Lambert et al. 1998)

While Porter (1980, 1985) referred to vertically integrated channels by his concept of value chain, other researchers extend the analysis of channels to the complete supply system and coordination of business processes between channel participants. Lambert and Cooper point out the marketing perspective:

“For the last 30 years many channel researchers ignored two critical issues: First they did not build on the early contributions by including suppliers to the manufacturer and thus neglected the importance of a total supply chain perspective.

Secondly, they focused on marketing activities and flows across the channel and overlooked the need to integrate and manage multiple key processes within and across companies” (Lambert and Cooper 2000, 68).

They refer to a supply chain structure as the network of members and the links between members of the supply chain and to business processes as the activities that produce a specific output of value to the customer (Lambert et al. 1998, 4). In this research, they are called intermediaries or service operators in a supplier network. Dibb et al. (1991) define distribution or marketing channels as a group of individuals or organizations that direct the flow of products from producers to customers, emphasizing the physical delivery of products as the basis for channel.

1.2. Objectives of the Thesis

Stockists, importers and agents have been the key players in the supply chain for over a hundred years. These intermediaries had a distinct competitive edge against the other

logistic alternatives. Producers were not able to meet OEMs requirements and OEMs were too distant to operate directly with them. Today the situation is different in many aspects. There are both conventional and new alternatives available for OEMs.

The purpose of this thesis is to analyze the transformation of intermediary roles. The handling and processing of products is a challenge to the operator for many reasons. Products are bulky and becoming more complex. They are produced globally in high volumes but customer service is mainly local.

This research has the following three objectives:

1. To specify various operators in steel distribution and to differentiate their roles in terms of logistics services provided, processing capabilities available, and the characteristics of products handled by defining appropriate explanatory models.
2. To identify the general trends of logistics operations and product characteristics within distribution channels, and refine these trends vis-à-vis the changing logistics roles of the operators on the basis of historical reviews of the steel markets in different countries.
3. To examine the evolution of steel distribution in Finland over several historical periods determined by external market conditions and to compare the structural changes of channels with the trends identified in the general international analysis.

The first objective is to provide an overall picture on steel distribution and to identify the key operators, such as a mill (producer), an OEM (Original Equipment Manufacturer) and especially the different intermediaries between these two who add value by storing, processing and assembling, or by delivering products. In addition, the services provided by these operators are to be described by appropriate models or frameworks that visualize and measure the service levels. The conventional features of distributor services studied in the context of heavy logistics are the speed of delivery and the breadth of product choices, as well as the capabilities of the processing lines established by the service centers. Somewhat more innovative is the objective to analyze the impact of the tangible characteristics of products, identified by dimensions, weight, and the standards concerning the shape of the item. Here one surrogate measure, the bulkiness of product, stands for the size and weight whereas the other, complexity, measures the structure of assembly and dimensional tolerances of the product. Hence, it is assumed that large and bulky products normally require heavier

type of logistics services within the supply channels than more delicate products call for.

The second objective involves the analysis of both the operations and services performed within the supply channel and (re)assignment of the logistic roles to the participants of the channel. To make things even more complicated, totally new types of channel alternatives and operator roles are bound to emerge during the evolution of steel distribution. The purpose is to illustrate the development and trends of services and proliferation of intermediary roles using the models established above. The general trends of logistics operations and product characteristics within distribution channels can be derived from the logic behind the frameworks themselves. When applying the analyses to heavy logistics in general, and in the steel distribution and its intermediaries in particular, these trends can be refined and related to the changing logistics roles of the operators in the international steel markets. This is accomplished via a review of industrial data and statistics resulting in a set of trends that depict, in more detail, the direction of the transformation of the operator roles in steel distribution, with a focus on the role of steel service centers (SSCs).

The third objective, then, is to interpret and examine the predictions incorporated in general trends of services and empirical movements of roles identified with the international data in the case of Finnish steel markets. It also constitutes a managerial test of the frameworks introduced in the thesis. There have been major changes in external market conditions that determine natural periods of evolution of steel distribution in Finland. At first, industry was supported by imported steel only, until the domestic production was established in the 1970's yet in a regulated environment. The third period dawned in the 1990's with economic integration that created open markets and sparked the ongoing transformation of the industry. Through these periods, the pace of evolution of the Finnish industry can be compared with various international markets and general industrial trends.

1.3. Research Approach and Structure of the Thesis

The research problem could be studied from various perspectives giving information on intermediary roles, transformation of roles and operator's capabilities. Logistics research is often based on quantitative models and statistical testing of hypotheses.

Some alternative approaches to logistics research have been discussed and classified by Abnor and Bjerke (1997):

1. The analytical approach, in which the researcher is a distant and objective researcher.
2. The systems approach, in which researcher seeks objectivity.
3. The actors approach, in which researcher is a part of process

This thesis deviates from the more traditional analytical approach in the direction of the systems approach but ultimately relying on the actors approach to the research problem. Real-life working experience and managerial issues are taken into consideration. The researcher has interpreted both quantitative and qualitative data in the analysis with methods routinely used in case studies. Analytic techniques include pattern-matching logic and comparisons of multiple cases (Yin 2003). The cases used in searching for empirical patterns relevant to heavy logistics include both corporate histories and statistics on the level of a typical supply chain or a specific industry. Instead of rigorous testing of hypotheses, the general logic within the industry will be identified. The second level is descriptive with reference to cases and comparisons and with explanations of the trend.

Empirical analysis is guided by the choice of a theoretical framework consisting of three models (Figure 1-3). Our first approach analyzes an operator's service capabilities, which are important in heavy logistics. The analysis is based on the distribution service model of Shapiro and Heskett (1985) in that relates the extent of stockholding, i.e., the number of product choices offered to the customer, to the speed of delivery. Their model was first introduced for the analysis of a case concerning the competition of Metal Service Centers in the US.

The second model is by Hayes and Wheelwright, and it provides normative advice on the matching of the desired product mix with the required automation in processing facilities.

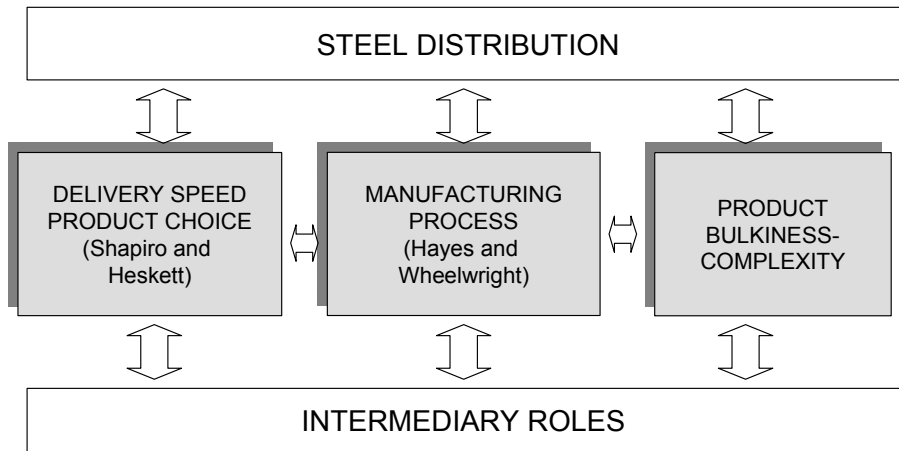


Figure 1-3 The Three Models Applied in the Analysis of the Roles of Intermediaries in Steel Distribution

The second analysis is based on the analysis of production capabilities by Hayes and Wheelwright (1979, 1984). The Product-Process Matrix of Hayes and Wheelwright is widely adopted by logistics researchers. Schmenner (1994, 1998) classifies the challenges presented to management by the generic production strategies, and Vonderembse and White (1996) have added product variety and process alternatives with product characteristics. Krajewski and Ritzman (2002, 43-48, 54-59) present service and manufacturing processes applied to steel. In this thesis the matrix is applied to heavy logistics for additional differentiation of the roles of intermediaries.

The third model considers the physical characteristics of products as potential determinants of the appropriate type of intermediation. In the case of bulky products such as steel and paper, one would expect the logistics capabilities of operators to affect the choice operational units and intermediary roles of companies despite the different forms of financing, customer relationships or vertical integration. To that end, a framework for classifying the intermediate products in terms of size, weight and design complexity has been developed here to trace the footsteps of logistic operation.

The empirical part analyzes the capabilities of different intermediaries based on the concepts of Hamel and Prahalad (1994). In the strategy evaluation, Hamel and Prahalad explain why firms should focus on their core competencies and outsource other operations. In addition, intermediary services are analyzed in relation to other channel operators. The transformation of the logistic roles of intermediaries are

determined here by the reallocation of processing operations and delivery services. Hence, instead of the four channels and business processes included in a Channel Model of Haapanen and Vepsäläinen (1999) this research focuses on the processing and transfer of raw material and products.

For collecting the data for analyses, Yin (2003) identifies six sources: documents, archival records, interviews, direct observations, participant observation and physical artifacts. Accordingly, the researcher has used multiple sources for evidence: personal interviews, the researcher's own experience in the management of an intermediary, visits on domestic and international intermediaries, OEMs and mills, opinions of key persons, unpublished surveys within the steel industry, yearbooks, annual reports, conference papers and numerous articles on these subjects in professional journals. Much of the data on these specific issues is available only in the files of companies and associations. If data is available publicly, it is seldom directly applicable to this research problem. The information is often in an unstructured form in many databases within the steel industry. The data are rather general and for production than for intermediary service purposes. Hence the case examples need some subjective interpretations, and participant observations have often followed events in real time.

This research benchmarks among different countries and periods since the transformation of intermediary roles has not happened simultaneously and the market structures differ even between European countries. In terms of size and structure, the Finnish market is comparable with other Nordic countries but, undoubtedly, much different from German, English, French or American steel markets. One major reference is the US steel market against which the comparisons are made at a rather general level.

The researcher has more than 16 years of experience of Valtameri Oy; an ordinary, middle-sized stockist in Finland, turning into a service center. Its history is typical of other Nordic and international steel markets. The company, started as a trading house in 1913. In its early stages, it diversified its business activities: foodstuffs, paper, chemicals, and machines. Steel products were added to the product offering later as substantial demand emerged. The operator's capabilities in international sourcing also enabled steel imports and stockholding. Today Valtameri is part of Asva Oy, the

leading steel service center in Nordic countries owned by the Finnish steel mill Rautaruukki.

The thesis consists of five chapters. The first chapter is the introductory part identifying the research problem and specifying the objectives. The second chapter describes the analysis framework containing three models. The Service model consists of the delivery speed and product choices. The Product-Process model proposes the matching combinations of product variety and process type. The product characteristics model includes two dimensions: bulkiness and complexity. Finally, three trends on the transformation of intermediary services and operators are proposed.

The third chapter analyzes the roles of international operators and their service capabilities. This chapter makes comparisons between different western countries and North America. Moreover, the three trends stated earlier are examined and defined in terms of the transformation of the roles. In the fourth chapter the Finnish steel distribution is analyzed over time in three stages; the Import period, the period of Domestic Production and the period of Open Markets. The comparisons to the general trends and to the international development of steel distribution is made. In addition, benchmarking with other industries such as paper and sawn goods indicates similar development of customer services, manufacturing processes and product characteristics. The fifth chapter presents conclusions, theoretical and managerial implications, and suggestions for further research. A glossary of the key concepts in steel distribution is included at the end.

2. Intermediary Roles and Service Capabilities in Steel Distribution

Products and services in heavy logistics have some unique characteristics. Products are heavy, sizeable and sometimes complex to work with. Business processes are asset-specific operations. Handling and processing require substantial investments from the operator for capital-intensive systems. Accordingly, service operators have invested in capabilities that they have chosen to match their service concepts.

In the analysis, first two approaches are based on existing models. The first model focuses on service capabilities, namely product choices and the delivery speed of the operator. The second model has a focus on product-process combinations. The third is an extension based on product characteristics and evaluation of the business processes in a value creation.

2.1. Intermediary Roles in Value Creation

Producers are steel mills, which produce steel and metal products in standard forms. Producers, also called upstream operators, may deliver products to intermediaries or directly to OEM customers. *Original Equipment Manufacturers (OEM)* are companies that assemble finished products from parts, components or modules supplied by intermediaries

Value-added services may locate in different positions along the supply channel. Intermediaries operate as a coordinating link in the middle between the mill and the OEM. In this research, intermediaries are divided into active core intermediaries and supportive intermediaries.

Core intermediaries with ownership of the goods make a greater contribution to value creation than supportive intermediaries. This thesis focuses on the core intermediaries who take title (ownership) to the goods. The emphasis is on operator's value-added services between mills and OEMs. Supportive intermediaries are discussed only when they have a role in distribution. Table 2-1 provides a classification of operators of the supply network.

Table 2-1 Classification of Operators in a Supply Network

| OPERATOR | Material Ownership | Type of Value-Added Operation |
|---|---------------------------|--------------------------------------|
| <i>Producer – Mill</i> | Full | Process – own or std design, sell |
| <i>Stockist</i> | Full | Source, store and sell |
| <i>Service Center</i> | Full/Partial | Source, store, process, sell |
| <i>Contract Manufacturer</i> | Partial/None | Process-custom design |
| <i>Component Supplier</i> | Full | Process-own/std design, store, sell |
| <i>Manufacturer - OEM</i> | Full | Process – own design, store, sell |
| <i>Retailer</i> | Full | Source, store, sell |
| <i>Agent</i> | None | Source |
| <i>Carrier</i> | None | Transport, partial store |
| <i>Logistic Service Provider</i> | None | Transport, store, partial assemble |

Core intermediaries are service providers that own the goods. They physically handle products and provide valued-added services. Risk taking is in product sourcing, stockholding, processing and related services. These intermediaries negotiate, finance and process the goods they own. Such operators are stockists, service centers and component suppliers.

Service centers (SSC) have become key operators in the intermediary services. As a part of their service concept, they carry substantial stocks of raw materials. SSCs and subcontractors transform base products to customized parts and components according to customer requirements. According to Metal Service Center Institute, service centers are the intermediaries between steel producers and finished product producers. “Steel service center (SSC)” is a catch-all name for an operation that buys finished steel, often processes it in some way, and then sells it in a slightly different form. SSCs distribute the steel and other metal products in the exact quantities, the exact form, and at the exact time required by customers. Service centers are less capital-intensive than steel mills because they do not need furnaces, casters and rolling mills (Metal Service Center Institute 2003).

Stockists, which carry stocks of base products from many suppliers, source products in high volumes from producers and trading houses. Instead of processing base products, they focus on ordinary stockholding and so their value-added input to products is low. Stockists operate with a break-bulk and consolidation principle regionally and locally, and the key business process is timely delivery of product(s) to the customer.

Contract manufacturers produce parts, components or sub-assemblies of modules and operate as the 1st tier suppliers to the OEMs. They have capabilities in manufacturing of complex products. Manufacturing is triggered by orders of OEMs and often uses their raw materials. Contract manufacturers have seldom own stocks.

Component suppliers specialize on component manufacturing. They manufacture either against OEM's order (MTO) or for open markets (MTS). Materials are sourced normally from stockists or from the mills directly. Components are delivered directly to OEMs assembly line such as an assembly line of a car manufacturer (Figure 2-1).

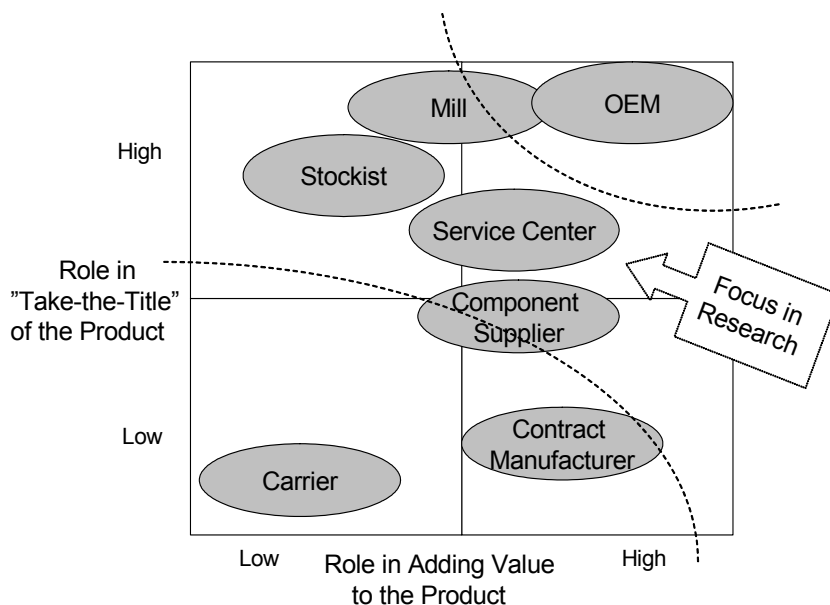


Figure 2-1 Description of the Roles of Intermediaries in a Supply System

Supportive intermediaries: In the second group, the focus is on managing flows of information or goods between the operators in a supply channel. They have no title as owners of the goods. Operators in the second group give supportive expertise, information and logistic services.

Operators such as agents, consultants, lead logistics providers (LLPs) and other carriers of the goods, and purchasing organizations provide supportive services in the supply system. The roles of supportive operators are described in more detail in the analysis of channel structures. E-Commerce is an additional alternative for informing about

availability and sourcing of products. Producers or service centers see it as a true channel.

Third-party logistics (3PL): Third-party logistics means using an outside company for one or more logistics services regardless of how extensive, complicated, or strategic those services are. For example, companies can use a third-party logistics provider to supply basic warehousing services in a couple of cities.

Fourth-party logistics (4PL): By contrast, fourth-party logistics means using integrator for the sole purpose of helping your supply chain achieve its full strategic value (Marino 2002, 23).

2.2. Capabilities of Intermediary Services

Researchers have discussed widely of service and processing capabilities. Hamel and Prahalad (1994) launched the concept of core competence. This concept is essential in explaining the key business processes that create value for the customers in the supply chain. Many other researchers refer to the same concept with different definitions, for example, Porter (1985), Dierkx and Cool (1989) and Stalk et al. (1992) seek to explain the operator's competitiveness.

Hamel and Prahalad (1994) have argued that competition occurs not just between product or service offerings, but also between firms and coalitions of firms, for example, among the supply chains. Companies compete in building core competences that transcend the resources of individual business units (Hamel and Prahalad 1994, 274). This notion suggests the idea of competition between channel alternatives. Competitive service concepts go through the whole chain to the final product. It is worthwhile to note competitive power of total supply system and identify the roles of operators in value creation.

Operator's core competences and capabilities are often referred in speaking of value creation in a logistic system. Haspeslagh and Jemison (1991) refer to the concept of competitive advantage over other alternatives. Synergy occurs when capabilities transferred between firms improve a firm's competitive position and consequently its performance. They claim that the most managerially relevant view of the value creation process is to see a firm as a set of capabilities (embodied in an organizational

framework) which, when applied in the market place, can create and sustain elements of competitive advantage for the firm (Figure 2-2).

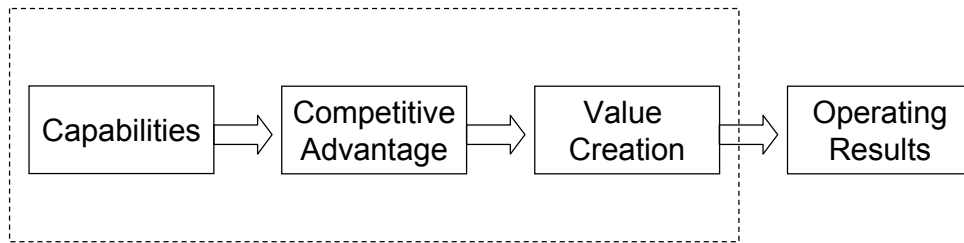


Figure 2-2 Capabilities-Based Perspective on Value Creation (Haspeslagh and Jemison 1991, 23)

Haspeslagh and Jemison (1991, 23) suggest in that a firm's competitive advantage is a result from the application of wide range of capabilities and, in particular, of a set of core capabilities central to competitive advantage, that

- Incorporate an integrated set of managerial and technological skills,
- Are hard to acquire other than through experience,
- Contribute significantly to perceived customer benefits, and
- Can be widely applied within the company's business domain."

They say that competitive advantage is created by capabilities. An operator is able to perform better in the supply system than other alternatives. Quinn and Hilmer (1994, 43) suggest that if managers wish to leverage their companies' skills and resources, they should combine the following two issues:

- Companies should concentrate the firm's own resources on a set of "core competences" where they can achieve definable pre-eminence and provide unique value for customers.
- Companies should strategically outsource other activities including many that have been traditionally considered integral to any company, and for which the company has neither a critical strategic need nor special capabilities.

Most managers include these ideas in their logistic strategies.

2.2.1. Managerial Aspect of Heavy Logistics

This research also takes a managerial approach to the capabilities and roles of intermediary operators in value creation to the product. We ought to understand how the system is managed and by whom. The Global Supply Chain Forum has defined supply chain management as follows (Lambert et al. 1998):

“Supply chain management is the integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders”.

Mentzer (2001) emphasizes strategic coordination and the role of individual operator the supply system. He explains the following:

“Supply chain management is the systemic coordination of the traditional business functions within a particular company and across companies within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole”.

These definitions identify key business processes and value-added inputs in the complete supply system. Shapiro and Heskett (1985) stress cases and case methods in their managerial research on logistics. Value creation in heavy logistics is a long-term commitment for operators. Investing in a capability is a strategic decision by the management. Justification is needed as stockists plan to enlarge their services or OEMs plan to outsource value-added processing.

2.2.2. Product Descriptions in Manufacturing Processes

Typical products in heavy logistics are steel, paper and timber products. There is, however, no uniform classification for products, and steel products alone are classified in various ways. Educational dictionaries define ordinary products in heavy logistics as follows (Worlsteel 2003):

“Steel is a hard metal alloy composed of iron and carbon, and used for making machines, tools, knives, and the like.” Another source defines steel as follows: Steels are classified into mild or soft steels, medium steels and high or hard steels. These classifications refer to the raw material, process and applications of the product. Steel is “a tough alloy of iron containing carbon in variable amounts up to 2 percent” (Funk and Wagnas 1970). International Iron and Steel Institute (IISI) claims that “Steel is not a single product. There are currently more than 3500 different grades of steel with many different properties-physical, chemical, environmental, 75% of which have been developed in the last 20 years.”

Defining the word paper, we refer to Wordsmyth (2001), The Educational Dictionary-Thesaurus:

“Paper is a thin substance made from any of a variety of fibrous materials, used for wrapping, decorating walls, and the like. Timber is similar to “a hard wood, board, logs, softwood, blank” or “a wooden beam or other supporting member, as in a roof” Timber is “wood suitable for building purposes” and paper as “a substance made from cellulose material, as rags, wood, or bark, treated with various chemicals and formed into thin sheets or

strips for writing, printing, wrapping and a wide variety of other uses in industry and the arts.”

In a manufacturing process, a steel product transforms its physical characteristics. Intermediary service adds value gradually to a product. Product hierarchy is defined on different levels, depending on the value-added processing input. In heavy logistics, products have basic forms at an early stage of production. In the initial stage, mills produce the base products and then sell them in larger quantities for raw material to OEMs or stockists. First intermediary stage is stockholding, order picking and delivery of a standard or processed product to the customer. Processing of components and parts, which may also require some assembly operations, has a high value-added input compared with stockholding services. Processing and assembling are customization services, which are performed against customer orders. Product is processed to another form and size by cutting, bending or slitted into parts or customized components. Components, parts and modules are assembled into a system or part of a system. The assembly line coordinates all logistic flows into a system, which is the final product (Figure 2-3).

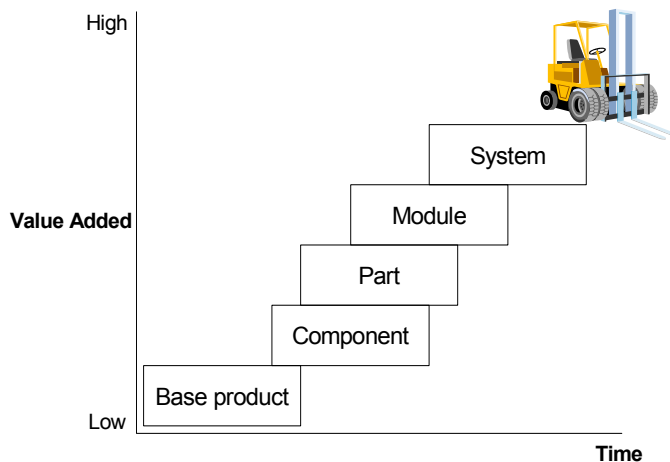


Figure 2-3 Value Based Product Hierarchies and Process Types

2.2.3. Service Process Descriptions

In this research, the analysis of key business processes is limited to value-added services in physical business operations. As shown in Figure 2-4, purchase order initiates the delivery process. The product is delivered in standard or processed form to the OEM. The intermediary services between the producer and the OEM’s assembly

line consist of three service processes: break-bulk (stockholding), processing and assembling.

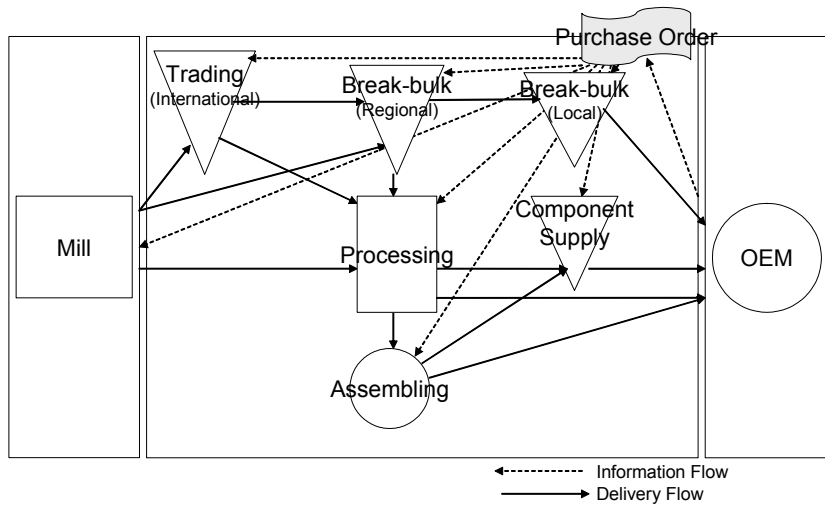


Figure 2-4 Service Processes in Heavy Logistics

Stockholding has a low value-added input. Key business processes are sourcing, break-bulk service and consolidation of small deliveries. Sourcing takes place from either local or foreign mills or trading houses. Multi-echelon distribution may include stockholding in several locations along the supply channel. In value-added processing, a similar type of sources is applied.

Stockholding is one of the key business processes among stockists and service centers. Ballou (1992), Aschner (1990), Lambert and Stock (1993) present several reasons for stockholding:

- improves customer service with product availability on short-lead times and in smaller quantities
- leverages production economies by allowing long production runs at constant quantities
- permits purchase and transportation economies with large lot sizes
- hedges against the price changes
- protects against demand and lead-time uncertainties with appropriate investment in safety stocks
- hedges against the contingencies such as labor disputes, fires, floods and other exogenous variables.

The processing of materials is a broader service concept than delivery of a standard product. Customization is high for technical components requiring engineering. Customization in masses is more complex than one piece. Logistics and processing technologies have developed significantly after the introduction of flexible manufacturing (FMS) and Computer Aided Design (CAD).

2.3. Specifying the Distribution Service Matrix

Delivery and timing of delivery is an important business process in the logistic flow. The critical point in deliveries is the arrival of products to the OEM. The timing of arrival is more important in situations in which OEMs are not willing to carry their own safety stocks. OEMs often specify the delivery due date based on their manufacturing process or assembly schedules.

Shapiro and Heskett (1985, 50-51) refer to the operator's delivery services and product offerings in the U.S. markets as follows:

“Even for a commodity like steel, fast response, local presence, and quick, consistent delivery times can be key success factors, as proven by the increasing success of the metal service industry.”

They discuss the four elements in customer service, namely delivery speed, availability, consistency and responsiveness. Delivery speed is an operative capability, which is often appreciated by the OEMs. Time requirements for deliveries increase the complexity of service. Speed capability is important in heavy logistics as customers tend to postpone sourcing to the latest point to avoid own stockholding. Moreover, customers are no longer willing to wait for a delivery but require short and/or timely deliveries. The last two service elements refer to managerial issues in logistics, namely consistency in deliveries (reliability) and the responsiveness (flexibility) of the service provider. Customers appreciate operator's flexibility with respect to unexpected changes in demand, product specifications or delivery terms.

Shapiro and Heskett (1985), in which the speed of delivery and the breadth of product choices describe the service of an intermediary, base our analysis of service capabilities on application of the Distribution Service matrix.

1. Delivery speed: High delivery speed means good availability of the product for the customer. It is assumed that with a supplier's high

delivery speed customers have a low need or no need for stockholding.

2. Product choice: Broad product choices enable high availability of raw materials for various needs and customer applications. A product range of 10,000 stock items is an example of broad product choice.

Delivery speed is a critical logistic issue. In short, lead-times the OEMs are able to postpone manufacturing of goods to the latest order point. Delivery speed has a time dimension ranging from hours to days, weeks and months. The time requirement is often linked to delivery distance and to the location of the operator. Delivery lead-time is commonly understood as the “difference between the placing of the order and delivery of the product (Vonderembse and White 1996).” Total delivery lead-time depends on the operator’s chosen strategy. Stockists often have their core capabilities in high delivery speed and product choices. Local and regional stockists normally have high delivery speed and local and foreign mills low delivery speed.

A stock-delivery of a standard product is generally overnight. Local distribution centers (LDC) have high – even a few hours – delivery speed on limited product choices. Regional stockists are generally capable for overnight deliveries on most base products and for a few days to one-week lead times in customization services. High number of product choices and processing increase operative costs. Processing services transform standard products to another shapes or sizes. Delivery lead-time increases accordingly due to processing. Intermediaries focus either on delivery speed or on product choices or on both. In outsourcing, OEMs expect deliveries of raw materials or components on a certain day or even at a certain hour or minute for the OEMs’ processes. Scheduled deliveries are applied in a car assembly. Key suppliers make scheduled deliveries to the OEM. The Distribution Matrix model in Figure 2-5 explains the relationship between an increasing delivery speed and/or the breadth of product choices and the level of service.

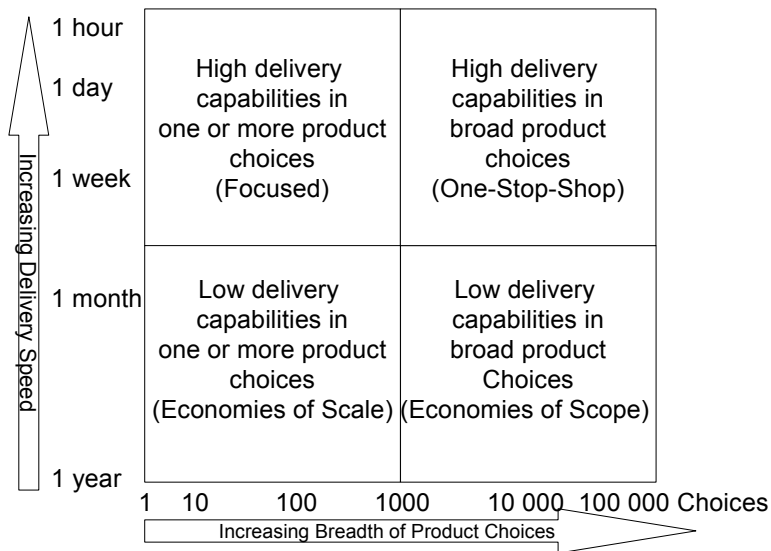


Figure 2-5 Distribution Service Matrix (Adapted from Shapiro and Heskett 1985)

The second service dimension is the number of product choices. Most steel products are commodities, which have international standards. Standards facilitate recognition of product, communication and operation with product. Products are developed either for generic purposes or for specific customer needs. A One-Stop-Shop operator has almost every kind of product to offer, whereas producers or specialized stockists offer only limited product choices. Inventories and costs are accordingly high or low, depending on the breadth of product choices. Stockholding of many product groups and product choices requires space and infrastructure for logistic operations. Figure 2-6 summarizes the cost-service trade-offs.

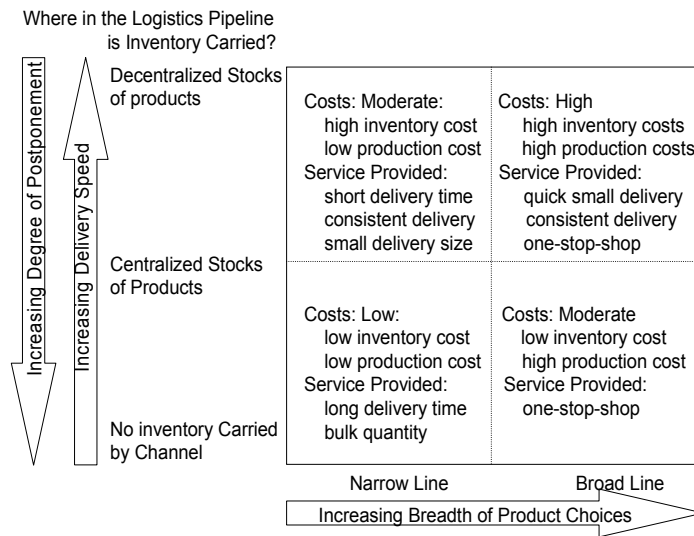


Figure 2-6 Cost-Service Tradeoffs in Distribution Services (Shapiro and Heskett 1985)

The breadth of product choices and the delivery speed are capabilities that describe an operator's service performance. High service capabilities add costs as product choices are increased and infrastructure for fast deliveries created. Unit costs easily increase stepwise and exponentially as the level of service capabilities increases. In practice, mills and stockists are not able to deal with broad product choices.

2.4. Specifying the Product-Process Matrix

The second analysis is based on the Product-Process Matrix (Hayes and Wheelwright 1979, 1984) that elaborates the interaction between the product mix and the manufacturing process in various life cycle stages. Kela (1993) restates the same framework for manufacturing capabilities. There are four process alternatives (Figure 2-7): job shop (jumbled flow), batch production (disconnected line), connected line (worker/machine) and continuous flow. In a connected line, the worker-paced process normally has lower capacity than machine based automated processes. Types of product mix range from one-of-a-kind projects to high volume commodities. Products such as ships, oilrigs, and bridges are complex systems produced as a project. A module of a vessel is for instance a plate bent and machined for installation or assembly with other parts. Cars and home appliances are manufactured in volumes of batches, where steel parts and components are major elements in the assembling of final products.

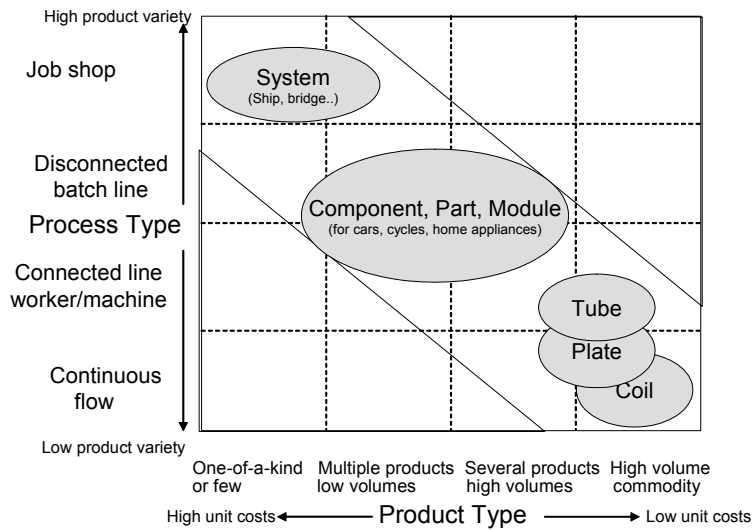


Figure 2-7 Product-Process Matrix in Heavy Logistics (Applied from Hayes and Wheelwright 1979)

Mills produce bulky products in a continuous flow. They locate in the lower right corner of the Product-Process Matrix. Integrated mills produce a high number of coils, plates and tubes. In the Product-Process Matrix, the efficient choices are on the diagonal as indicated in Figure 2-7. The system is final product of the OEM, which is assembled from a number of components and parts.

2.5. Specifying the Product Characteristics

In addition to the Matrices of Distribution Services and Product-Process Matching, introduced above, this research applies a new model of product features for the investigation of the logistics roles of intermediaries. The objective of the *Product Characteristics model* is to describe the tangible characteristics of products, identified by dimensions, weight, and the standards concerning the shape of the item, for assessing their implications for the logistics roles. The model uses two measures: one is the *bulkiness* of the product, measured by size and weight, and the other is *complexity*, measured by the designed structure of assembly and dimensional tolerances of the product. It is obvious that product bulkiness is relevant in stockholding, processing and transportation, whereas complexity mostly affects processing and handling requirements. Processing capabilities are capital-intensive

decisions and managerial choices, whether the operator offers products with high or low tolerances.

Product characteristics have a key role in the design of supply systems. In general, single touching or stockholding and processing add to the total costs. This is a critical issue for low-priced commodities. Transportation of goods has also economical limits: bulky steel coils or paper rolls can be transported only with specific rail wagons or trailers. Another problem is coordination with the next processes: how are the lifting and further transportation and conveyance systems coordinated with the warehousing or processing services?

2.5.1. Product Bulkiness

Steel products are sizeable and heavy at the mill. A bulky product is difficult in many basic logistic operations. Bulky products have characteristics that make operations very challenging. *Size* and *weight* are dimensions of product bulkiness. Size is measured by the length (m) or surface area of a product (m^2) or a volume (m^3) and weight (ton or kg). Tubes are long products measured in meters. Plates are measured in m^2 and round coils in diameters or m^3 .

Both product size and weight play a key role in building the operator's logistic capabilities. Product size is normally more dominant than weight in heavy logistics. Product bulkiness, as said earlier, includes three dimensions in this research: length (or area or cubic) of product and weight of product. In this research, bulkiness takes further four dimensions: over-sized, container-sized, palette and letter-sized products. These dimensions vary a lot between inbound and outbound logistics. The application to steel products is the following (Table 2-2):

Table 2-2 Dimensions of Product Bulkiness: Applied to Steel Products

| <i>BULKINESS</i> | <i>LETTER</i> | <i>PALLETTE</i> | <i>CONTAINER</i> | <i>OVER-SIZED</i> |
|-------------------------|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|
| <i>Length</i> | <i>< 0,3 m</i> | <i><1,5 m</i> | <i>< 6,0 m</i> | <i>>6,0 m</i> |
| <i>Area</i> | <i>< 0,25 m²</i> | <i>< 1,0 m²</i> | <i>< 15,0 m²</i> | <i>> 15,0 m²</i> |
| <i>Weight</i> | <i>< 0,1 tn</i> | <i>< 1,0 tn</i> | <i>< 20 tn</i> | <i>> 20 tn</i> |

Steel is a sizeable product when delivered from the mill. A coil is round in shape, a tube is long, and a plate is flat. At the mill-end deliveries mainly take place in container sizes or over-sized packages, depending on product. In processing products often are palette- and letter-size parts and components (Figure 2-8).

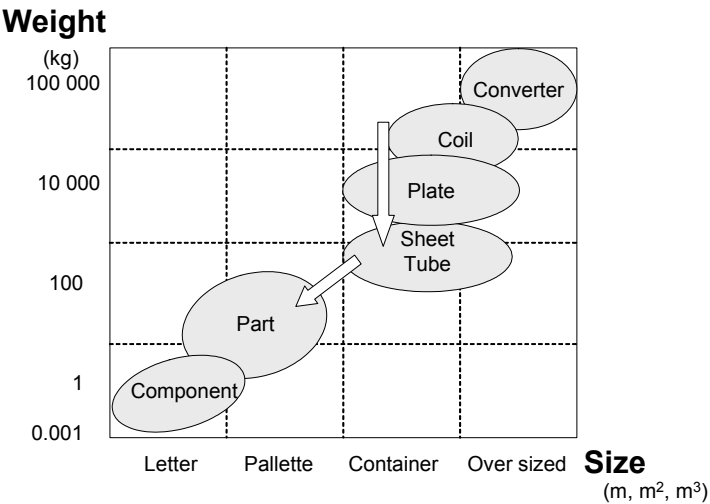


Figure 2-8 Dimensions of Product Bulkiness: Weight and Size

Large size in heavy logistics often means technology and infrastructure that enables operation with the product. If products are sizeable plates or long profiles, they have a high degree of bulkiness. Over-sized master coils of 25 tons or 12 meters long tubes or sizeable plates have high bulkiness. Even moving or lifting the product by one meter requires specific and expensive infrastructure. Nevertheless, the value-added element is low in product handling. The lower left hand corner of the model has low bulkiness. Letter- and palette-size products are logistically easier to handle and deliver than bulky commodities.

2.5.2. Product Complexity

The complexity of product design is connected with value-added processing services. Product complexity has two dimensions: tolerance and shape. In processing, a bulky base product is transformed into complex part(s) or component(s) and finally assembled into a module or large system. At the mill-end producers commonly speak of prefabrication and SSCs speak of value-added processing service. Both mean product-customization to the required dimensions and quantities.

Tolerance is a dimension of quality and accuracy. Parts and components normally have high tolerances and quality requirements. They increase product complexity. Many steel parts are cut-to-shape and length and welded to a system. Cutting to angle or specific shape is more demanding than ordinary cutting. Complexity increases as a standard product is processed. In processing, the product value normally increases and the bulkiness decreases. Highly differentiated products have high tolerances that match high customer requirements. For instance, car manufacturers are able to produce large special components with a tolerance of four microns, or 1/25th part of the thickness of a human hair.

Shape is a dimension of complexity as a standard base product is cut, bent or machined. In processing, the processed area increases. Coil as a raw material has minimal area processing. Cutting a plate from a coil increases value to a product. Further bending, priming or painting increase processed area than original base product. If a plate or profile is customized into a part or component, the area that is processed increases accordingly. Customized parts such as a car body or door have several processing services compared with the original master coil or sheet. Such components also have high requirements for quality (Figure 2-9). Products with very high tolerances are in the upper right-hand corner of the complexity matrix. They are precision parts or components. They are difficult to customize and require high-know how or possibly special compositions.

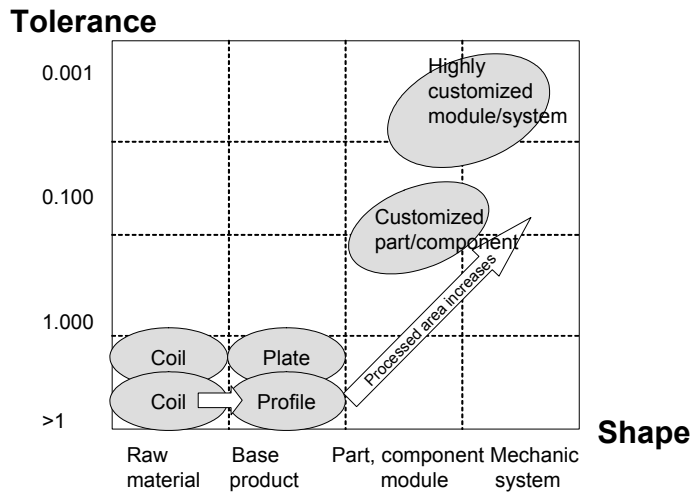


Figure 2-9 Dimensions of Product Complexity: Tolerance and Shape

Complexity requirements are high in mass customization, precision processing and product applications to specific circumstances, such as high durability, ultra-light applications, high or low temperatures, low friction, high pressure components, parts and modules. These are designed as integral parts of a system. High complexity is becoming one of the key issues for operators in assessing their logistic roles.

Product bulkiness-complexity is a relevant driver in the analysis of the outbound and inbound logistics between operators. In a value creation, inbound and outbound logistics are regarded as separate business processes between operators. Intermediaries source bulky base products from mills (inbound logistics). After stockholding, processing or other value added logistics intermediaries deliver components, parts and modules to OEMs (outbound logistics). Intermediaries decrease product bulkiness and increase complexity substantially. Steel parts, components and modules that are delivered by intermediaries play an essential role in the whole supply channel. The end-product is a system. Such products include oilrigs, cars, airplanes or ships (Figure 2-10).

Complexity

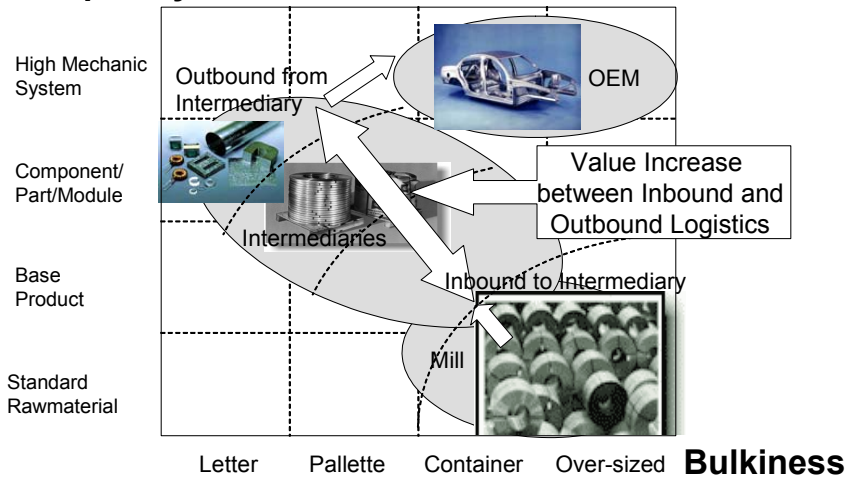


Figure 2-10 The Product Bulkiness and Complexity Matrix in Heavy Logistics

In this evaluation, value creation is measured between the inbound and outbound logistics. Production starts with 125 to 150 tons smelting lots at the converter that is typically 30 meters high furnace. Production is a continuous process (Teräskirja 2000). One smelting produces master coils of 25 to 30 tons at the mill. These over-sized raw materials are cut at the mill to container-size bundles and packages. Outbound logistics operates at the mill with products and raw materials that have high weight and size.

In the initial phase, the master coil is decoiled into a number of customized coils or cut to bundle of sheets or plates. In the outbound logistics, the product has higher value, lower bulkiness and higher complexity. Analysis between inbound and outbound logistics is used especially in evaluating the roles of operators in a supply system.

Inbound logistics downstream operates with mill-size products that range from five to 25 tons, depending on the product. In a break-bulk delivery or processing, the product bulkiness normally decreases. Outbound logistics is one product, processed part or component, which is often in letter-size or palette form. The ordinary weight is below 100 kg. Product bulkiness decreases substantially, especially downstream and before the assembly. In the assembly, bulkiness increases as the parts and components are assembled into a system.

Most high complexity products are manufactured by OEMs, component suppliers, contract manufacturers and SSCs. Precision and mass customization is a value-added

service with high requirements for product tolerances and operator capabilities. Precision and electronic components are such products.

2.6. Distribution Channels and Processes

The supply channel consists of upstream and downstream operators, which have diverse service capabilities. Cross-company co-ordination reduces costs, is streamlines business processes, and increases responsiveness between operators. Stern et al. (1996, 1-2) refer to institutions that depend on each other to cater effectively to end-user demand:

“Marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use. From the outset, it should be recognized that not only do marketing channels satisfy demand by supplying goods and services at the right place, quantity, quality, and price; but they also stimulate demand through the promotional activities of the units (e.g., retailers, manufacturers’ representatives, sales offices, and wholesalers) constituting them. Therefore, the channel should be viewed as an orchestrated network that creates value for end-users by generating form, possession, time, and place utilities.”

Haapanen and Vepsäläinen (1999) refer to four separate channels: persuasion, finance, ordering and transfer. Kotler (1991) presents six channels that are information, promotion, payment, risk taking and financing, negotiation, ordering and delivery. In heavy logistics, value-added processing plays a key role. Persuasion, financing, ordering, processing, and transfer are business processes performed by operators. The business operator may include all these processes in the service concept. Stockists and service centers supply all four services. The intermediary business scope is broad and integrated. The carrier operates only in the transfer channel, while a service center is able to operate in all channels.

2.7. General Trends of Capabilities and Products in Distribution

This research aims first, at a general level, to explain the development of service and processing capabilities and product characteristics within the distribution channel. These general trends will then be contrasted with the evolution of the logistics roles assumed by the different operators and intermediary parties of the channel in the special case of steel distribution (to be pursued in the next Chapter). The three models described in this Chapter - with the focus on the level of service, product-process

combinations and product characteristics - will be used to analyze and illustrate the trends of capabilities as well as the evolution of the logistics roles of the intermediaries.

The first model concerns distribution services (Figure 2-11). Following the original theorizing of Shapiro and Heskett (1985), the trend on the development of the distribution services can be stated as:

Service Trend: The development of service capabilities will allow, in general, faster delivery of broader selection of products at all stages of the distribution channel.

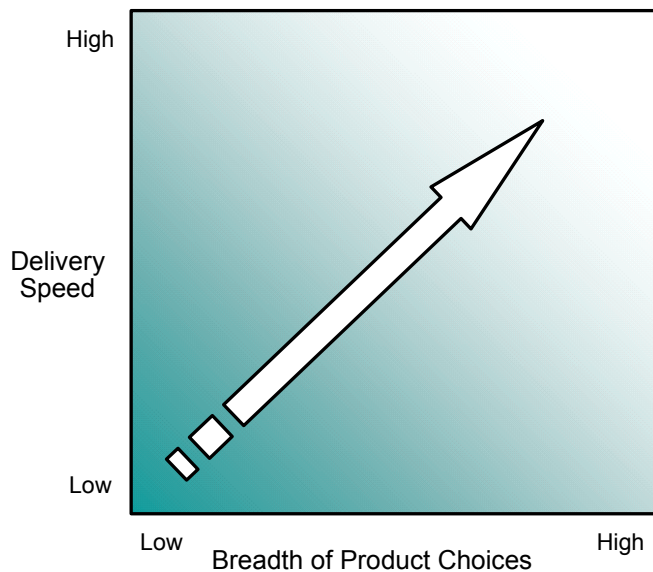


Figure 2-11 The Trend in Distribution Services

This means that the resources of the parties have originally restricted the distribution services to slow (matter of months) delivery of a narrow (selection of hundreds) line of products. There are many reasons to expect the kind of improvement in service level indicated in Figure 2-11: increasing competition, faster pace of business processes enabled by information systems and networking, and economies of scope in warehousing.

The second model was originally motivated by the problem of coordinating the life cycle of manufacturing processes and individual production lines with product improvements and standardization (Hayes & Wheelwright 1979). The assumption was that the adoption of new production lines and technologies coincided with new

generations of products since more automated processes provided not only economies of scale but also faster turnaround and higher quality. Hence, the next trend can be proposed for the development of manufacturing processes (Figure 2-12):

Processing Trend: As products and processes move along their life cycle, the process type applies more automated flow for larger volumes of more standardized products.

This kind of diagonal matching of manufacturing capabilities associated with the downward dynamics has been observed in most industries studied. The question of interest is if the same trend applies to the operators participating in steel distribution.

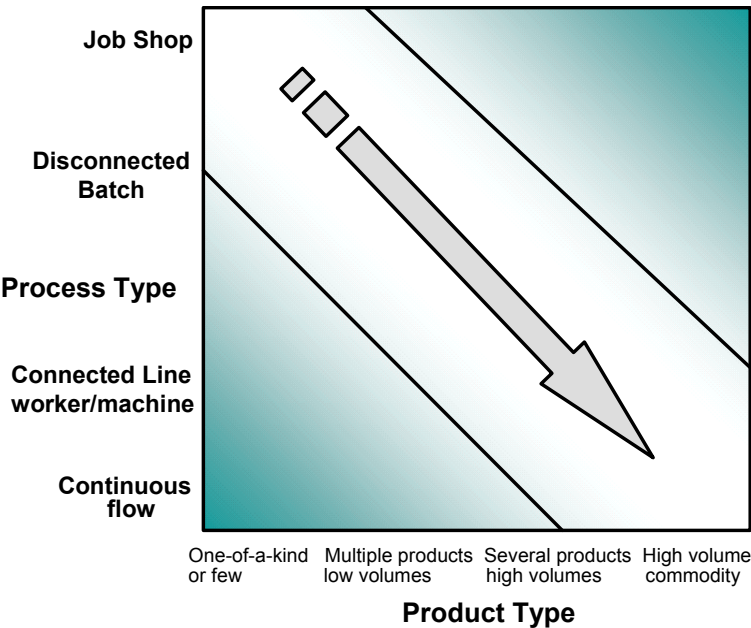


Figure 2-12 The Trend Combining Process Life Cycle and Product Mix Changes

The third trend proposed to illustrate the changes of product characteristics (Figure 2-13). As described in Section 2.5, the processing of raw materials through the value chain first into components usually moves the material from basic forms and bulky items towards smaller size and more refined mechanical standards. In the assembly process, then, the components and parts are built into modules and products, which mean movement towards large but still more complex systems. When looking at the characteristics of the products handled and processed within each role, however, a different trend can be expected: The complexity of the physical items handled by, for

instance, a stockist or a component supplier, may be expected to increase across the roles of the distribution channel (due to higher quality of machining equipment), and the capacity to handle larger, more bulky items is improving through automation. In many industries, however, such as electronics and fine mechanics, more advanced products tend to be smaller, and hence may reduce the average bulkiness of products. To recapitulate, the following paths can be expected in the development of the physical characteristics of products:

Product Characteristics Trend: The logistics and manufacturing technologies enable the handling of ever more complex products with possible sizes varying from extremely bulky to extremely small.

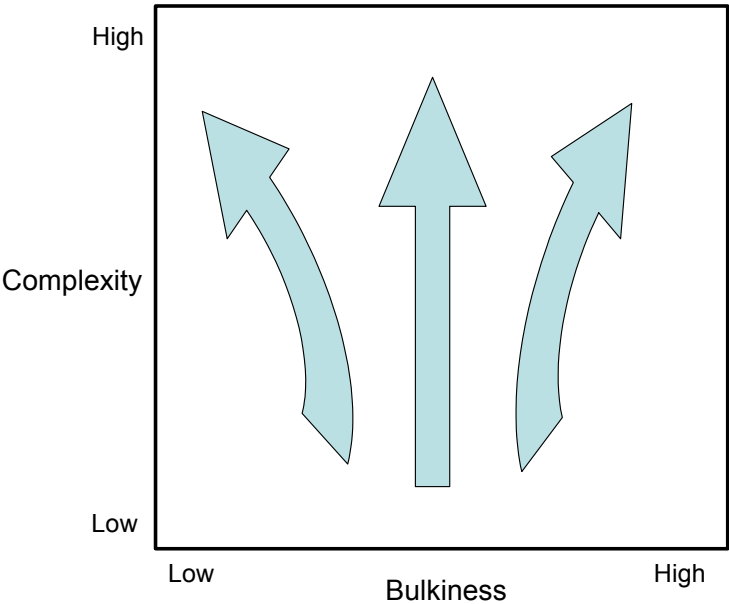


Figure 2-13 The Trends in Product Characteristics

These trends, as plausible as they seem in the light of stylized facts, will be contrasted below with the logistic roles attained by the different operators. There are two types of concerns in this respect: First, the capabilities of the mills and intermediaries may not differentiate the roles of the companies (or the change of capabilities over time may have that effect), and second, the development path of the capabilities and services provided by a company in a specific role does not follow the prescribed direction of the trend. These concerns will be addressed in the following first in the empirical review of international steel markets, which provides refinement of the above trends in terms

of the logistic roles of the different operators. The second application is a longitudinal analysis of steel distribution in Finland. In addition to historical data and the models, previous research and personal managerial experiences feature strongly in the analysis.

3. Review of Steel Distribution in Selected Countries

The introductory part has a description of the environment in which competition takes place. Steel markets, consumption and key operators provide the background for the analysis. Analyses are made from various perspectives concerning services, processes, product characteristics, and channels. Channel structures and the roles of intermediaries are analyzed for the largest West European countries and North America.

3.1. World Steel Markets

The steel industry is a global business. It is a basic industry, with long and established traditions. The steel industry is also a mature industry: markets have excess supply and capacity. The main indicators of market size are product demand and supply. Demand indicates how much steel is used in various markets. Steel supply on the market is a sum of the output of local mills and imports of which exports is deducted. Level of imports and local production varies between countries. Production capacity is often higher than output due to excess capacity. This means that the role of exports is also important.

In this research, three aspects of steel markets are described:

1. Consumption: The main indicators on the demand side are consumption per capita and consumption in metric tons a year. Demand includes the total steel consumption of the OEMs from foreign and local sources.
2. Production: The key indicators are the production capacity of the mill and the quantity produced in metric tons a year. This indicates the potential supply on the markets.
3. Foreign trade: the main indicators are the quantity of exports and imports.

The steel industry is an old and capital-intensive industry. Most large steel producers are state-owned and quoted publicly. Steel markets are cyclical and impacted by supply and demand. Demand fluctuates according to the demand for end-products manufactured by OEMs. Due to constant over supply, the steel industry has built-in controls on markets and competition. World steel consumption has increased in general

and new, lighter steel products and special products are being developed. Such traditional market segments as the automobile industry also use more competing alternatives than steel. The stainless steel and aluminum markets are, however, more limited than the carbon steel markets.

3.1.1. World Steel Consumption

Steel is used in many products as components, parts and structures. The largest consumer of steel is the construction industry. Large markets are in the automotive and packaging industries. Special steels, metals and stainless steels have recorded substantial growth due to increasing demand for electronics components and medical equipment. Steel is used in different areas of life; buildings, machines, packages, electronics, ships, airplanes, cars, home appliances, bridges, small articles and accessories are examples. Some examples of applications where steel is used (Worldsteel.org 2003):

- In 1863, George W. Ferris designed a Ferris wheel for the Chicago exhibition; it was 13.6 meters long and 0.8 meters diameter and weighed 70 tons.
- Surgical knives for keyhole and ophthalmic operations made from stainless steel are only 4 mm long and 0.09 mm thick – less than the thickness of a human hair.
- The National Bank in New York has the largest vault door ever made. Made in steel, it is 4.25 meters in diameter, 0.75 meters thick and weighs 80 tons.

Steel is consumed in every aspect of human life. Total world steel consumption is estimated at 768 million tons in 2000 and 830 million tons in 2005. This IISI (International Iron & Steel Institute) estimate includes annual growth of 0.7% in 15 EU countries and North America (NAFTA) (IISI 2001).

The largest steel-consuming countries are China, Japan and the USA in that order. The annual consumption of each of the three countries is around 100 million tons. The second group consists of Russia, Germany, and the Republic of Korea. Annual consumption is 40 to 50 million tons in each country. Steel consumption in the EU totaled 144 million tons in 2000. World steel consumption increased by 21.1% from 1994 to 2000 (Table 3-1).

Table 3-1 Steel Consumption in Different Market Areas in 1994-2000 (IISI 2001)

| Steel Consumption Mt | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| European Union (15) | 116.3 | 127.1 | 115.8 | 129.6 | 138.1 | 138.3 | 143.8 |
| Former USSR | 34.3 | 32.2 | 30.3 | 31.6 | 28.8 | 33.6 | 40.7 |
| NAFTA | 125.1 | 116.9 | 124.4 | 132.9 | 141.9 | 137.5 | 146.9 |
| Central & South America | 20.3 | 23.2 | 24.2 | 27.8 | 27.4 | 24.3 | 26.9 |
| PR China | 105.4 | 87.4 | 97.3 | 103.5 | 113.9 | 130.8 | 141.2 |
| Asia | 282.5 | 284.6 | 295.4 | 305.8 | 285.6 | 310.7 | 338.5 |
| World steel consumption | 635.2 | 684.4 | 654.9 | 697.0 | 692.5 | 712.5 | 768.8 |

The Nordic countries - Finland, Norway, Denmark and Sweden - are small markets representing about 0.5 to 1.0% of world consumption. Steel consumption in Sweden is more than double that of Finland or Norway.

Steel consumption varies significantly, depending on the country and its steel-consuming industry. Steel consumption in Europe is 340 kg per capita and the North America 420 kg per capita. In Africa, steel consumption remains low, at a level of 20 kg per capita. Asia has the highest consumption: Japan 635 kg, Taiwan ROC over 920 kg, and Singapore 1200 kg per capita (IISI 2001). Japan and Taiwan have industries that consume large volumes of steel and operate on global markets. The US steel markets are large; NAFTA's steel consumption totaled 146.9 million tons in 2000. This consumption is equal to that of 15 European Union countries (143.8 million tons) and PR China (141.2 million tons). North America consumes 420 kg per capita and Europe 340 kg per capita (IISI 2001).

The Nordic countries have a higher per capita consumption than the average in Europe: Finland 417 kg and Sweden 429 kg. The eastern bloc countries have low consumption: Poland 207 kg, Estonia 157 kg, Russia 123 kg and Latvia 74 kg. Germany is one of the largest steel exporters and importers. Germany consumes steel 439 kg per capita (IISI 2001). It is at the same level as North America but remains below the Asian high-consumption countries. It seems that steel consumption varies much between countries, depending on the steel consuming industries and foreign trade.

3.1.2. World Steel Trade

The steel trade is increasing constantly as the volume of manufactured goods is increasing. Steel is a widely used commodity and new products are developed for special applications. New steels are lighter and more durable than in the past. World

steel trade has increased by 6 to 7% annually between 1990 and 2000 (Figure 3-1). The trade volume depends on the growth of products and applications where steel is used as a component, part, or system. Steel remains an important raw material while competing materials are emerging as new applications.

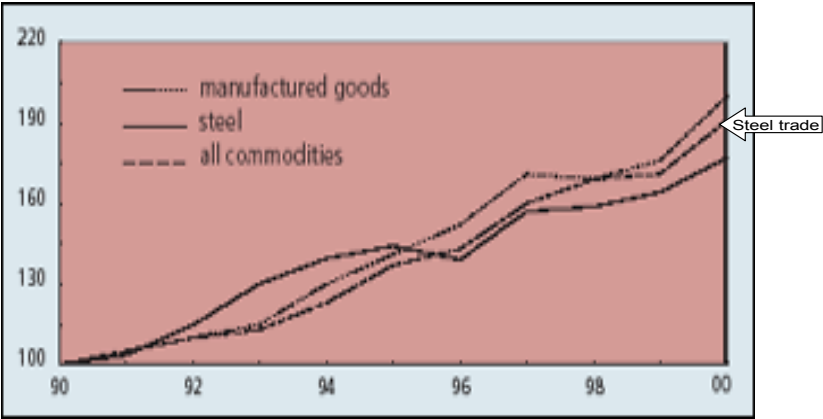


Figure 3-1 World Volume in Steel Trade (tons) 1990 - 2000 (IISI 2002)

Exports of steel have a growing importance in world trade. The volume of exports has doubled to 247 million tons in 1975-95 as total production increased by 30%. Exports accounted for 22.6% of total production in 1975 and 37.8% in 1995; the figure rose to 40.2% in 1999. The percentages of exports have increased accordingly (Figure 3-2).

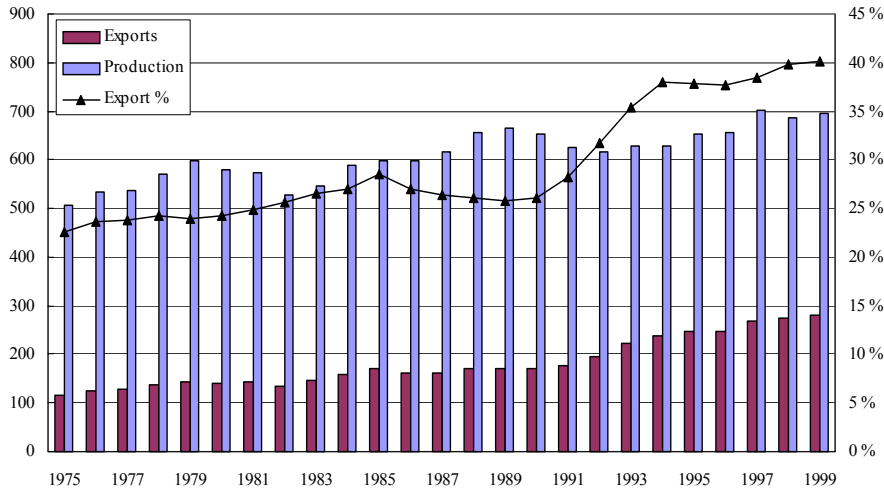


Figure 3-2 World Steel Production and Exports (tons) in 1975-1999 (IISI 2001)

The high role of exports refers to the necessity of international and global markets. The three largest net exporters are Russia, Japan, and Ukraine. In 1999, these three countries exported 58.8 million tons of steel more than they imported. The three largest net importing countries were the USA, China and Italy. They imported 43.2 million tons (mt) more than they exported. The largest steel exporters were Russia (27.5 mt), Japan (26.1 mt) and Germany (20.9 mt). The largest importers in 1999 were the USA (32.7 mt), Germany (17.2 mt), and Mainland China (17 mt) (IISI 2002). These figures indicate that steel has an active role in world trade.

Consumption shows a steady increase in spite of cuts in international capacity. The number of products is high and still increasing. The steel industry is a basic global industry. Exports and international trade play a key role within steel producers.

The role of exports is important, especially for smaller mills in Northern Europe. Even a high domestic market share is insufficient for economic operation. The Nordic steel markets are small by international comparison. Sweden has a higher share of total imports than Finland. Exports have gradually enlarged from home markets to neighboring countries and other continents. Sweden is more dependent on steel imports than Finland. The apparent steel consumption in Sweden exceeded 3 mt in 1997, increased to 3.7 mt in 2000 and declined to the level of 3.1 mt in 2001 to 2002 (IISI 2003). The volume of imports in 2000 was 3.3 mt.

3.2. World Steel Producers

Primary steel producers are large enterprises operating in many markets. The industry is capital-intensive, as one integrated steel mill is a large investment. Early steel producers were private companies. At later stages, many of these steel producers became state-owned companies due to substantial investments. New capacity is added and old cut retired. Traditional concepts within the whole industry and its operators are transformed accordingly.

The world's largest steel producers in 2000 were Nippon Steel and POSCO. They have annual output ranging from 26 to 28 mt of steel. Five of the ten largest steel producers were in Europe: Arbed, Usinor, Corus, Thyssen Group and Riva. The world's 80th

largest producer Nova Huta Kuncice produced 2.4 mt in 2000. Although the steel industry has consolidated, it is still more fragmented than the forest industry.

Competition structures among steel producers have changed on the top. Nippon Steel was the world's largest in 1999 and the third largest in 2001 with a steel output of 26.2 mt. The new world leader is Arcelor with 43.1 mt as three European steel producers united their operations in autumn 2001: Arbed, its partner Aceralia, and Usinor. The South Korean POSCO was the second largest (27.8 mt). The Nordic mills are small on a world scale and even by European comparison. The Nordic steel mills Rautaruukki and SSAB together have a production capacity of about 8 mt. Rautaruukki is ranked the 41st (4.2 mt) and SSAB the 53rd (3.8 million tons) largest in the world (Table 3-2).

Table 3-2 Largest Primary Steel Producers in 1999-2000 (Mt) (IISI 2002)

| <u>World Steel Producers</u> | <u>1999</u> | <u>Rank</u> | <u>2000</u> | <u>Rank</u> |
|------------------------------|-------------|-------------|-------------|-------------|
| Nippon Steel | 28.4 | 1. | 25.2 | 2. |
| Posco | 27.7 | 2. | 26.5 | 1. |
| Arbed | 24.1 | 3. | 22.2 | 3. |
| Ispat International | 22.4 | 4. | 20.0 | 6. |
| Usinor | 21.0 | 5. | 22.2 | 4. |
| Corus | 20.0 | 6. | 21.3 | 5. |
| Thyssen Group | 17.7 | 7. | 16.1 | 8. |
| Shanghai Baosteel | 17.7 | 8. | 16.7 | 7. |
| NKK | 16.0 | 9. | 12.8 | 10. |
| Riva | 15.6 | 10. | 14.1 | 9. |
| ----- | ----- | --- | ----- | --- |
| Rautaruukki | 4.3 | 46. | 4.2 | 41. |
| SSAB | 3.4 | 60. | 3.4 | 53. |

The ranking has changed in 2002 as Arcelor was established. It is today the largest steel producer with a steel output of 43.2 mt in 2002. The next largest are earlier leaders POSCO (27.8 mt), Nippon Steel (26.2 mt) and LNM Group (19.8 mt). Rautaruukki is the 47th largest (4.2 mt) and SSAB the 53rd largest (3.8 mt). In Western Europe Rautaruukki and SSAB are the 9th and 10th largest steel producers in 2000 (IISI 2003).

Ahlberg et al. (1999) have prepared a strategic classification of large steel producers. In this classification, the leading producers are consolidators with an annual capacity of 50 mt. They are gigantic producers. The capacity of a consolidator is more than fifteen times the capacity of Rautaruukki and 2.5 to 5 times compared with the top European

and North American steel producers. The largest steel producers are either consolidators or geographic incumbents. They operate globally on European, American and Asian markets. Large eastern producers are included in this classification. Rautaruukki and SSAB are classified as differentiators. The fourth group is called the specialists (Figure 3-3).

| Consolidators | Geographical incumbents | Differentiators | Specialists |
|--------------------|-------------------------|--------------------|-----------------|
| Arbed | Bethlehem | AK Steel | Böhler-Uddeholm |
| BSKH | BHP | Allegheny Teledyne | Cartech |
| Ispat Interational | China Steel | Kobe | Heckett |
| Kawasaki Steel | CSN | Mannesmann | SMS |
| Nippon Steel | Dofasco | Rautaruukki | Worthington |
| NKK | Iscor | SSAB | |
| POSCO | LTV | Techint | |
| Thyssen-Krupp | Nucor | | |
| Usinor | Riva | | |
| | Stelco | | |
| | Sumitomo | | |
| | U.S. Steel | | |
| | Voest-Alpine | | |

Figure 3-3 Profiles of World Steel Producers (Ahlberg et al. 1999)

The steel industry is a capital-intensive industry with generally low profitability. A survey (Ahlberg et al. 1999) states that over the past decade, the global steel industry has earned an annual operating return on assets of only 4 percent - half the rate of aluminum and pulp and paper. Only a few of the 50 largest steel companies recorded strong profits and growth from 1988 to 1997. None of the traditional industry leaders - large, integrated companies such as Nippon Steel (Japan), U.S. Steel, and British Steel – were included in this successful group (Ahlberg et al. 1999).

This classification excludes the two new and largest European steel producer groups: Arcelor and Corus. Both were formed in 1999 by merging. British Steel and Hoogovens from Holland merged to 1999 form a new company called Corus (Figure 3-4).

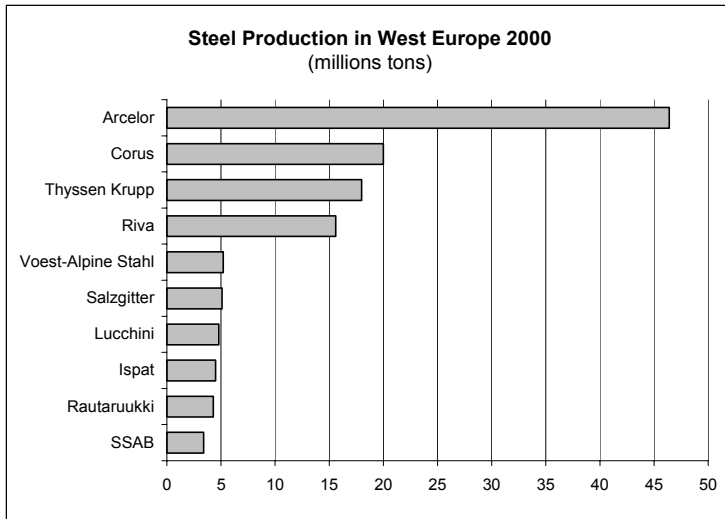


Figure 3-4 Largest Steel Producers in West Europe (IISI 2002)

Arcelor is twice as large as the second largest European steel producer Corus is. Its total capacity was 45 mt in 2000. A merger of three European producers formed Arcelor: Aceralia Group (Spain), Arbed Group (Luxemburg) and Usinor Group (France). If we add two additional producers - Thyssen Group (Germany) and Riva (Italy) - these four groups are the dominant producers in West Europe. The remaining producers have 5-mt capacity each or less.

The dominance of the largest steel producer is remarkable in the European steel markets. Arcelor is the key supplier of steels and aluminums for European car manufacturers. In Europe, 20 % of the steel used by the construction industry is Arcelor steel. Arcelor is the world leader in steels for refrigeration, washing and cooking appliances and in steel for cans and packaging (www.arcelor.com 2002).

Arcelor (2001) informs of their ambitions as follows:

“In recent years, world steel markets have become increasingly global in scope. Supply and demand have become more transparent as major customers go global and the new technologies of information and communication make information available everywhere in real time. Producers have to adapt their offer accordingly.

Compared with its supplier and customer industries, concentration is weak in the steel industry. The top ten groups supply less than 39% of world production, while the top ten automobile producers have 95% of the world market and the top 10 manufacturers of electric household appliances 80%.

When the new company is created, the partners will make up the world's largest steel group. .. However, being the world leader is not a goal in itself."

Other large groups aim at the global market arena due to the mature economies in steel markets and the global operations of their main customers. Chairman and CEO of Ispat International forecasts that there will be fewer global producers as the steel industry consolidates like the aluminum industry.

"Everyone speaks of the rule three, but we still have so many players in the steel industry. Considering how the aluminum industry has evolved, we in the steel sector would need to have at least ten steel companies with 50 million tonnes each... The aluminum sector has consolidated well, with 5 companies accounting for about 80% of the market... whereas in the steel industry the top 10 steelmakers collectively produced 25% of the world's crude steel production in 1999... To fulfill our vision of becoming the world's first global steel producer, we have over the past decade, acquired 9 vertically integrated steelmaking facilities in 8 countries" (Mittal 2002).

Stainless steel markets are more limited than steel markets. The largest producers of stainless steels were ThyssenKrupp, Arcelor, Outokumpu and Acerinox in 2002 (Figure 3-5).

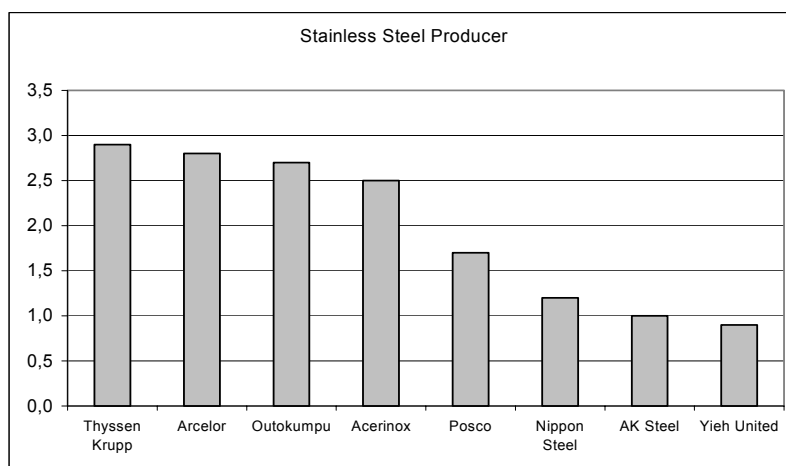


Figure 3-5 World Stainless Steel Producers and Forecasted Volumes (mt) in 2004 (CRU International, 2002)

The largest steel producers focus on diversified product choices and cover different product shapes and sizes. Steel production has consolidated in large global companies. Leaders in the steel industry are formed by chains of mergers and acquisitions between steel producing groups in different countries.

New types of production systems are introduced on international markets. The *mini-mill* concept combines innovative technology, local employment and resources. Such mills use recycling and have a lower cost structure than ordinary integrated steel mills. Mini-mills operate actively in the USA with limited product choices and higher delivery speed than integrated steel mills.

Steel is a global industry with local customer service. “One of the main issues facing the industry continues to be globalization and consolidation,” says Lakshmi N. Mittal, Chairman and CEO of ISPAT. He also believes that “Fragmentation of global steel industry can best be addressed by combination of faster globalization, consolidation and forms of strategic alliances” (Mittal 2002).

3.3. Steel Distribution Channels

The roles of intermediaries are analyzed in Western countries and the US. It has been difficult to obtain uniform information on markets and operators. In the analysis, general trends are described and analyzed with cases and reference companies.

3.3.1. Role of Intermediaries in International Steel Distribution

The roles of intermediaries vary greatly between different countries. The SSC industry seems to be stabilized in most European countries but without generic regularity. Intermediary services mainly comprise stockholding, processing and break-bulk, and consolidation. Key operators are accordingly stockists and service centers.

Stockists had high market shares in West European steel distribution in 1988: the UK 59%, France 45%, Germany 36% (80% with commission sales), Italy 45%, Belgium/Luxemburg 58% and the Netherlands 56% (EU Competition-Commission 268c3, 1990). The shares of intermediaries depend on the structure of steel-consuming industries. The share is high in Benelux and Finland and low in Sweden. The role of SSC industry has increased constantly in the UK and Spain. Germany has a high number of intermediaries with an increasing role in steel distribution. There are countries where SSCs and other intermediaries have maintained a stable volume from year to year. Sweden is one example. The volume of SSC Industry by country has been between 15 and 60% of the total steel consumption (Figure 3-6).

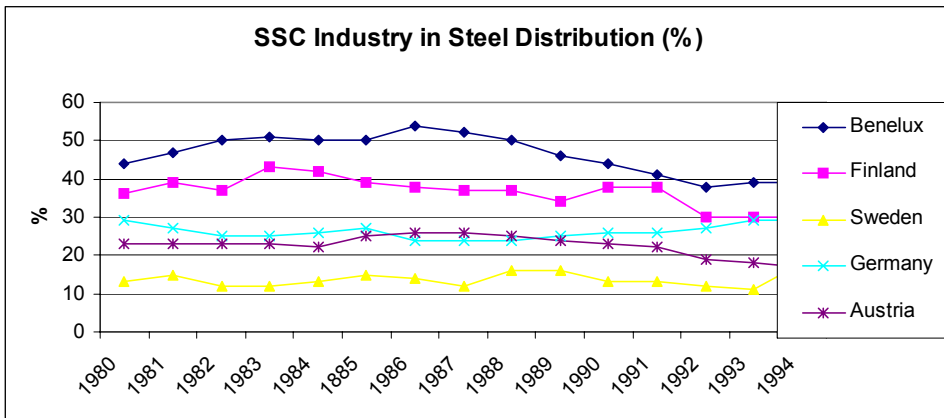


Figure 3-6 Joint Shares (%) of Stockists and Service Centers in Steel Distribution 1980-94 (Viitamo 1997, 59)

Consolidation happened at different times in West European countries. A survey of roles reveals that West-European stockists were still rather fragmented in 1980. Five dominant stockists represented 1/3 of steel distribution in Germany and half in the Netherlands. The ten largest stockists covered half of German and French steel distribution and 2/3 of Dutch steel distribution (Gadde 1980). Consolidation has been higher in Sweden and increased in other West-European countries towards 1990. Finland consolidated later after the recession of 1991 to 1993.

West European producers are large; international operators compared with Nordic producers. Consolidation in Europe was intense in the late 1980's. The UK, France, Germany, and Italy integrated both vertically and horizontally. In Northern Europe, stockists first consolidated and after consolidation producers integrated vertically with stockists and service centers.

Service centers and stockists maintained their role in steel distribution. There have been no major structural changes between upstream and downstream operators in 15 years. Major transformation has supposedly taken place in consolidation between stockists, value-added services of intermediary operators, and vertical integration.

In stainless steel distribution, the structures are different between large and small market areas. The largest markets - Germany (36% of the European volume), Italy (27%) and France (13%) - represented 76% of West European stainless steel consumption in 1992. Stockists supplied 40 % in Germany, 50% in Italy and 38 % in

France of cold rolled flat products. In smaller markets, stockists have a higher market share. Stockists supply 70% in Spain and 80% in the UK. In long tube products, Italian markets are concentrated both geographically and by user segment, and customers buy mainly mill-directly (Teruzzi 1993).

Next, channel structures are analyzed in various large steel-using countries. First, markets and services are described in the UK, France, Germany, Italy and Scandinavia and finally in the USA.

3.3.2. United Kingdom

Intermediary operators have had a growing importance in steel distribution towards the 1990s. The United Kingdom had broad national coverage with its 400 to 500 stockists and 1,078 depots. Largest stockists in UK had a nation wide coverage and locations in Northern Ireland.

Major stockists had half of the total number of depots. Walker and BSD were the two largest stockists, with nationwide coverage on broad product choices. The next largest intermediary was ASD Plc. Smaller stockists covered limited product choices and market areas. The UK had 312 depots for tube products, 270 depots for general steels, 356 depots for strip mills, and 256 depots for stainless steel stockholding in 1989.

The larger stockists and SSCs operate with all major product choices and processing services. The market share of the two largest (BSD + Walkers) totalled 34% in 1988. British Steel had 38 depots and Walker 40 depots in UK. Other stockists had 1,000 depots in the UK (EU Competition-Commission 1990). Most stockists have remained local and specialized (Figure 3-7).

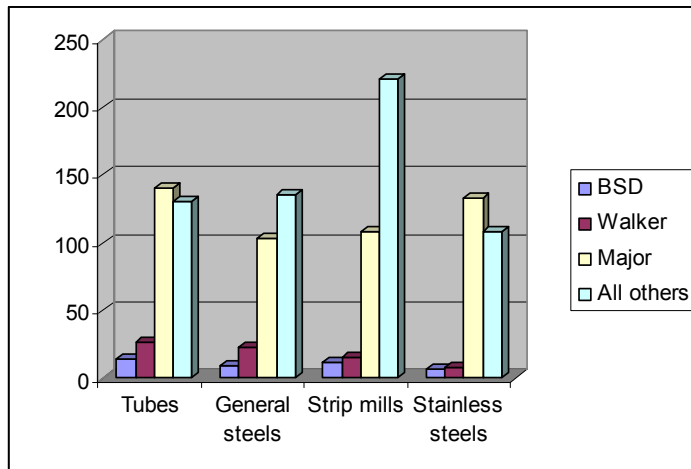


Figure 3-7 Number of Depots of UK Stockists 1989 (EU/BSC 1990)

The large integration was realized as British Steel entered into a merger of Walker and British Steel Distribution (BSD) in 1989. This strengthened the roles of intermediaries on One-Stop-Shopping (OSS) services. The EU Commission-Competition had to analyse the competitive situation in 1990 between stockists and their relations with suppliers. The investigation suggested the following:

“On the 21st of December 1989 the Secretary of State for Trade and Industry referred to the MMC for investigation and report the proposed acquisition by British Steel plc of C Walker & Sons (Holdings) Ltd (Walker). Walker and British Steel (through its distribution division, British Steel Distribution (BSD) are the two largest steel wholesalers in the United Kingdom. Together they hold about 34% of the total wholesale market and each supplies the whole range of steel products. British Steel is a major producer of steel products, supplying 58% of total purchases by the stockists in the United Kingdom and about four-fifths of purchases by both Walker and BSD (EU Competition-Commission 1990).”

This merger of the two largest stockists created an evident market leader in UK with broad product choice and service capabilities. There were, however, a great number of minor stockists. It seems that specialization increased as the largest intermediaries increased their product choice capabilities by uniting forces. “The merger in contemplation would bring together the two largest stockists in the United Kingdom. We estimate that in 1989, Walker held about 19% of the United Kingdom stockholding market and British Steel, through its stockholding division, British Steel Distribution (BSD), held 15%. The third largest supplier in the market, ASD Plc, held about 8% and

there were about 20 other large stockists with market shares ranging from 1 to 4%” (EU Competition-Commission 268c3, 1990).

The EU summary report referred to steel stockists in the UK as follows:

“There are 400 stockists in the United Kingdom. They include multi-outlet firms operating nation-wide or various parts of the country, large firms with a single depot operating in a more limited regional area and small firms operating with one or more depots at a local level....The importance of stockists has grown markedly in the last 20 years. In 1973, their share of sales of major steel products was 39% as compared with 60% in 1989. The share of UK stockists increased from 1986 to 1988. Stockists delivered in 1986 57%, next year 58% and 1987 59%” (EU Competition-Commission 268c3, 1990).

Some stockists and SSCs integrated or specialized in market segments. Brown & Tawse had capabilities for limited product choices, especially in general purpose tubes, Charles Day Steels Ltd in steel profiling and William King Ltd (SSC) in narrow coils and blanks. William King operated with the car industry through a joint venture with the Japanese Mitsui Group (Mi-King Ltd).

Stockists and SSCs currently have a dominant role in the UK steel distribution. Market coverage is dense with local and national depots. Serving a high number of small customers, the EU has given the following statement on channel structures and sourcing in UK (EU Competition Commission 268c3, 1990):

”Total sales of all steel products in UK in 1989 were 10,470 kt; of this total 6,289 kt or about 60% were actually distributed through stockists. The other 40% (4,181KT) were direct sales to end users. End users who buy stockists’ products direct from producers usually purchase large volumes. The majority of customers either does not need products in high volumes delivered mill-directly at lowest prices or require services and processes not supplied by the mills. Accordingly these customers can only buy products from stockists.”

The number of OEMs and other customers gives an idea of the break-bulk deliveries and consolidation services. Walker, the largest steel stockist in the UK estimated that its top 11 customers accounted for 9.7% in 1989 of its total sales in the UK, while its top 28 customers accounted for just over 15% of its sales. Walker had over 30,000 customers and just over half of its sales were accounted for by about 29,500, representing over 97% of these customers, who each had annual purchases of less than £100,000. In the tube section, the weighting toward smaller customers was even more pronounced (EU Competition-Commission 1990, 268c3).

This refers to a focus of a few large OEM customers and a great number of small irregular customers. Both are important for intermediaries. Another large SSC, ASD Plc, had 12,000 customers ranging from the largest blue chip organisations to the smallest sole traders. It had 20 units with the backing of a major central warehouse for immediate supply of steel from stock (Mac Donald 1993).

Stockists operated locally with OEMs and sourced mainly from a local producer British Steel (BS). With its associates, British Steel supplies 58% of the stockist's total purchases, including around 85% of the products bought by the largest stockists Walker and BSD. The same EU analysis confirms that British Steel supplied 7.3 mt of steel products to UK markets in 1989, which is 62% of the total volume in the UK (EU Competition-Commission 1990, 268c3). These figures prove that intermediaries have a dominant role in steel distribution and the role of local producer in sourcing is strong.

The local steel producer British Steel was nationalised first in 1949. This gradually continued in 1953 and then in 1967 most mills were largely renationalised when British Steel Corporation (BSC) was formed from 14 major steel producers. The Government announced their intentions for privatisation in 1988. British Steel brought together all its distribution activities in the division known as British Steel Distribution (BSD) in April 1989. British Steel had sales offices in 20 countries and a network of more than 200 agents. British Steel had five integrated steel mills and 20 sites comprising rolling mills, process lines, tube mills, plate and rail mills (EU Competition-Commission 1990).

Former British Steel operates currently as a part of Corus after a merger with Koninklijke Hoogovens in 1999. The world's 6th largest steel producer Corus has developed a European SSC network to meet the needs of nearly every sector of the industry. Consisting of over 60 service centres, this network supplies and processes over four million tonnes of steel and aluminium each year (corusservicecentres.com 2002).

British Steel produced plates & sections, strip mills, tubes and stainless flats for wholesaling. BSC delivered 5.8 million tons to UK home markets in 1989. Stockist's share was 58% and mill-direct deliveries to OEMs accounted for 47% (Figure 3-8).

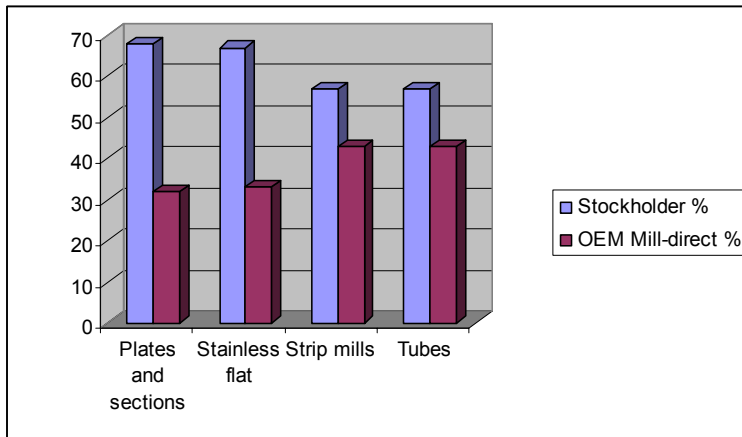


Figure 3-8 Deliveries of British Steel (BSC) in UK in 1989 (EU/BSC 1990)

The role of OEMs in mill-direct deliveries is significant. BSD estimated that the purchases of its top 20 OEM customers, each purchasing at least worth £1.8 million of steel products in 1988/89, accounted for 21% of its total purchases. In stockholding, foreign producers were active and made 20 acquisitions by 1990. Parent companies were specialized steel and metal producers or large steel mills. Vertical integration in distribution channels developed high after the merger of BSD and Walker. Local and foreign producers owned the largest stockists (Table 3-3).

Table 3-3 Steel Stockists in UK Owned by non-UK Producers 1990 (EU Competition-Commission 268c3, 1990)

| Steel Stockist | Parent Company | Country of Parent |
|----------------------|-------------------------|-------------------|
| Ovako United Kingdom | Ovako Oy | Finland |
| Hammer Steel Co | Usinor Sacilor | France |
| James Fairley | Usinor Sacilor | France |
| Baxter Fell | Hoogovens | Netherlands |
| Norsk Jernverk (UK) | Norsk Jernverk | Norway |
| SKF Steel | SKF Steel | Sweden |
| Skandia Steel | SSAB | Sweden |
| Uddeholm Ltd | Uddeholm | Sweden |
| Sandvik Steel UK | Sandvik Steel | Sweden |
| Alloy & Metal | Avesta | Sweden |
| Crusteel Ltd | Colt Industries | USA |
| Thyssen Fine Steel | Thyssen Edelstahl | W Germany |
| Howard E Perry | Klockner/ Usinor | W Germany/France |
| Krupp Steel Co | Krupp Stahl | W Germany |
| Joron | Hoogovens | Netherlands |
| Downings | Van Leeuwen | Netherlands |
| Lion Tube | Van Leeuwen | Netherlands |
| Garfield Lewis | Thyssen Edelstahl | W Germany |
| A P Steels | Arbed/Peine Saltzgitter | Luxemburg/Germany |
| Gwent Steel Ltd | Hoesch | W Germany |

Acquisitions in the UK indicate that the role of mills has increased in steel distribution. The largest mill-independent stockist in the UK is the German-French based *Klöckner & Co*, which acquired first *ASD Plc* and then *Richardsons Westgarth* in 2000.

Stockists and service centers have increased their role in distribution. Between 1996 and 1999, UK sales of steel stockists increased by almost 15% to a level of 7.7 mt. In 2000, the market of steel stockists marginally declined to a level of 7.3 mt. This was largely reflected by the slow down of the UK manufacturing output growth combined with the depressed market conditions in the automotive sector. The role of steel stockists has increased continuously. The market share of materials typically handled by steel stockists has increased from 64% in 1996 to 69% in 1999. In 2000, the proportional importance of steel stockists is believed to have declined to a level of 68% (Market & Business Development 2002).

3.3.3. France, Germany, Italy and Benelux

France and Germany are the largest markets in West Europe. The roles of stockists and SSCs were significant in 1988. In France, intermediary deliveries were 45% of the total volume and in Germany 36%. In Germany, stockists also act on a commission basis for producers. With this volume, intermediaries have a share of 85% (EU Competition-Commission 268c3, 1990).

Most of the largest stockists, however, were no longer mill-independent entrepreneurs. Local or foreign steel producers owned the largest stockists. Mill-owned turnover in 1980 was 84% in France, 8% in Germany and 63% in the Netherlands. In Italy, the mill-owned share of stockholding was 53% and in Belgium/Luxemburg 21% (EU Competition-Commission 268c3, 1990). Mills had a dominant role in steel distribution in the late 1980's. From 1980 to 1990, mills integrated vertically and entrepreneurship disappeared. Mill-owned distribution dominated in Germany and France. Italy and Benelux were also vertically integrated by 1988 (Figure 3-9).

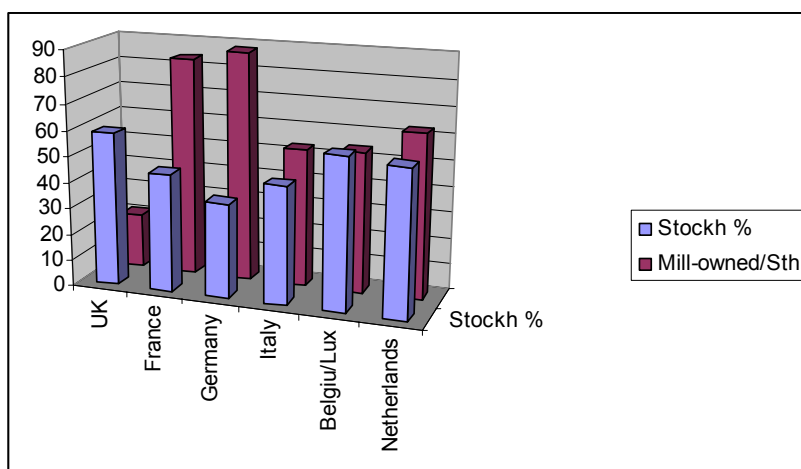


Figure 3-9 Shares (%) of European Mill-Owned Stockists in All Intermediary Deliveries in 1988 (EU Competition 268c3, 1990)

Further integration in Germany, Italy and France continued. The merger of *Thyssen Stahl Ag* and *Krupp Hoesch Stahl Ag* in 1997 formed Thyssen Krupp Stahl with their own SSCs. The Italian producer Ilva had its own service centers, and stockholding facilities close to OEMs. The French producer Usinor Sacilor had its own subsidiaries in distribution: Nozal and Longometal. They had a nationwide coverage in France and broad product choices with processing capabilities. In addition, a large service center in France PUM merged with Usinor Distribution in 1999. Usinor Sacilor continued integration in the neighbouring markets by acquisition of ASD, the next largest SSC after BSD in UK.

The French-German merger of service centers formed the largest network of intermediary operators in Central Europe. The new company was named Arus SA (formerly Hardy-Tortueaux SA). Arus combined French service centers with Klockner Stahl und Metallhandel GmbH in 1996. Arus merged with the German-based Klöckner by a purchase of 62% of Arus' capital (Klöckner 2002).

Nozal and Longometal are now a part of Klöckner & Co's multi-metal distribution network (Klöckner Distribution Industrielle). Klöckner & Co is the largest European steel and metal distributor, which employs 11,000 employees in Austria, Belgium, Canada, Czech Republic, France (KDI SA, Klöckner Metal Services SA), Germany, Great Britain (ASD plc, Klöckner Metall Services Ltd, Armstrong Steel Ltd), Italy, the Netherlands, Spain, Portugal, Switzerland and the USA. Klöckner is an old German

trading house, transport company and producer, which started in 1906. Klöckner became a multinational trading house in 1991-96, focusing on steel and metal distribution (Klöckner 2002).

In stainless steel distribution, the presence of a local producer is strong, as Terruzzi (1993) confirms:

“There seems to be an inverse correlation between the size of market and the importance of distribution: This may be interpreted by the presence of strong national producers in the most important markets (Germany and France)... If we take a closer look at the situation in stainless steel cold rolled products distribution system, we can also see that many producers, furthermore, have constructed commercial barriers in their own markets, allowing them to maintain an adequate presence. In particular, French producer, Ugine, the German producers Thyssen and Krupp, and the Spanish producer, Acerinox, all practice this type of commercial policy. These producers in fact control end users (OEMs), delivering a very important part of their domestic sales of stainless steel cold rolled products to them... In countries with higher consumption the access to the end users (OEMs) seems easier even by foreign producers”.

Distribution channels in West European countries have been transformed, especially since 1990. Key intermediaries tended to become market leaders by mergers. Integration has advanced rapidly in Europe. The EU has close control over mergers and integration downstream. In steel distribution, a strong horizontal consolidation of stockists and vertical integration by the mills has taken place in most West-European countries.

3.3.4. Scandinavian Countries

Intermediary deliveries in Nordic countries have fluctuated between 5.9 and 6.2 mt in the 1980s. Sweden has represented about 40% of the Nordic markets, Finland 25%, Norway 20% and Denmark 15% (Nordic Steel Stockists 1989). In Sweden, the market structure was quite different in the mid 1970s. Direct deliveries and the role of imports were apparently higher in Sweden than in the other Nordic countries. The consolidation process had taken place much earlier in Sweden (Figure 3-10).

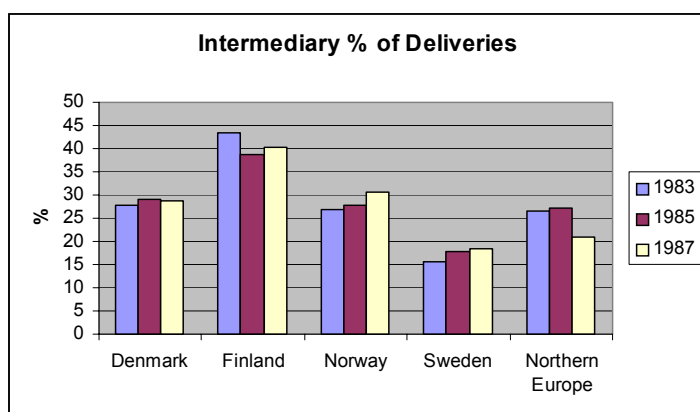


Figure 3-10 Share of Nordic Steel Stockists of All Deliveries (Nordic Steel Stockists 1990)

The role of stockists declined in North European distribution by 1987 to 20% of total distribution (Nordic Steel Stockists 1990). The role of stockists is highest in Finland. By the late 1980's the Finnish stockists delivered about 40% of all deliveries as Norway and Denmark were at a level of 30% and Sweden 15%. Nordic stockists estimated that the share of processing services in Sweden was highest in 1987 with a volume of 40% of all deliveries. Of the total intermediary deliveries, stockists delivered as processed 30% in Finland and 13% in Norway. The trend was expected to develop increasingly towards value adding processing services and an increasing role for service centers (Nordic Steel Stockists 1988).

Steel stockholding in Sweden first consolidated horizontally. Consolidation from 1948 to 1980 decreased the number of intermediaries by 2/3. Most stockists were members of JBG. In 1948, the Swedish Steel Stockists and Wholesalers (JBG) had 18 members. Consolidation among Swedish steel stockists was activated after low steel demand in 1974-75. The number had decreased by eight companies by 1976 and further by four companies by 1980, mainly due to mergers. In 1980, six steel stockists remained (Gadde 1980). Ten years later, there were only two dominant service centers; Tibnor Ab and Bröderna Edstrand Ab.

The main reasons for consolidation and mergers were the broad product choices in stockholding. Conventional stockists tended to increase service by increasing number of stock items. This business concept required substantial capital for inventories and space for operation. Secondly, investments in value-added processing services (cut-to-

length, shearing, priming and painting) needed high volumes against substantial investments (Gadde 1980).

Developments in Sweden indicate that high service capabilities require more sales to cover the costs of logistic and service capabilities. Most stockists have merged with each other to have more revenues against logistic and service investments. Intermediary markets in Sweden consolidated already in the mid 1970s. In Sweden, only four stockists covered the whole country in 1975: *Söderberg&Haak*, *Odelberg&Olson*, *Ahlsell&Ågren* and *Bröderna Edstrand*. They represented 75% of the total volume of Swedish steel stockists (SOU 1977:15-16). The first two stockists had invested especially in value-added processing services to become service centers. They also had a dense coverage of local depots around Sweden. Wholesale volumes were too low to cover investments and in June 1976 *Söderberg&Haak* and *Odelberg&Olsson* merged. *Söderberg&Haak* (Ratos) acquired *Seaton&Co* in Gothenburg earlier. These three companies formed the backbone for further consolidation in Sweden. The new name was *Tibnor Ab*.

Consolidation progressed next to vertical integration. Mills increased their role in steel distribution. *Stora Kopparverk* acquired *Dickson&Sjöstedt*, a steel stockist and wholesaler in Gothenburg in 1976. SSAB formed a joint steel wholesaler *Ahlsell Stålgrossisten AB* in 1978. *Dickson&Sjöstedt* joined this vertical integration. SSAB announced acquisition of *Tibnor* from Ratos in 1979 (Gadde 1980). In addition, the Johnson group (Avesta) acquired regional stockists in 1979, which further consolidated downstream operators. Horizontal consolidation and vertical integration in the supply channel were realized from 1976 to 1979 in Sweden. This was earlier than in most West European countries. Steel stockists in Sweden sourced their rawmaterials dominantly from foreign mills in the mid 1970s. Stockists delivered about 30% from steel consumption in Sweden (Figure 3-11).

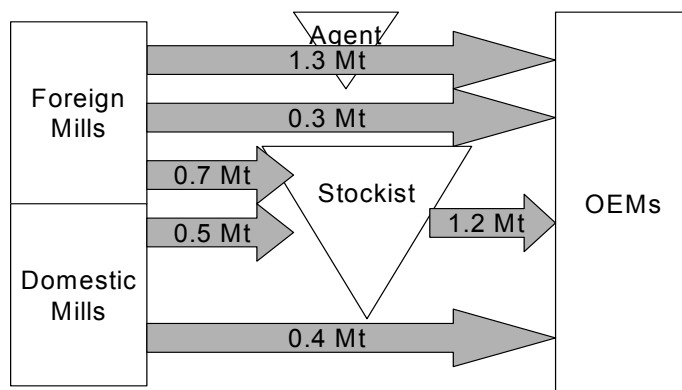


Figure 3-11 Steel Distribution Channels in Sweden in 1975 (Gadde 1980)

The share of importers and agents was rather high (30%). They delivered 1.3 million tons to OEMs. The volume of stockists in Sweden totalled 1.2 million tons in 1975, of which stock deliveries were only 0.5 million tons (11.9%) and direct OEM deliveries 0.7 million tons (16.7%). During 1980-1990, stockists delivered less than 20%, which is rather low by international comparison. Supply channels in Sweden are more diversified than in Finland. Steel consumption was 4.3 million tons in 1975, of which foreign sources represented 47%.

In Sweden, the market leader in steel distribution is *Tibnor Ab*, which is the largest service center in Scandinavia. It employs 1,400 people. Turnover exceeded €585 million in 2001 (including industrial sales). SSAB (85%) and AvestaPolarit (15%) own Tibnor. Tibnor operates in Scandinavian countries and Poland. Tibnor has a wide coverage with 20 stockholding locations (Tibnor 2002). Tibnor has many locations in Sweden and in Norway (former Schreiner Fleisher AS). “On most product areas Tibnor has a market share over 50% in Sweden,” says Director Sven Bergman (Tibnor 1994). The next largest are Bröderna Edstrand Ab and Helens Stål Ab (Rautaruukki).

Tibnor lists 5,000 stock items of commercial steels and 3,000 stock items of metals. Tibnor has subsidiaries in Finland, Norway and Denmark. Turnover is €595 million (6,474 million SEK) in 2001 (Tibnor 2002). Tibnor also has product areas other than steels and metals. Tibnor has developed Tibnor Extranet for order processing and e-Commerce capabilities (www.tibnor.se).

BE Steel Group (Bröderna Edstrand Ab and Starckjohann Steel Oy) is the largest mill-independent service center group in the Nordic countries and the Baltics. Trelleborg

(49%) and Nordic Capital (51%) acquired both Starckjohann Steel (Finland) and Bröderna Edstrand (Sweden). Both are old entrepreneurs. Bröderna Edstrand started business operations in 1885 in Malmö and stockholding of steels in 1900. Currently, Bröderna Edstrand operates with broad product choices (OSS) with processing capabilities in general steels, stainless steels, aluminium and special steels. The turnover of BE Steel Group exceeds €455 million (Profit €13.9 Million) and they have 884 employees (BE Steel Group 2003).

In steel production in Sweden, there were many small more or less specialized producers in 1960. Consolidation among Swedish steel producers increased rapidly in 1978. The three largest producers of commercial steels, Domnvarvets Steel Mill, Öxelosund and NJA merged with the 50% state-owned *Svenskt Stål AB (SSAB)*.

Small mills focused on limited product choices: stainless steel plates, welded tubes, wire rope, steel plates, and sheets. Sweden had 5 to 10 steel mills in 1962. Number of mills diminished 3-5 in 1976 and finally one large-scale mill was left in 1988 (Jernkontoret 2002). The dominant producer SSAB had core capabilities in the production of steel plates. There were, however, a number of small more or less specialized mills in Sweden. One of them is Sandvik.

Sandvik Specialty Steels Ab is the only company in its areas of operation with a truly global presence and a strong market position. Sandvik is a world-leading manufacturer of products with extensive value-added services in stainless steels, special alloys, metallic and resistance materials, steel belts, process plants based on steel conveyor belts, and sorting systems (Sandvik 2001).

Swedish SSAB has built their core competencies on niche areas. Chief Executive Officer Anders Ullberg gives a comment to SSAB shareholders following:

“Today we are also one of the leading suppliers of high-strength sheet in Europe. In order to focus on extra- and ultra high-strength sheets, a segment in which the number of companies is limited and in which we possess unique production condition”.

SSAB’s strategy confirms importance of processing and international markets.

“The Group’s trading and processing operations will be actively utilised in neighbouring markets so that the steel operations’ strong position and high market shares can be further strengthened” (SSAB 2001).

Analysis show that trend in Scandinavia has progressed towards vertical integration and specialization. Production and distribution are concentrated on large or specialized operators. SSCs cover nationwide and neighbouring markets with broad product choices and processing capabilities. Developments in Sweden have been towards a larger One-Stop-Shopper by combining product choices and services in one operator. Tibnor is evidence of this.

3.3.5. North America

The North American SSC markets are large. The SSC industry has remained highly fragmented with more than 1,332 companies operating in excess of 3,500 sites. The American SSC industry generated net sales of almost \$59.9 billion in 2002 (Stundza 2003).

The North American intermediary markets are served by SSCs and local or specialized stockists. The SSC industry is large, covering many public, family- owned, and mill-owned, more or less focused operators.

The top 100 service centers provided 46% of all steels and metals shipped to end-users (OEM). Shipments of steel, aluminium, copper metals and superalloys to domestic buyers fell by almost 14% or 28.15 mt in 2002, which was the lowest tonnage in a decade (Stundza 2003). This will be analyzed in more detail by cases and SCN surveys later on.

Service centers nowadays have a dense nationwide coverage. Based on MSCI data, the SSC industry in North America comprises over 5,000 service center locations, which operate throughout the USA in every state and service over 300,000 customers. The SSC industry is highly fragmented, consisting of a large number of small companies and a few relatively large companies. Based on analysis of the Rayerson MSCI data, the SSC industry handled approximately 25.7 mt or 25.6% of the metals distributed in the United States in 2001 (Ryerson Tull 2001).

Ryerson Tull and ThyssenKrupp operate overall throughout the USA and Canada. Only four competing service centers have such market coverage: the fourth largest Integris Metals (annual revenues \$1.7 billion) and the ninth largest EMJ (Earl M. Jorgensen) (\$1.06 billion). Other service centers focus on selected market areas or product choices.

The top 100 service centers have lost sales. A survey (Purchasing 2003) indicates that annual sales have declined by about 17% in two years from \$340 million in 2000 to \$300 million in 2001 and \$280 million in 2002 (Appendix 1).

Service centers in North America have started losing market share to mills. Especially, small-tonnage mini-mills have increased their role in steel distribution. Service centers accounted for 64% of the total US metal buy in 2000 and producing mills had a share of 28%. Mills had increased their role to 41% in 2002 (Stundza 2003) (Table 3-4).

Table 3-4 Share of Intermediaries in US Steels and Metals Buy 1996-2002 (Purchasing 2003)

| % of total metals buy | 2002 | 2000 | 1998 | 1996 |
|------------------------------|------|------|------|------|
| <i>Producing mills</i> | 41 | 28 | 32 | 30 |
| <i>Service centers</i> | 54 | 64 | 62 | 64 |
| <i>Processors</i> | 3 | 6 | 3 | 5 |
| <i>Traders&merchants</i> | 2 | 1 | 2 | 1 |
| <i>Dot-coms</i> | 1 | 1 | 1 | 0 |

Service centers have invested substantially in processing capabilities. Development among mini-mills has also been encouraging. Dot-coms have had a nominal role since 1998 as an additional supply channel for mill-direct and SSC deliveries. In 2003, 18% of the buying groups surveyed had an electronic-procurement system at their company, a big increase from the 5% of two years earlier.

A survey (Purchasing 2003) indicates more supplier cuts for intermediaries. More than 40% of the buyers polled plan to reduce the number of service centers they use. The suppliers of the future, the buyers say, will be service centers that exemplify resourcefulness, relationships, and reliability (Stundza 2003).

3.4. Analysis of Service Capabilities and Intermediary Roles

The main operators of the early days of steel distribution were a mill, a stockist and a local distributor who served end-users. The roles of operators were clear. A mill produced long batches of standard products with a long delivery leadtime. Therefore, a stockist acted as an intermediary with a low breadth of product choices importing products into an inventory. Delivery lead-times were short only for products in inventory, for other products several months. A local distributor replenished from the stockist's inventory with a delivery lead-time equaling that of a transportation lead-

time. For a reference point, the logistic service capabilities of the different intermediary roles have been drafted in Figure 3-12.

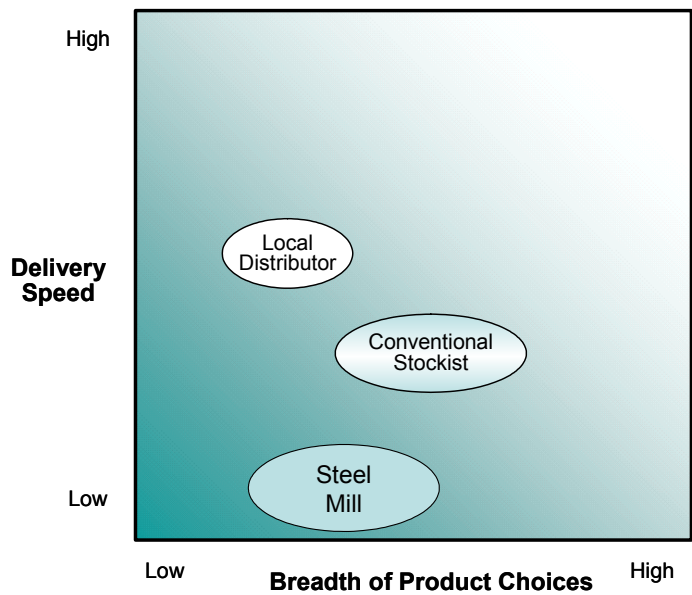


Figure 3-12 Logistic Service Capabilities of the Early Operators in Steel Distribution

Today the service center industry is in a key role in steel distribution and processing services. An interesting point is the emerging role of mini-mills on the US steel markets. Both Europe and USA are large markets for stockists and service centers.

The EU for decision-making in the Commission makes a survey of stockists in the UK. The survey states that product choices in the UK dominantly base on flat products and strip products. Strip mill products are dominant for processing. Long products (merchant bars, tubes) have lower share than flat products. Stainless steels and aluminiums have minor shares in the intermediary services (Figure 3-13). This structure may vary, depending on the steel-using OEM industry. In the UK, the car industry uses much steel in a processed form.

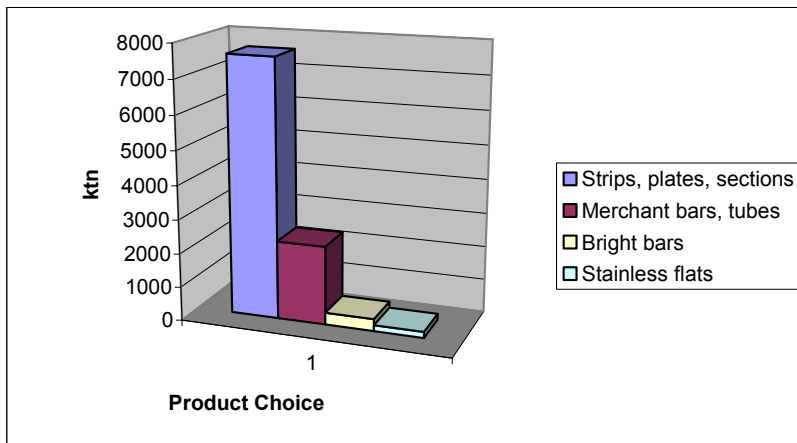


Figure 3-13 Product Choice Capabilities: UK Steel Stockists 1989 (EU Competition 268c3 1990)

A survey of the North American SSCs describes the product choices on a large intermediary market. It also highlights the present situation in the SSC industry. SSCs concentrate on broad product choices of different type of steel and metal products (OSS) or specialize in one core product area. This diversification is shown in Appendix 1, where the 100 largest US service centers are listed (Purchasing 2003).

Most US service centers focus on one product choice and serve primarily local markets. This is evidence of specialization in the intermediary services. Half of the service centers focus on carbon and alloy steels or aluminium. It seems that the size of the service center limits the product choices and market areas. Larger service centers tend to be One-Stop-Shop (OSS) operators with many product choices.

SSCs have boomed in the North American steel markets. North American SSCs have enlarged product choices and become large key intermediaries on the markets. Most of the turnover is contributed by large service centers (OSS) with many locations. The others have capabilities for broad product choices: 20% of the service centers have 2 or 3 choices and 25% operate with 5 or more product choices (Figure 3-14).

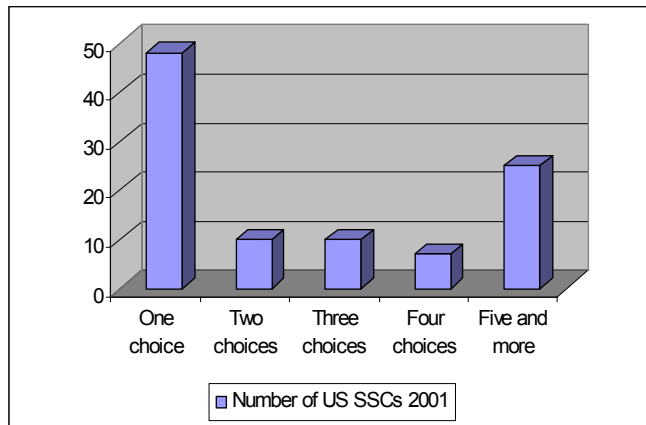


Figure 3-14 Number of Product Choices/ SSC: 100 Largest Service Centers in the USA (Purchasing 2002)

Specialization is typical in the intermediary services on large markets. Core capability is on one product choice with a great variety of products and high delivery speed. The stockholding program consists of many shapes, sizes and compositions. Specialized intermediaries are able to offer broad product choices of standard products from many sources with related logistic and processing services (Figure 3-15).



Figure 3-15 Specialization on one product choice: Bulky steel profiles

A recent survey among US service centers identifies services and business processes where improvements are most needed. Intermediary services and especially deliveries to OEMs play the key role in steel distribution.

A customer satisfaction survey among 74,200 North American steel-using OEM customers reveals that the lowest satisfaction rate is for delivery and price (64%). Overall satisfaction among all customers was 66%. The highest satisfaction rates are

for product quality (78%) and service (69%) (Jacobson MCN 2002). This survey confirms that customer delivery is still regarded as a problem among US steel users.

In the same survey, 40% of the OEMs mentioned that sheet mills should improve their deliveries. Of all the OEMs, 18% named quality, 15% service, 7% price and 2% product availability in 2001. The overall customer satisfaction rate in sheet mill deliveries had decreased from 8.25 of 2000/Q4 to 6.9 of 2002/Q3. Dissatisfaction had increased, particularly with the availability and price, and decreased with quality (Jacobson MCN 2002).

The survey further suggests that delivery has to be improved more than price, service or quality. This survey of some 2,700-service centers sheet customers and 3,200 OEM customers tell that dissatisfaction is even higher in a multi-echelon than in mill-direct deliveries. Service centers still have a need to improve their performance (Figure 3-16).

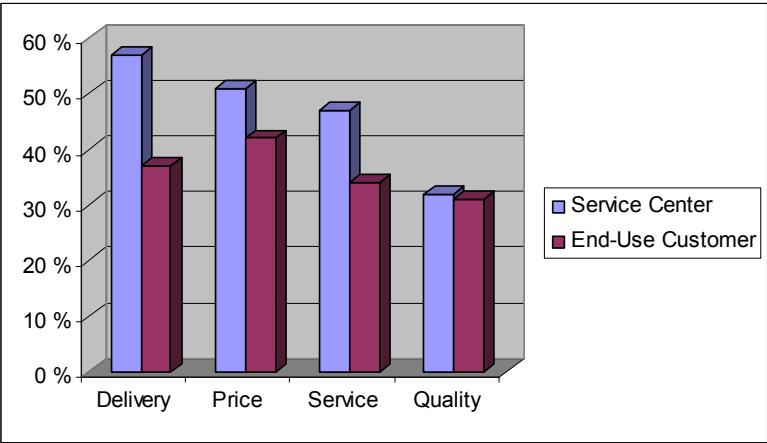


Figure 3-16 OEM Customer Dissatisfaction in USA 2002 in Sheet Products (Jacobson Survey/MCN 2002)

Based on the above, the improvement in conventional intermediary services has not been very great in the USA. Today OEM buyers in general put less emphasis on traditional intermediary services. Another survey proves that OEMs put priority on price (7.2) and quality (7.5) rather than on-time delivery (5.9) on a scale of 1-10. OEMs welcome also e-commerce capability (4.5). E-sourcing refers primarily to the use of automated requisition systems, reverse auctions, and web portals; 60.5% use e-sourcing for buying from distributors (Purchasing 2003).

The largest SSC *Ryerson Tull, Inc* has broad product choices in the USA and Canada. Ryerson Tull offers 100,000 products covering 11 product choices in 57 locations in 2001 (55 locations in 2002). Warehouse space totals 10 million sq.ft. Product choices include carbon & alloy steels, stainless steels, specialty steels, copper, brass, bronze, aluminum, super alloys, grating (carbon, stainless & aluminum), fiberglass, industrial products. Increasing product choices enable the services of a One-Stop-Shop operator. The delivery fleet includes 500 trucks. As a leading distributor and processor of steels, annual sales totaled \$2.2 billion in 2001 (Purchasing 2002) and \$2.1 billion in 2002 (Purchasing 2003). It has capabilities in metal trading around the world. Joseph T Ryerson started the company in Chicago 160 years ago and it merged with J.M. Tull Metals in 1986. This marriage enlarged product choices even further. Ryerson Tull Inc. has high processing capabilities: sawing, slitting, blanking, pickling, cutting-to-length, leveling, flame cutting, laser cutting, edge trimming, edge rolling, fabricating and grinding to process materials to specified thickness, length, width, shape and surface quality pursuant to specific customer orders. More than one-half of the materials sold by Ryerson Tull are processed in its 57 service and stocking locations including exports to Asia, Mexico and Canada.

ThyssenKrupp Materials NA Inc. is the second largest service center in the USA. Total sales declined to \$1.9 billion (2002) from \$2.2 billion (2001). A delivery fleet of 508 vehicles equals that of Ryerson Tull Inc, but the warehouse space is 3 million sq.ft. Operation in 63 locations covers 10 market areas including the USA, Canada, and Mexico. Product choices include carbon & alloy steels, stainless steels, specialty steels, copper brass, aluminum sheet, plate, extrusion and rod & bar, titanium & alloys and industrial alloys (Purchasing 2003).

TW Metals Inc has high capability in selected metals. TW Metals Inc is the 17th largest service center in North America. Two entrepreneurial companies, Tube Sales and Williams, started the company over 100 years ago. TW Metals has 17,000 stock items of stainless steels, aluminum, high alloy, copper, brass, magnesium and carbon steels. They include standard and unique items. The product shapes are coil, plate, bar, rod and wire. There is a delivery fleet of 200 trucks. TW Metals employs EDI and Quick Response Teams for quick quotes on bills of materials, accurate replies, timely deliveries and professional expertise service. Turnover of \$500 million covers the

North American markets (30 areas in the USA), Europe (UK, France, Belgium, Israel), and Japan and Singapore. TW Metals has service capabilities with broad product choices and processing. It has strengthened its processing capabilities by investing in advanced processing technologies. Company offers 15 processing capabilities on specialized product choices. TW coordinates the customer's total material requirements in order to supply product in kit form, fabricated parts, or finished assemblies (twmetals.com 2002).

McNichols Co in Florida is the 50th largest SSC and a specialized SSC *Action Stainless & Alloys Inc* in Texas is the 100th largest. McNichols covers four product choices: carbon & alloy steels, stainless steels, specialty steels, and aluminum. With a turnover of \$96 million, they serve two market areas, the Midwest and the Plains. Action Stainless focuses on one choice, namely stainless steels. Turnover of \$26 million comes from two market areas. Action Stainless & Alloys Inc. operates in six locations and specializes in stainless steels (Appendix 1).

The service capabilities of the mills are rather limited compared with those of service centers. Integrated steel mills produce most steel products. A new production and service concept, the *mini-mill*, is increasingly improving both delivery speed and the breadth of product choices. During the 1990s, mini-mills were active in slab castings, reinforced bars, rods, beams, and other profiles. Mini-mills have recently enlarged their role in the USA. They operate mainly on local markets. The service capabilities are comparable to those of stockists and local distribution centers (LDC). Product choices are still limited. Production is an integrated process. Mini-mills use recycled raw materials in steel production. They have entered flat-rolled production. North America has 32 mini-mills producing steels and metals companies (www.business.com/mini_mill/ 2003).

Nucor Corporation, one of the oldest mini-mills manufactures and sells hot-rolled steel (angles, rounds, flats, channels, sheet, wide-flange beams, pilings, billets, blooms, beam blanks and plates). Large producers have also entered the mini-mill market; *Ispat International* and *POSCO* have started their own mini-mills. Perhaps no other mini-mill has been as successful as Nucor in capitalizing on its cost advantages. It has increased its output from virtually nil at its founding in 1966 to 12.2 mt in 2001,

accounting for 12.6% of total domestic output. Over the same period, its sales have increased to \$4.2 billion from \$21 million, and net income has risen to \$174 million from just over \$1 million (Larkin 2002).

Product choices at the mini-mills are more limited than at the integrated steel mills. In 1989, Nucor gained a competitive edge by developing a new steelmaking technology that enabled it to crack the flat-roll carbon sheet and strip steel market - the last bastion of the integrated steelmakers. Nucor's output in this category rose from 420,000 tons in 1990 to 5.1 mt in 2001 (Larkin 2002).

The entrance and expansion of new mini-mills (flat mills) has created 18 mt of new steel making capacity. US shipments of steel rose about 20 mt from the level reached in the early 1990s, and the mini-mills now account for close to one-half of total steel shipments. Mini-mills accounted for nearly 100% of US shipments in long products and one-third in flat products in 2000 (Steelnet.org 2003). Mini-mills are new operators; they are neither traditional steel mills nor ordinary stockists. This development seems to support specialization upstream in limited product choices.

The above analysis of steel distribution in the North-American markets confirms the emerging roles of both SSCs and mini-mills. In addition, some interesting changes were detected in the role of the conventional stockists. This extension to the trend describes two alternative ways of a conventional stockist to increase the level of service (also referred to by Shapiro and Heskett (1985, 463-479) in the case study of Halloran Metals). Conventional stockists first grew into chains competing in superior service. Large customer base and multiple warehouses close to customers enabled overnight deliveries of a broad product line ("Stockist chain" in Figure 3-17). Their sales philosophy, "No order is too small", attracted customers for whom the infrequent sourcing of small quantities of raw materials was the way of life. Little or no processing was provided to avoid investments in costly processing equipment. The premium service with a broad product choice and fast deliveries allowed them to achieve high margins.

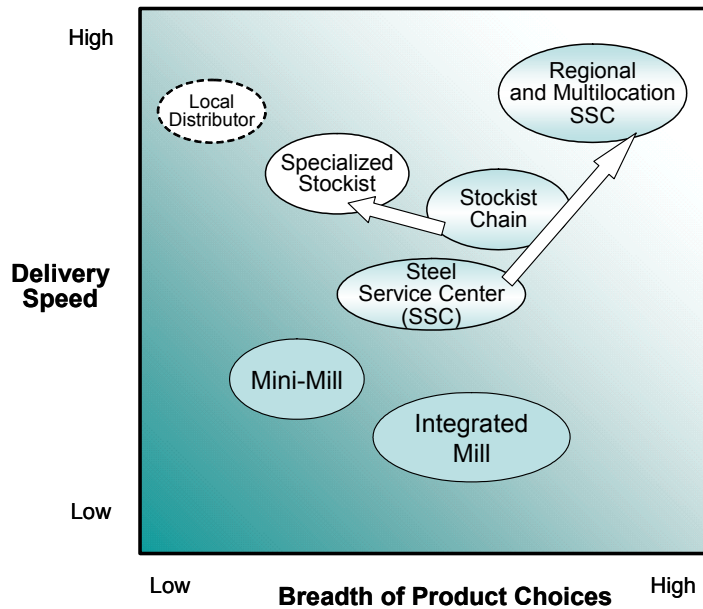


Figure 3-17 The Processing Capabilities of Operators Late in the Industry and the Emergence of Specialized Stockists and Steel Service Centers

However, already in the 1970's have another type of stockists emerged that started processing services for larger OEMs and invested into equipment for cutting, shearing and bending. Processing enabled the service on a wide product choice yet with a limited investment in inventory, but at the cost of longer delays of delivery. This type of stockist, called Steel Service Center (SSC), aimed at delivering larger order sizes and full loads to fewer and bigger customers on weekly basis. Lower prices were maintained due to scale economies and centralization of inventories and processing equipment.

The major Steel Service Centers turned later into larger regional and even international chains with multiple locations. International experiences refer to specialization in competition against One-Stop-Shoppers. Some stockists have specialized on one product choice and high delivery speed. In Figure 3-17, the said development locates such a specialized stockist into the upper left hand corner of the matrix. Service capabilities have improved considerably at the mills too. In the USA, mini-mills have entered to the market with flexible production programs and a limited product range. Service capability gap, however, exists between mill-direct deliveries and OEM requirements.

3.5. Analysis of Processing Capabilities of the Operators

The processing capabilities of intermediaries developed in the 1980’s in the West European countries. Since then steel service, centers (SSC) have increasingly enlarged their processing capabilities and gradually specialized in high value-added services in both Europe and the USA. The situation early in the post-war environment in terms of processing capabilities of the operators of distribution has been described in Figure 3-18.

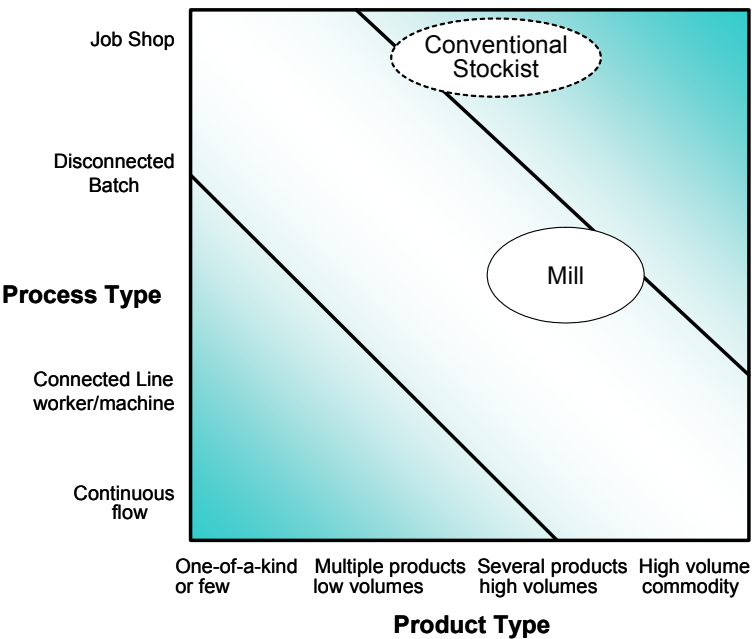


Figure 3-18 The Processing Capabilities of Steel Mills and Stockists Early in the Industry

Later on, service centers, component suppliers and contract manufacturers have acquired specific technology for value-added processing services. A recent study has identified altogether 56 processing services. This gives an idea of diversification in value-added processing services (Table 3-5).

Table 3-5 Processing Services in Steels and Metals (Purchasing 1999)

| | | |
|-----------------------------|-------------------------|--------------------------|
| Anodizing | Gauge- correcting | Punching |
| Bending | Grinding/polishing | Pvc coating |
| Blanking | Heat-treating/annealing | Rebar fabrication |
| Boring/drilling | Hot-dip galvanizing | Redrawing |
| Brazing | Injection molding | Roll-forming |
| Burning | Laser cutting | Sawing |
| Cambering | Length-cutting | Shearing |
| Chamfering/beveling | Leveling | Slitting |
| Chrome-plating | Machining | Straightening |
| Coining | Ndt-x-raying | Stress-relieving |
| Cold-reducing/cold rolling | Oscillating | Structural rolling |
| Drawing | Painting/coating | Tempering |
| Edging | Perforating | Threading/grooving |
| Electric-resistance welding | Pickling/coating | Toll processing |
| Electro galvanizing | Planing | Tumbling-deburring |
| Embossing | Plasma-cutting | Water-jet-cutting |
| Extruding | Plate rolling | Welding |
| Flame-cutting | Plating | Wire drawing |
| Forming | Pressing/molding | (56 processing services) |

Each service concept requires investments to the infrastructure to processing technology, feeding systems, inventories and transportation systems. Service concepts are individually designed according to operator's business issue. These choices are capital-intensive decisions by operator's management. As an example in specialization, a service center focuses only on processing of long profiles and tubes. Processing may include such services as cut-to-length, priming and painting or bending services. Cutting services of profiles by sawing a standard profile into two pieces has low complexity. Shot blasting and painting services are adding value more and complexity to a profile. Highly specialized quality services of sawing in angle, automatic sawing of batches or metal coating are examples on complex processing service concepts.

Assembling after processing of components and parts is adding further value to product. In some cases, OEMs outsource assembling operations to third parties. Products are sub-assemblies, modules or even products. Assembly takes place normally in the downstream close to the OEMs final assembly.

The SSC industry has grown rapidly and is enlarging its role in steel distribution. In North America, service centers supplied 28.15 million tons of steel, aluminum and brass mill products in 2002 for production and the construction sectors. Service centers have lost volume to mini-mills, which was 54% of total metal purchases in 2002 (64% in 2000). Producing mills had increased their share from 28% (2000) to 41% (2002).

The top 100 service centers provided 46% of all the metal shipped by distributors to end-use-buyers in 2002 (Stundza 2003).

The analysis of the 100 largest SSCs in the Northern America shows that large and small service centers have invested in processing capabilities to meet higher customer requirements. The survey suggests the following: In highly diversified service centers, the processing capability is high. These have approximately 7.2 different types of processing services. Service centers have accordingly high capabilities in different product groups, choices, and value-added processing services. Service centers operate on diversified markets after investing in processing capabilities. Foreign operations with their twenty largest service centers collect \$400 million in turnover. The main export areas are Mexico, Canada and more sometimes Asia and Europe (Stundza 2003).

Processing capabilities are capital-intensive investments requiring scale economies for intermediary services. Service centers with one processing capability operated on average in 2.5 markets. Adding of processing capabilities leads to larger markets and broader product choices. Service centers with five or more processing capabilities operated on average in 7.16 markets. It seems that market area increases from the local to the regional or the international, as service centers add more processing capabilities (Figure 3-19).

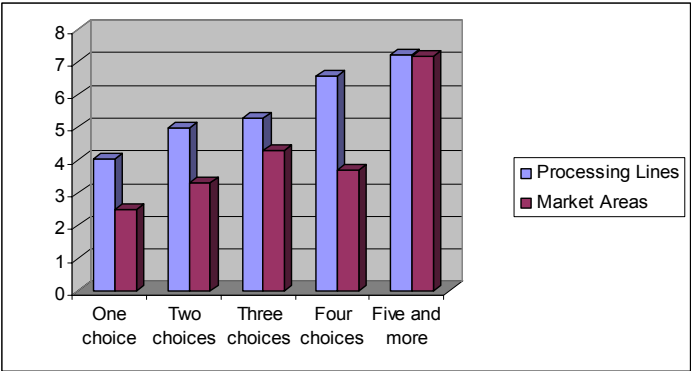


Figure 3-19 Number of Processing Lines/SSC and Market Areas: USA 2001 (Purchasing 2002)

Processing capabilities increasingly transform the basic roles of intermediaries. The need for stockholding alone is decreasing as customers demand processing services and

outsource manufacturing to intermediaries. Intermediaries are primarily responsible for stockholding services if OEMs carry their own stocks and mills do not stockhold products.

The largest service centers have a portfolio of processing capabilities. A recent survey states that in North America, an average 69% of the service centers offer sawing, 67% cut-to-length, 64% shearing, 46% flame cutting, and 32% slitting services to OEMs. There have also been extensive investments in more specialized services: blanking is offered in 28% of the service centers and leveling in 27% (Figure 3-20).

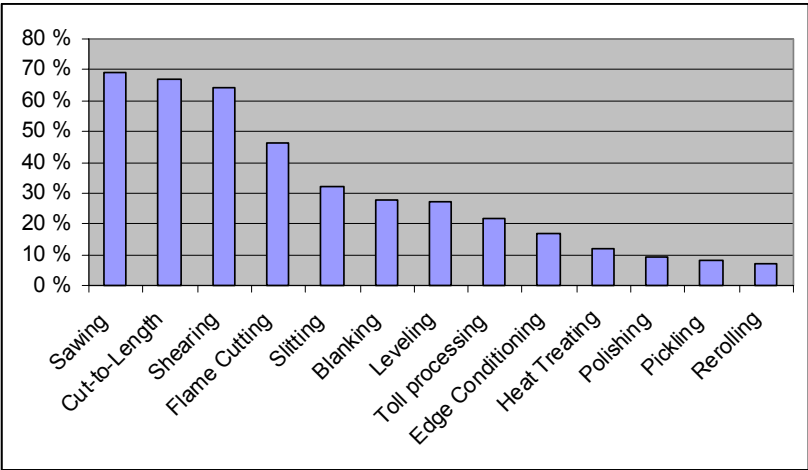


Figure 3-20 Number of Processing Services Among US Steel Service Centers (Metal Center News 2002)

This survey refers to a strong role for the service center industry in steel and metal distribution. The service center industry also includes outsourcing services and manufacturing-oriented logistics. The same survey states that more than 85% of the capital equipment budget is invested in trucks (21.9%), material handling (36.4%), sawing (10.4%), cut-to-length (10.4%) and flame-cutting (7.4%) equipment.

The survey states that the most common processing service is sawing and cut-to-length service. Such lines are often automated with flexible manufacturing systems (FMS). Service centers are able to make one-of-a-kind parts for a high number of volume components. The technology of the sawing equipment puts limits on the thickness dimensions of the products. The following example describes cut-to-length capabilities for long profiles (Figure 3-21).

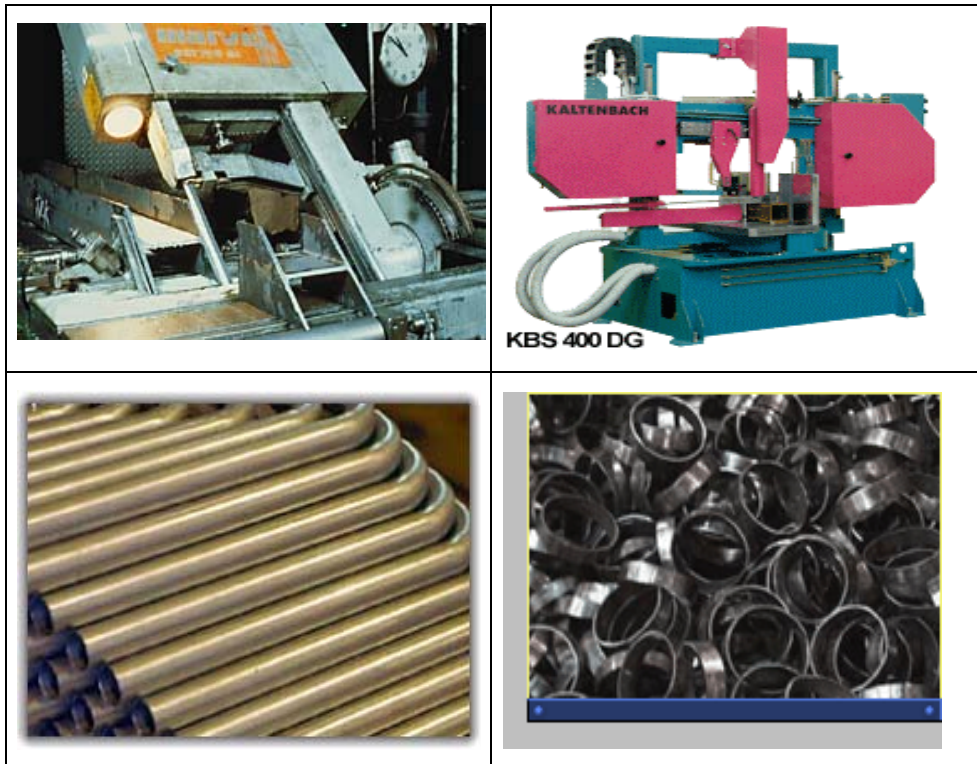


Figure 3-21 Processing Capabilities in Long Products: Cut-to-Angle (part), Cut-to-Length, Bending (batch) (Courtesy: Ryerson Tull, Kaltenbach, TW Metals 2002)

Shearing and slitting lines require different types of technology and equipment. These services are provided by coil centers. Coil centers are more capital-intensive lines than sawing lines. A coil slitting line uses standard coils as raw material for customized orders. Master coils are first decoiled to smaller coils specified for customers further processing. Coil slitting lines produce customized strips, bands and sheets. Then manufacturing processes are batch-type and job shop-type. Shearing at a coil center reduces product bulkiness decreases complexity, depending on the customer requirements (Figure 3-22).

Coil centers operate with steel, stainless steel and aluminum as core capabilities for the processing of bulky coils. Product choices are broad and production process is based on flexible manufacturing systems. Coil centers mainly operate on an MTO basis after receiving an order and the customer requirements. Coil centers are capable of producing standard sheets on both an MTS- and an MTO-basis.



RyersonTull: Precision levelling of aluminium and steel

Figure 3-22 Coil Processing (batches, job shops and decoiling) (Ryerson Tull 2003)

Some service centers specialize in limited product choices and technologies. The following benchmarking gives an idea of the processing capabilities in selected markets: Asva Oy (Finland), ASD Plc (UK) and TW Metals Inc (USA). Each of these SSCs is the dominant service center in their own market area (Table 3-6).

Table 3-6 Benchmarking Processing Capabilities: Asva-Finland, TW Metals-USA, ASD Plc-UK (asva.com/prefabrication-services, twmetals.com/products-processing, 2002)

| ASVA Oy (Finland) | TW Metals Inc (USA) | ASD Plc (UK) |
|--|--|----------------------------------|
| Cut-to-length: hot rolled, cold-rolled steel, stainless steel, aluminum sheets | Abrasive sawing: edge, conditioned bar | Profiling |
| Slitting | Precision sawing in non-ferrous | Grinding and automated deburring |
| Decoiling | Automated deburring | Flame cutting |
| Mechanical cutting | Precision plasma cutting | Drilling |
| Bending | Lathe tube cutting | Punching |
| Flame cutting | Shearing | Bending |
| Plasma cutting | Contour sawing: circles and rings | Notching |
| Machining | Leveling | Slotting |
| Sawing: cut-to-length, angle | Slitting | Shotblasting and priming, |
| Shot blasting and priming | CNC vertical machining | Shearing |
| | Plasma cutting | Guillotine and cropping |
| | Tube shearing | Sawing |
| | Cut-to-length | Pickling |
| | Water jet cutting | Oiling |

These SSCs have gradually invested in more specialized processing capabilities. The costs depend on the infrastructure and technology of the processing equipment. Upgrading of capabilities in processing services is a capital-intensive decision ranging from a weighted average of about \$60,000 for small service centers to more than \$700,000 for large SSCs. The overall average investment level in 2002 was estimated at \$306,000. The two main motives for buying new equipment were replacement of old and outdated machines (54.5%) and increasing of total processing capacity (29%). This survey indicates that the service center industry continuously invests to maintain its role in processing services (Metal Center News, 2002 April).

The processing of metals or steels requires tooling with high asset-specificity. A slitting line is an investment from \$3 to 5 million, depending on the equipment. For example, the cost of sawing equipment accounts for one-tenth or less of the cost of an ordinary coil slitting line. Priming services are usually combined with cut-to-length processing lines to combine two processing services. Lifting and feeding of products requires special technology. This kind of processing capability gives idea of asset-specificity.

ASD invested £3 million in new processing capabilities. Coils of up to 25 tonnes can be decoiled with maximum widths of 2 meters into any length requested by the customer, normally up to 12.5 meters. Computer-controlled profile burning machines have a cutting capacity of 43 meters in length and over 4.7 meters in width. The plasma facility extends the ability to deal with traditionally difficult profile shapes such as long narrow strips of thin material. The processing capabilities include profiling, grinding and automated deburring, flame cutting, drilling, punching, bending, notching, slotting, priming and painting, shearing, guillotine and cropping, sawing, pickling and oiling (MacDonald 1993).

The amount of value-added depends upon the job done. The following estimates made by Prudential Securities Inc. are typical of the value-added amounts among North American SSCs (Table 3-7).

Table 3-7 Value-added Services in North America (Prudential Securities Inc. 2003)

| <u>Type of Processing</u> | <u>\$ per ton</u> |
|----------------------------------|--------------------------|
| Slitting | 150-275 |
| Blanking | 85-175 |
| Stamping | 75-150 |
| Galvanizing | 100-125 |
| Tempering | 35-120 |
| Annealing | 20-85 |
| Pickling | 14-45 |
| Cutting-to-length | 15-45 |
| Plate cutting | 15-35 |
| Edge rolling | 2-8 |
| Storage | 5-15 |
| Shipment | 15-45 |

This survey gives an idea of the value-added substance of SSCs and stockists. Cost structures may be different, depending on the volumes and technologies. Slitting lines are capital-intensive investments. Cutting-to-length and plate cutting services are comparable with regard to storage and shipment costs. SSCs gradually improve their capabilities in processing services.

Processing in steel distribution was analyzed using the Product-Process model. The Processing Trend proposes that distributors are moving towards more automated manufacturing processes. Based on the Product-Process model to remain cost efficient a company will produce higher volumes of less product variants having invested in more automated production equipment. The development both on international and domestic markets supports this trend. During the early days of steel distribution, steel mills produced only a few product variants in long production batches. Today, mini-mills and SSCs compete successfully against integrated steel mills with their processing capabilities of shorter batches for many product variants assisted by investments in automated production technology. The analysis of the late stage of development of the processing capabilities is shown in Figure 3-23.

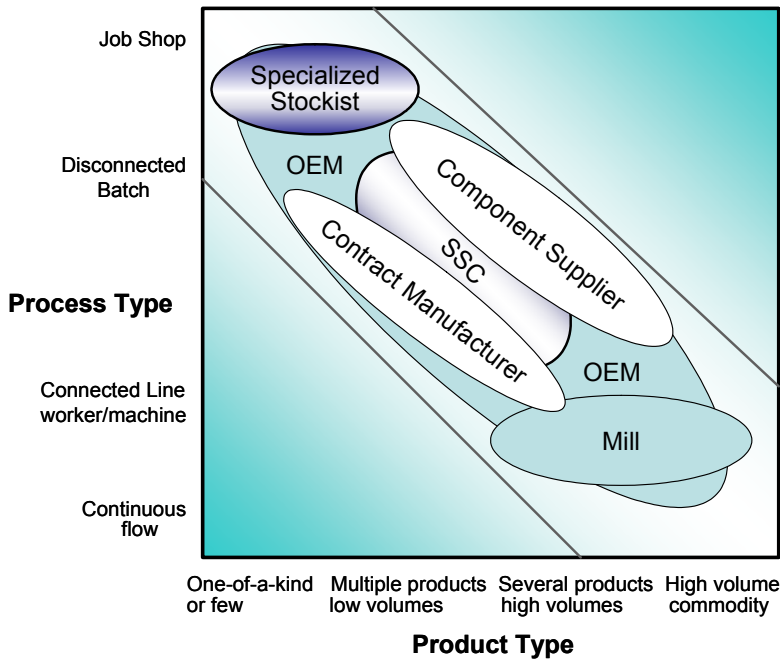


Figure 3-23 More Automated Production Processes Coupled with Specialization of Intermediaries Late in the Industry

Today the degree of processing by specialized stockists and integrated mills is also higher than that of a conventional stockist or a mill of the early days. At that time, two operators, a mill and an OEM did the processing. Increased outsourcing by OEMs has created new operators to support SSCs namely, contract manufacturers and component suppliers. Their role in value-added services seems to grow in importance. We may summarize the development of processing capabilities the following way:

1. Outsourcing of processing services by OEMs transforms traditional roles of intermediary operators.
2. Processing capability requires substantial investments and know how by the operator. To become profitable the volume is a critical issue.
3. The polarization of processing capabilities (mills and OEMs) has decreased in form of intermediary operators of which SSCs are taking the leading role.
4. Ordinary stockholding has transformed either into a stockist with a specialization on a limited product choice and minimal processing or a SSC with a wider product choice due to increased processing.

Next, the analysis of the roles of operators is enlarged into the product characteristics.

3.6. Analysis of the Characteristics of Products Handled by the Operators

Early in the post-war environment the operators of that time namely, mills, stockists and OEMs, were able to handle products up to container sizes. OEMs were capable in manufacturing complex products as described in Figure 3-24. Two main producers of the early days, a mill and an OEM were capable in manufacturing products to a certain degree of bulkiness and complexity. There was a business opportunity for stockists that were the leading intermediaries of the early stage.

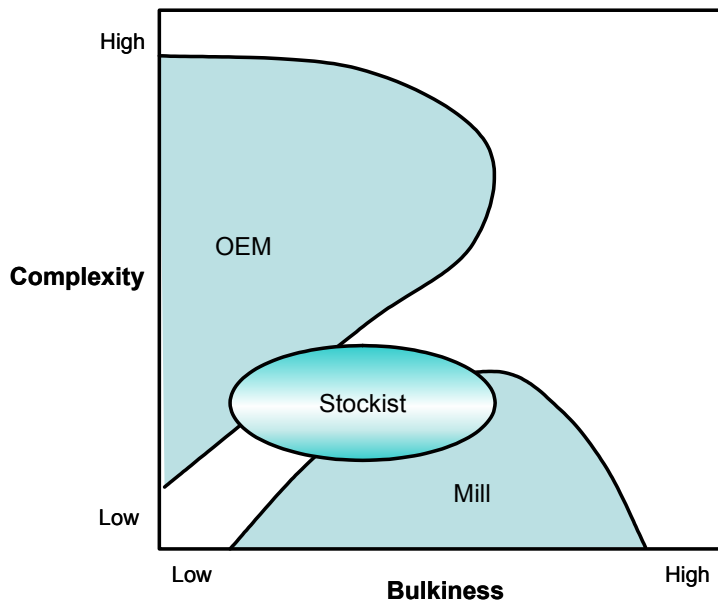


Figure 3-24 The Characteristics of the Products Handled by Steel Mills, Stockists and OEMs Early in the Industry

Product characteristics determined at the-mill end were standardized according to internationally accepted norms. Plates and tubes were delivered at the lengths, which were practical for transporting and stockholding of the products. At the early times, the product length of 6 meters and less was an ordinary size for a plate or long profile. The lifting capacity (tons) or transportation (tons and meters) often limited product bulkiness to container-sizes or palette-size deliveries to the intermediaries and OEMs. Coils were not ordinary product shapes, as ordinary stockist had no capabilities for processing services. Operative capabilities were especially for flat and long product shapes.

In this research, product characteristics are classified according to the shapes, to three levels: Round products (coils), Flat products (plates) and Long products (profiles). Composition of a product adds the number of product choices. One plate in steel, aluminum or stainless steel has similar dimensions (flat), but they are considered as three different product choices. Basic classification of product choices is based on generic product characteristics as follows (Worldsteel 2003):

1. Round products: Coils are round and is rolled from steel ingots. In the initial stages of steel production product is in a round form as a master coil. Driving product dimension is product size. Product is in a compact form for uniform product applications.
2. Flat products: Plates and sheets are flat products and made from coils by cutting-to-length. Dimension is area (m²) flat plate or sheet covers. IISI is defining a flat steel product as a plate product or a hot rolled strip product-typical end use applications are automotive body panels and domestic "white goods" products.
3. Long products: Profiles and tubes are cut sheared from coils, bended and welded or drawn in tubes, cut from plates and welded in profiles or extruded from ingots. Driving product dimension is length (m). IISI tells that a long product is a rod, a bar or a section – typical rod products are reinforcing rods for concrete; engineering products, gears, tools etc. are typical of bar products" sections are the large rolled steel joists (RSJ) that are used in building construction projects.

The purpose of this classification is purely practical. Most mills and intermediaries have focused on limited business areas as steel plates and sheets, seamless tubes, coil slitting or copper products. Guidelines for this classification are based on the stock lists of steel service centers and stockists. The highest number of product choices is apparently in long products due to many profile shapes and product applications (Table 3-8).

This kind of classification of standard products is most suitable for heavy logistics. In the early stages there are only few product groups identified. As production flow continues from raw materials (coil) to flat and long base products, the number of product groups increases. Product choices by shape and composition cover well product characteristics and are practical in the analysis.

Table 3-8 Product Choices by Shape and Composition

| Carbon Steel, Stainless Steel, Copper, Nickel, Aluminium, Plastics | | |
|--|------------------|------------------------------|
| ROUND | FLAT | LONG |
| Hot Rolled Coil | Coated Sheet | Pipe |
| Cold Rolled Coil | Galvanized Sheet | Mechanical Tubing |
| | Corrugated Sheet | Hydraulic Tubing |
| | Perforated Sheet | Angle |
| | Plate | Channel |
| | Expanded Metal | Beam |
| | Grating | Bar |
| | | Tee |
| | | Rail |
| | | <i>Profile Shape:</i> Round, |
| | | Square, Hexagonal, |
| | | Oval, Unequal |

Chemical composition is used in the Purchasing Metal Sourcing Guide. This classification is used in sourcing purposes. This classification refers to a wide variety of different product families. Some of them are specialized compositions for high quality applications. Purchasing Guide identifies 23 different metals and steels. This classification is not the most suitable to describe the product choice of a steel stockist or service center. There are different type of compositions and product dimensions and shapes. Operators are not able to cover many different product compositions (Table 3-9).

Table 3-9 Steel and Metal Product Choices by Composition (Purchasing 1999)

| | | |
|----------------------------|-----------------|-------------------|
| Alloying & Planting Metals | Iron | Stainless steel |
| Aluminum | Lead | Steel |
| Beryllium | Magnesium | Superalloys |
| Brass | Nickel | Tin |
| Bronze | Palladium | Titanium |
| Cobalt | Platinum | Tungsten |
| Copper | Silver | Zinc |
| Gold | Specialty steel | (23 compositions) |

Most popular steels are such ordinary and commercial steels and metals as carbon steels, aluminum, copper, specialty and stainless steels. Niche areas as gold, palladium, silver, tungsten etc are used in highly specialized product applications. Products according to composition are generally divided in carbon steels, mixed metals, aluminum, copper products, stainless steels and other alloy steels. By alloying the composition the characteristics of steel may be developed by alloying silicon,

manganese, chromium, nickel, molybdenum, wolfram, vanadium (V), and Cobalt (Co). First product dimension is oversized hot-rolled or cold-rolled steel, stainless steel or aluminum master coil. This kind of classification is applicable on limited niche product applications.

Widely used classification of products is based on technology or production methods. Producers tend to classify according to production. They are speaking of hot rolled coils, cold rolled plates, cold drawn tubes, welded tubes etc. Production technology is dominant in some tube products. Tubes are classified in seamless pipes, welded tubes, and drawn tubes or round, square or rectangular tubing. If we add to this precision tubes, hydraulic tubes or stainless steel, copper, aluminum tubes, we may note many different classifications for steel and metal products.

Number of different type products is undoubtedly high. There are different grades, wall and plate thickness, lengths, shapes, angles etc. Steel is produced in numerous forms, dimensions and grades. Operator's capability is high if it covers all three levels: round, flat and long products. Increasing product composition and shape specificity is increasing even higher the operator's capability. Product thickness, size, shape and composition are adding number of product choices. High capability is stocking list of 100,000 products and low capability is one base product in a standard form.

Benchmarking of products in West European markets provides interesting findings. Products in heavy logistics are highly standardized. Stock lists of SSCs and stockists are much alike in various countries. They generally describe the stock range and services. Ordinary stockists have products of 6 meters or longer in their stocks. This dimension is commonly used for long products (profiles) and flat products (plates). The product sizes are container size or over sized when delivered from the mill to an intermediary. Product bulkiness often decreases substantially after stockholding during the break-bulk delivery.

Aluminum products are comparable to steel and stainless steel products. However, an aluminum product is much lighter in weight, although the external product dimensions are equal. The product bulkiness is higher in aluminum plates than in long profiles.

Bulkiness comparisons are based on international surveys. The case market is Germany, and products consist of aluminum plates and aluminum profiles. The

analysis describes the outbound logistics from stockists to OEMs. This survey describes the role of an intermediary in break-bulk deliveries of standard products.

In aluminum plates, 83.4% of deliveries were below 500 kg among German stockists. This represented 38.5% of the total turnover. In aluminum profiles, the product bulkiness decreases and the number of deliveries is higher than in aluminum plates. The majority of stock deliveries (96.6%) were below 500 kg, totaling 48.8% of total turnover (Figure 3-25).

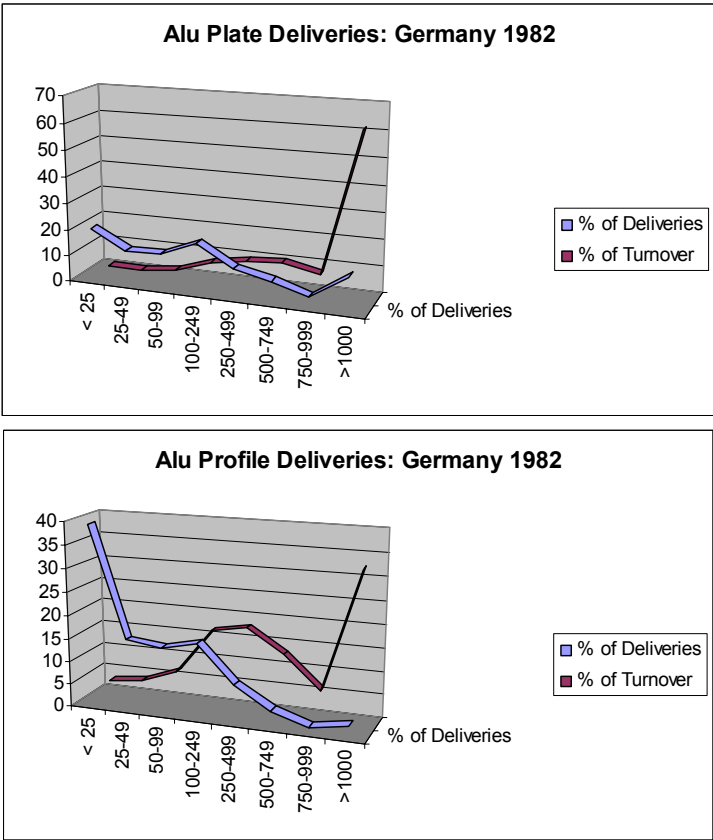


Figure 3-25 Downstream Product Bulkiness: Aluminum Plates and Profiles, Germany 1982 (Fianatm, Metallkomission 1984)

In inbound logistics, product bulkiness has generally increased in western countries. Coil sizes have increased and as have mill-delivery lengths in profiles. The earlier product bulkiness was only a fraction of the present smelting inputs of master coils. Product bulkiness in long products and plates has not changed as much. Standard plates (10-15 meters) or profiles (12-25 meters) are, however, much bulkier than the 5 to 6

meters of the early days. This means that between mills and intermediaries (outbound logistics) product bulkiness has increased substantially.

Product bulkiness has increased especially upstream as one coil has a weight of 20-30 tons or more. The SSCs, contract manufacturers and component suppliers gradually process over-sized products into letter-size and light products. An evaluation based on product characteristics clarifies the logistic roles, especially between upstream and downstream operators. In general, downstream operators are capable of processing low and medium bulkiness products, whereas upstream producers those of container and over-sized.

The Product Characteristics model explained how product bulkiness and complexity affects the distribution in general. In Chapter 2, the Product Characteristics trend assumed that the logistics and manufacturing technologies enable the handling of ever more complex products with possible sizes varying from extremely bulky to extremely small. Based on the above analyses the product characteristics of today have developed since the early days of steel distribution with the following effects on the operators' roles:

1. The product characteristics have become important change drivers of the roles of operators.
2. Capability to produce more bulky products has increased remarkably at the mill level while OEMs have become more capable in assembling of both more bulky and complex products.
3. Investments in more automated production equipment enable new business scope for specialized intermediaries and SSCs in handling of more complex and bulky products.

Figure 3-26 illustrates the current situation positioning mills and OEMs with their increased range of manufacturing capabilities (low end and high end) on product bulkiness and complexity.

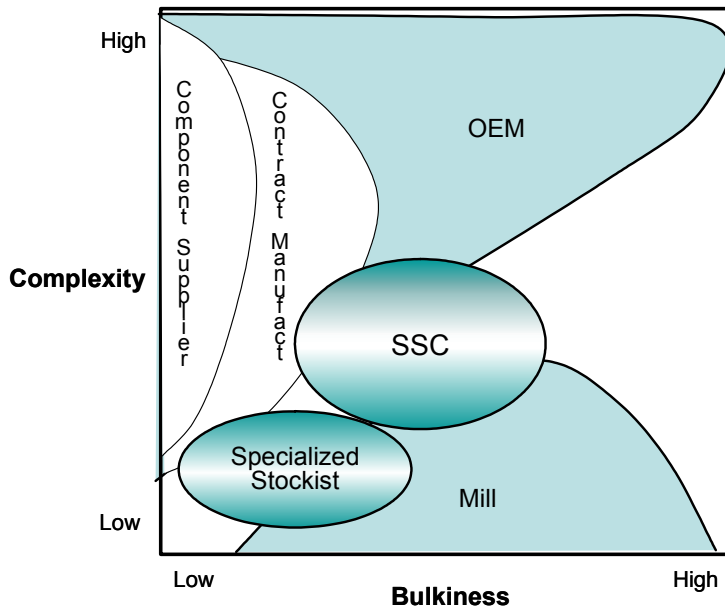


Figure 3-26 Product Bulkiness and Complexity Enable Additional Business Scope for New Intermediaries

In spite of the higher capabilities of processing by these two operators, a mill and an OEM, have increasingly outsourced some of their business domain to new operators. The development has been remarkable in the increasing complexity of products which has generates new operators such as component suppliers and contract manufacturers. Moreover, there has been a diversification of stockholding by specialized stockists and SSCs. The gap between a mill and an OEM has become narrower yet leaving enough room for the new intermediaries. As a conclusion, the Product Characteristics model clearly separates the roles of different operators in steel distribution.

4. Three Periods of Transformation of Distributor Roles in Finland

This part increases understanding of what has happened in the logistic roles of operators and services over time. The purpose of this chapter is to deepen our analysis on what has happened in the logistic roles. Evidence for our three hypotheses is sought through the Finnish steel distribution.

Transformation of steel distribution is thought to have happened in three periods. The longest stage is the 1st called an Import period. Logistics based dominantly on the imports and services by stockists. The 2nd period is a short transition stage of Domestic Production, which started large-scale steel production. The 3rd period is named a period of Open Markets as steel distribution enlarged from Finland to international markets (Figure 4-1).

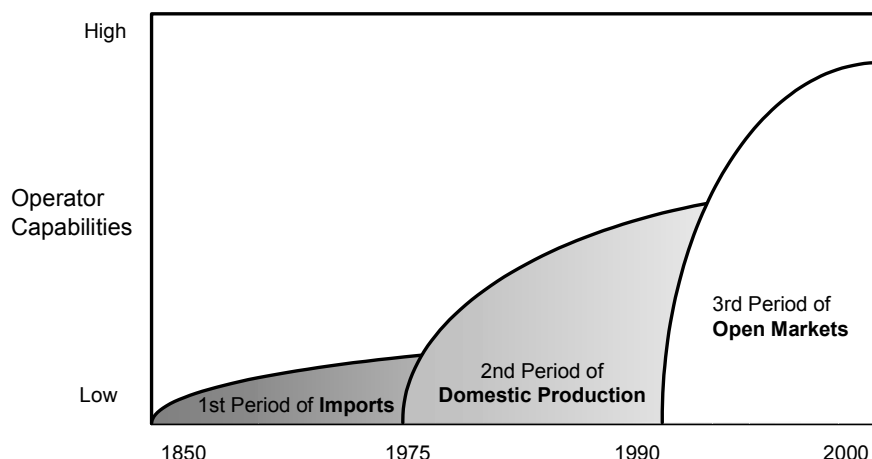


Figure 4-1 Three Development Periods in Finland

The Import period was the start-up period in steel stockholding and distribution. The words “entrepreneurship and controlled imports” characterize early steel distribution. Availability of raw materials was dependent on the imports and capabilities of entrepreneurs.

Entrepreneurs introduced new products and sources to OEMs. Spirit of entrepreneurship was the driving force in starting new operations. Local production was so limited that industry was dependent on imports services provided by trading

houses and agents. The Import period lasted over hundred years from 1850 up to 1970's, until local steel production was able to satisfy most of the domestic demand.

Entrepreneurs were intermediaries, who facilitated logistics and product availability through their personalities. They were individuals, which early opened new markets. Entrepreneurs had capabilities in efficient sourcing and international networks and they mastered operations with complicated import licenses and practices. They benefited from close contacts with customers and international mills. Early entrepreneurs were independent intermediaries, who in many cases owned the whole supply channel as the key operator between the mill and the OEM. The 1st period was lengthy but also a “Golden Era” for trading houses, stockists, importers and agents.

Entrepreneurs had spirit and enthusiasm. They were business pioneers and risk takers, who had imagination. The following three family-entrepreneurs – two intermediaries and one OEM customer - confirm all this:

Entrepreneur 1 (Spirit and common sense):

“Entrepreneurship has its life span; it doesn't last forever and there is no particular time for it. Spirit will wake up, as there is something new in the air. Entrepreneurs are looking after their own success. It is difficult to share success with another competitor”, says Kauko Kuosmanen (2001), former Chairman of Valtameri – a trading house and steel stockist.

Entrepreneur 2 (Spirit and risk taking):

“An entrepreneur has to work hard, save money and dare to take risks”, says Antti Wihuri (1883-1962), founder of a large business conglomerate Wihuri Corporation – a manufacturer of buses and Valtameri's OEM customer of special steels and aluminum profiles.

Entrepreneur 3 (Spirit and service):

The founder and Chairman of Kontino – a traditional stockist – Mr. Toivo Matikkala tells in the advertisement campaign of the company's successful history in the early 1990's:

“As I started Kontino 50 years ago our challenge was to serve the customers with the best products and services available for us.”

This message includes strong entrepreneurship and commitment to customer service by stockholding of broad product choices. The promise to customers contains the message of strong input on customer service. Full-page advertisement of 1951 in the Handbook

of Trade following message emphasized customer service on broad product choices by advertising that

”We are able to deliver every kind of steel product with a flexible service to every kind of needs” (Matikkala 1951).

Entrepreneurship seems to have been familiar with hard work, risk taking and living with opportunities. A common characteristic for the 1st period of steel distribution is that the founder started a small business and soon enlarged the services. The service scope grew to additional products and markets. Small companies grew to general trading houses with own imports and stockholding services.

The 2nd stage of Domestic Production changed sourcing from international suppliers to domestic mills. Local production capacity increased. Imports declined drastically as Rautaruukki started steel production in Raahе in 1967. Stockists consolidated to larger entities or specialized and introduced related processing services. First service centers emerged to the markets. In the beginning of the period, competition among stockists was furious. Products and services had low differentiation and the number of stockists was high.

Later product customization increased as customers requested processing services and outsourced some of their traditional manufacturing. Intermediaries invested in value-added processing capabilities. Consolidation period lasted a good twenty years until Finland entered the EU in 1995.

The 3rd period of Open Markets is characterized emerging markets and new type of service providers. Co-ordination of key business processes is one of the main challenges for this period. Two events in the environment have affected in heavy logistics. Firstly, Finland became a member of the European Union (EU). Competition changed as EU practices removed many restrictions on markets and exclusive rights. New competition laws enabled entering to emerging markets and alternative suppliers, which earlier were excluded from distributors. Restrictions in competition were lifted off in 1992. Secondly, 128 GATT countries including Finland signed WTO’s (World Trade Organization) agreement covering broadly the world trade.

The 3rd period is opportunistic for intermediaries. Environment, information technology (IT) and logistic infrastructure as well as transportation, stockholding and

processing technologies have developed remarkably. All this will act as a change agent in the intermediary roles.

The Finnish steel distribution is analyzed in this section within three models described in Chapter 2. The Service model by Shapiro and Heskett analyzed operator's service capabilities with a delivery speed (operative performance) and product choice (scope of service). Delivery speed classifies operator's logistic capabilities to different delivery time zones. The second, The Product-Process model by Hayes & Wheelwright is looking for matching pairs for various types of products and processes. The third, The Product Characteristics model introduced concepts of bulkiness and complexity for analysis purposes.

4.1. Import Period

Three periods of the research are long enough to explain the evolving logistics roles of intermediaries. Most data of this study is applicable to the 2nd and 3rd periods. There is only limited data on history of steel distribution available for the 1st period.

4.1.1. Intermediaries

Young entrepreneurs established first steel production plants and started local stockholding services in the 1850's. Local production was first non-existing and later too limited to meet local steel demand. The industry was heavily dependent on the imports of big trading houses, which acted as the key integrators between steel mills and customers.

Entrepreneurs and risk taking was common in early steel distribution. These pioneers opened contacts to foreign suppliers and started steel stockholding. Families are found behind early trading houses: Starckjohann (family Starckjohann), Valtameri (family Kuosmanen), Kontino (family Matikkala), Algol (family Bargum), Julius Tallberg (family Tallberg), Onninen (family Auriola-Toivanen), and Mercantile (family Aminoff). Some had a chain of hardware retail stores (Starckjohann, Tallberg), which had steels in their diversified product choices. Hardware stores operated as local distributors for imported steel products. Rauta- ja Konetarve (family Koivulehto), Rake (family Cederberg), Helsingin Rauta, Teräs, Salon Kone ja Rauta, Mikra and many other family owned companies were established by a strong entrepreneur.

Entrepreneurship was the driving force behind the success of these companies. Those entrepreneurial trading companies were the first intermediaries, who started by importing necessary raw materials and machines for the Finnish industries. Core capabilities were in sourcing, good communication, international business contacts and local retailing network of hardware products. Many trading houses had their own fleets of ships and trucks. The competition was too low but increased towards the end of the 1st period.

During the Import period, intermediaries fulfilled one of the key issues in steel distribution namely the availability of products. Trading houses acted in all service channels as co-coordinators in key business processes: Persuasion, financing, ordering and transfer channel. Intermediaries invested substantially to transportation technology and stockholding facilities. Value-added input to a product was low but quite high for the customer due to a good availability of products.

Early trading houses/stockists worked in an environment of undeveloped communication infrastructure, international transportation and financial problems. Co-ordination of information was far more complicated than today: traveling and face-to-face communication with the producer or OEM customer, letters, telexes, phone calls, sometimes wait-and-see, sometimes pushing and long meetings more common business practices of that time. Steel distribution with import formalities, licenses and customs clearing were not easy in those circumstances.

Stockists back office operations were labor intensive. They had to hire many employees such as: typists, interpreters, sales people, warehouses with people, truck and lorry drivers, forwarding, license people, customs and forwarding people, telex and telephone operators and sometimes foreign network of own offices and fleet.

Starckjohann & Co is the oldest steel stockist in Finland. It started with hardware products and enlarged choices later to many other fields. Product-mix was built on the industry demand and individual customer needs. Sourcing rested on good personal contacts with prominent foreign suppliers. Their 120-year history describes the early steps of stockholding as follows (Erävuori 1987):

"Hardware is one of the oldest specialized fields of trade. It is safer to state that it is justified to speak of specialized hardware trade in the latter part of 1800's and evidently from 1860 onwards".

Mr Peter Starckjohann and A.W. Berg started their family-operated hardware company in 1868. In the beginning hardware stores imported through agents until Starckjohann started own sourcing from Russia, Baltic countries and even further. In early 1900, they had many traveling sales representatives. Later Starckjohann & Co had to find a new location and they moved to Lahti in 1940, a new city in southern Finland. Hardware was, however, the main business area and steel stockholding was managed as a separate department and later as a daughter company Starckjohann Steel.

The development in steel stockholding started from a small-scale hardware need of different kinds of iron and steel products offered by local stores. A general hardware store seemed to be the necessary link between a distant supplier and local customers. A specific feature is, how traders developed know how in new products (Erävuori 1987, 29, 31-32, 43, 66).

"Depending on the product choice of a specialized hardware trade there are three independent hardware stores, which have good reasons to be regarded as the oldest and still existing hardware stores in Finland: Simolin in Porvoo, established in 1853, Juuantehaan rautakauppa (today Carlson Oy in Kuopio), established in 1859 and thirdly Joachim Putkonen (later Putkola Oy) in Iisalmi, established in 1862. In 1881 started, Oy C.J. Hartman in Vaasa established its hardware department. At the same time Starckjohann & Co in Vyborg and Julius Tallberg started in Helsinki."

Many stockists have a long tradition in stockholding and handling of import formalities. They carried also financial risks. Over fifty years of experience is quite common among other intermediaries too: Oy Renlund Ab (established 1874), Julius Tallberg (1880), Algol (Albert Goldbeck-Löwe) started supply of metals in (1894), Mercantile (1901), Valtameri Osakeyhtiö (Suomen Valtamerentakainen Kauppa Oy) (1913), Kontino Oy (1928) and Rauta ja Konetarve Oy in the 1920's, Teräs Oy in early 1900's, Suomen Metalliteollisuuskonttori (1907) (later 1936 Telko Oy), G.H.H (1955) (later Aspo).

Valtameri had stockholding first in Helsinki downtown at Kaisaniemenkatu. It is located right in the city center and moved in 1952 to Hernesaari, neighbouring shipyard of Wärtsilä. As a basic concept in stockholding - one centralized location - was occupied. Later as its operative market area enlarged with regional warehouses and local distributors (LDCs).

Most deliveries were on agency basis to OEMs as mill-direct deliveries. Importers acted as exclusive agents. Producers required higher prices on importers' stock orders. Purpose of this was that producers wanted to maintain direct contacts with OEMs and avoid too strong intermediaries. Valtameri started imports of steel by specializing on long products. The first agency agreement was signed with the tube manufacturer Comptoir Belgofrance in 1930. Next business transactions were taken with US Steel (Kuosmanen 2001).

Steel stockists had direct OEMs, small customers and local distributors as their customers. Starckjohann, Renlund and Julius Tallberg had own hardware stores, which sold "almost everything to everybody". Algol Oy had own direct OEM customers (Kone ja Silta Oy, Hietalahti Shipyard etc) but also own regional distributors. In direct ex-mill deliveries trading houses acted as agents, in small deliveries as a stockist and to local distributors (LDC) as a wholesaler.

Trading houses had also other activities than wholesaling of steel giving those more legs in their turnover. Such wholesalers were mostly such middle-sized or smaller stockists as *Oy Mercantile Ab*, Valtameri Osakeyhtiö and *Oy Algol Ab*. Valtameri's core capabilities were in tubes and special profiles, Mercantile focused on stainless steels and Algol on German suppliers of long profiles and plates.

Some stockists were actively in retailing as hardware stores. Such old hardware stores as Starckjohann & Co, *Oy Julius Tallberg Ab*, *Rake Oy*, *Teräs Oy*, *Renlund Oy*, *Rauta ja Konetarve Oy* had own retailing network. These were known among steel users especially as hardware store keepers.

Kontino Oy focused barely on steel products: It specialized on every kind of steels and metals on broad product choices. The company later invested in processing services. Value-added processing capabilities include cut-to-length services in plates and long profiles.

Kesko Oy as the largest retail chain started imports of construction and building materials. Kesko established *Kimport* in 1957 and enlarged to other steel products. *Keskometalli Oy* continued by adding product-choices and processing capabilities. In volume-wise, Keskometalli soon became the market leader.

Tuko Oy (Tukkukauppojen Oy), Kesko's competitor in retailing operated through *Rautakonttori Oy*. Rautakonttori acted as a sourcing agent for its hardware store members. Centralized system had more negotiation power against foreign (British Steel) and Finnish (Outokumpu) suppliers. In stockholding and distribution, member hardware stores used their local facilities. Rautakonttori had a dense local network of distributors for steel and other hardware products.

Sourcing and order processing had their own organizations. Large customers and stockists established own sourcing organizations. The industry established own import organization *Telko Oy*, steel stockists *Stalko Oy* and hardware shops *Rautakonttori Oy*. These sourcing companies used member's stockholding facilities and co-ordinated ordering, negotiations and distribution. Steel mills remained in practise distant to most OEMs. As said above, *Telko Oy* (established 1908) co-ordinated industrial purchases for its members. This arrangement worked well until the late 1970's. When industries had limited advantage of *Telko Oy* it was merged to Starckjohann. The name changed to Starckjohann-Telko. Telko turned to other product areas than steel and it was later acquired by a trading house Kaukomarkkinat.

One of the most successful sourcing agents was *Stalko Oy*. It started with Russian and Polish steel and aluminium in 1953. It used the shareholder member's warehouses and distribution facilities. Stalko had also two exceptional tasks: Stalko had own warehouse in Lahti for stockholding of steel plates and slabs for safety purposes for the Finnish industry. Secondly, Stalko acted as an export agent to Soviet Union for Rautaruukki and Outokumpu before these local mills opened own export channels. Shareholders of Stalko were trading houses and steel stockists Starckjohann, Algol, Kontino and Valtameri. At the early stage, Mercantile was one of the founders but left Stalko after a few years. Stalko's role diminished as Rautaruukki was established and finally Stalko was finished in the early 2000. Mr Kauko Kuosmanen (2001), former Chairman of Stalko and Valtameri, refers to Stalko's exceptional role as a sourcing agent as follows:

“Stalko is an exception as a company where the closest competitors are the owners. They were able to build a friendly co-operation without disputes, which was not possible among other importers. It also had to fulfil state reserve stock requirements and to safeguard the continuous steel flow from Russia to Finland. It has also done such a good work for Finland that it is worthwhile for a separate business history.”

Stalko started at the time when steel producers of the eastern block countries were actively exporting to the west. Negotiation processes and import formalities were complex. Foreign trade was managed by centralized state-owned export and import organizations: Promsyrioimport, Razhnoimport in Soviet Union, Stalexport in Poland, Metallurgiehandel in DDR, Impexmetall in Hungary, and Motokov in Czechoslovakia etc. They acted as key negotiators and coordinators between mills and import/export agents. Sourcing agents had a capability on sourcing, negotiation practices and logistics.

Evaluation of steel distribution is interesting especially among the domestic producer. *Outokumpu* started production of metals and mining during the 1st period. *Rautaruukki* started production of steel plates and tubes during the 2nd period. Both are now international producers. Domestic producers used domestic channels in steel and metal stockholding and distribution. Exports have started with small organizations. Outokumpu had a focused distribution system both for the exports and for domestic sales. Marketing and other commercial matters were mainly the responsibility of the President of the company up to the 1930's. The Pori Mill and growing exports compelled the management to develop their marketing organization. New Sales and Purchasing Office was established in Helsinki in 1940. The office was modest with five employees. At that time, Outokumpu had 1840 employees (Kuisma 1989, 181). Marketing function had very limited resources and the top of the organization was usually responsible for the marketing strategy.

In domestic marketing joint sales organization, Rautakonttori acted as a key distributor. Rautakonttori was established in 1918 and it started co-operation with Outokumpu in 1940. This centralized sales association left domestic sales to its members, which were prominent hardware stores. During 1940-50, this arrangement proved too rigid especially for SMEs (Small and Medium size Enterprises). Some of the members wanted direct contacts to Outokumpu without Rautakonttori. Distribution of special metals was given to N. Westerback a gold smith in Helsinki in 1949.

Many domestic customers were, however, dissatisfied with the marketing in the 1940-50's. Accordingly, some larger distributors as Starckjohann and Rake wanted to enter to a direct contact with Outokumpu and leave the membership with Rautakonttori. The

agreement was terminated twice: 1949 and 1951. It is interesting to note that this arrangement did not change customer relationships. Most of the volume was still purchased through the central organization (Kuisma 1989, 182).

During 1930-40's approximately 20% of production was delivered to domestic customers. During the 1940's the authorities regulated domestic prices. The share of domestic sales increased and early 1950's it exceeded 60%. This trend turned down after 1960's and the importance of domestic markets drastically declined. Domestic markets are often too small for producers. Outokumpu had targeted for growth and especially through exports. Export organization was simple in the 1930's. President Eero Mäkinen alone was in keen contacts with the agents and their customers. Germany was the main market, where the agent Norddeutsche Affinerie in Hamburg assisted a lot in the exports efforts.

The total revenues of Outokumpu increased rapidly: During 1932-37 sales increased rapidly and by 1943, the total revenue was ten times higher than in 1932. The distribution and marketing was centralized into the Head Office and its Commercial Department. Erkki Valve managed Commercial Department in 1940-71. The successor, Mr Jorma Hakkarainen was employed as Export Director in 1968. He started a thorough development process in the marketing activities. The exports continue rapid growth to a dominant role in Outokumpu's business strategy.

The export organization started to develop in the late 1940's. The first active steps were taken to Sweden. At that time, the exports represented over 50% of the total sales. Outokumpu hired a sales representative Mr Fred Sjödin in 1946 for Sweden followed by a long-term co-operation with Dickson & Sjöstedt in Gothenburg in 1949. By that time, the role of exports had declined to 40% of the total sales. First sales representative in Norway was Mr Per Thömte. Marketing responsibility in Norway and Denmark was given to Dickson & Sjöstedt in 1958. This arrangement failed and local companies compensated them; Paul Bergsoe & Soen in Denmark in 1962 (Nordisk Jern & Metall) and in Norway Finn-Metall A/S in 1963 and later Finn-Kobber A/S in 1970. Marketing of nickel and copper products started a new company in Germany, Nordische Metall- und Handelsgesellschaft in 1960. Agreements were made with Portugal (1965), Switzerland (1965) and Iceland (1967) and in UK with Reynolds

European Inc (1965). Outokumpu acquired Reynolds in 1976 that became Outokumpu (U.K.) Ltd in 1982.

Outokumpu export activities were still very limited up to the 1970's. It was still a period of opening the contacts in the nearby markets based on co-operation with a few agents. Next, the importer/stockist representatives were acquired. Outokumpu's daughter companies started organizational growth on international markets. Own marketing organization and acquisitions was dominant in the exports. Own organization developed rapidly and the range of export products increased. In 1978, Outokumpu acquired in Germany from Telko's a local stockist/importer of stainless steel plates. The name Friedrich K Lurk KG GmbH & Co was changed to Outokumpu Deutschland GmbH & Co in 1982. Outokumpu acquired in 1980 three new marketing companies in Norway, Sweden and France. This development turned successful and Outokumpu established Outokumpu Metals Inc in the USA in 1982. The operators of the Import period are listed in Table 4-1.

Table 4-1 The Operators of the Import Period of Steel Distribution in Finland

| Intermediaries/Stockists | Mills | Agents |
|--|---|------------------------------------|
| Algol GHH(Aspo) Kontino Juuantehtaan Rautakauppa Mercantile Mikra Julius Tallberg Kimport (Keskometalli) Putkola Rauta-ja Konetarve Salon Kone ja Rauta Rake Renlund Simolin SOK (Sokmet) Teräs Starckjohann&Co Valtameri | A.Ahlström Fiskars Hackman Koverhar Outokumpu Rauma-Repola Vuoksenniska Wärtsilä | Rautakonttori, Stalko, Telko |

First period had a clear structure of distribution. OEMs were dependant on imports and international contacts due to limited production capacity of the domestic mills. The number of intermediaries and producers was high. Intermediary services were dominantly in sourcing, stockholding and deliveries (break-bulk and agency) of standard products. Further processing and assembling were normally made by the OEMs (Figure 4-2).

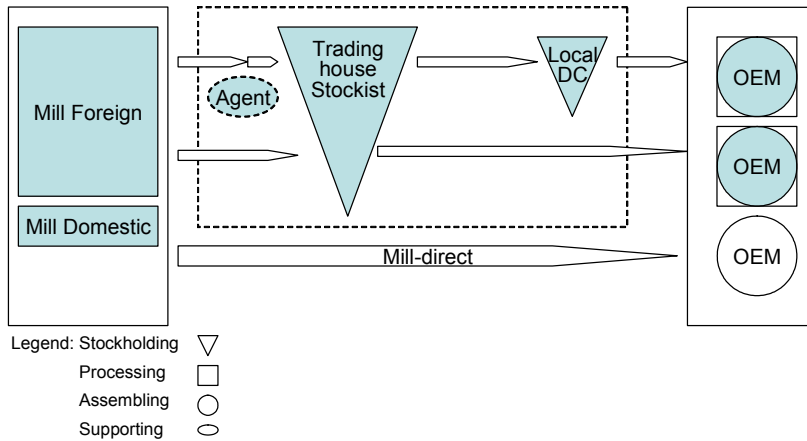


Figure 4-2 Channel Structures during the Period of Imports

During the Import period, entrepreneurs had a dominant role in steel distribution. They had a key role as logistic coordinators of services. The intermediaries had organizational infrastructures and know how for communication, financing, order taking services and physical delivery of standard products.

4.1.2. Distribution Services

During the Import period, the breadth of product choices was depending on the imports. Information on available choices was presented in catalogues and commercial advertisements. Mills started with simple products enabled by an existing manufacturing technology.

Local steel production started in Finland in the early 1600's. First mills were Mustio (1616) and Ojamo in the southwestern Finland. In thirty years, there were five mills as Billnäs, Fagervik and Fiskars were established. Up to the 1800, the Finnish mills had close co-operation in production and marketing with Sweden (Salokorpi 1999). Private entrepreneurs established first steel mills. Production of pig iron started as early as in the 1600's. Small-scale production was for local needs only. In Finland, there existed 38 mills in the production of iron, steel, copper and nickel during early 1900. Few of them are still in operation but 33 stopped their operation (Nirkko et al.1990).

First rolling mill started already in the 1850's. First furnaces with a new Siemens Martin technology were introduced at Taalintehdas Mill in 1879, at Wärtsilä Mill in

1885 and at Åminnefors Mill in 1887. The first signs of steel stockholding can be found as early as in the 1860's.

Production of iron and steel in 1870 totalled 21,000 tons of which steel only 3,000 tons. Steel production stayed at a low level a longer time: 5,500 tons in 1895 and 13,000 tons in 1913. Vuoksenniska Oy invested to a rolling mill with an electric blast furnace of 30,000 tons of new capacity. Production started in 1937. By 1940, Finland produced in three mills 72,000 tons of steel. Vuoksenniska represented 2/3 of the total Finnish steel production. Two minor mills were Fiskars Oy in Åminnefors and Inha and Wärtsilä Taalintehdas Mill (Viitamo 1997, 8-9).

After many stages, there were three local producers in the 1940's. For a long time the production, capacity was low in many locations. Finnish steel industry started to grow rapidly from the 1970's onwards. The steel producers in 1974 were A.Ahlström foundry in Karhula; state owned Outokumpu, Ovako Group with mills in Imatra, Åminnefors, Turku and Koverhar, Rauma Repola Lokomo Mills, and state-owned Rautaruukki and OY Wärtsilä AB Taalintehdas Mill.

Imatra steel started in 1914 as a private company. Its previous name was Ovako. Mr Berndt Grönblom started a foundry Elektrometallurgiska Aktiebolaget in Vuoksenniska and Nokia. Under a new, name Oy Vuoksenniska Ab (1933) it started production at the Imatra Works in 1936-37 (special products and bars) and Turku Iron Works in 1943. As an entrepreneur, Mr Grönblom made plans of producing steel plates at Oy Koverhar Ab Mill in Hanko. Project faced major problems, as there was an ongoing similar project by the Finnish State. The financial situation turned tight due to the recession in 1957. Koverhar started as iron works in 1960 as a joint venture between Swedish Stora Kopparberg and Oy Vuoksenniska Ab. Production specialized at an early stage and they had to export most of their production (Laakasuo 1985).

Outokumpu Oy was established with an agreement between privately owned Hackman & Co and the Finnish state in 1914. The name of the new company was Outokumpu Kopparverk. Main markets were in Russia and the first sales office was opened accordingly in St Petersburg (1914). Marketing and sales office located in Vyborg in the connection of Hackman & Co.

Original operation of Outokumpu was based on mining and technology. Outokumpu transformed its activities, as it became a joint stock company in 1932. At the same time business idea of a mining company was further developed. The purpose of the company was to avail mining resources of Outokumpu and possible new mines in Finland (Särkikoski 1999, 14). Outokumpu engaged in a new flotation technology in Outokumpu mill that enabled copper production. Outokumpu was able to produce 400 tons cathode copper in 1926 as Finnish state had need of 2,000 tons for copper ropes. Capacity was gradually increased in 1926, 1935 and 1941 (Särkikoski 1999, 42). Outokumpu invested a new furnace in Harjavalta with an annual capacity of 24,000 tons copper in 1949. Smelting capacity was 50 tons a day, which is a small quantity compared with today's technology (Särkikoski 1999, 129).

Rautaruukki project originally started with a consolidation of a mine and Otanmäki; a loss making vanadium plant. Otanmäki was merged with Rautaruukki in 1968 (Seppälä 1985). Rautaruukki was established in 1960 by the Finnish state and private OEMs, which were steel users. Finnish state owned 75 % of the company; directly 25% and 50 % through state owned companies Otanmäki, Outokumpu and Valmet Oy. Private shareholders Oy Fiskars Ab, Lokomo Oy, Rauma Repola Oy and Oy Wärtsilä Ab had 25 % of the company shares. Rautaruukki introduced the newest production technology in the Raahen Mill in 1967. Continuous casting technology from Russia enabled an annual production capacity of 500,000 tons by the end of 1970's. First products were steel plates.

During the Import period, intermediaries operated steel distribution by dominantly. Trading houses and hardware stores acted as main intermediaries in steel merchandising. Product choices of a hardware store were in the beginning limited. Ordinary iron and steel products were light building materials, nails or heavier castings and merchant iron bars. Product choices were still few due to restricted imports. Product choices were based on production range of the international producers and sourcing contacts of trading houses and importers with them.

Domestic steel and metal production was minimal or non-existing Ordinary delivery lead times were extremely long from international sources as production and transportation took easily several months. Communication with customers and mills

required local presence with an own staff. Import procdures required import licences, communication in foreign languages and arrangement for transportation and stockholding. Trading houses mastered all these qualifications. They also acted in wholesales to local distributors. In the inbound logistics, delivery was a complex and time-consuming process. In stock deliveries, the delivery speed for the products was satisfactory.

During the Import period of stockists delivered only standard products. They acted as key co-ordinators of logistic processes. Core capability consisted of product sourcing, stockholding and break-bulk delivery in standard form. Producers focused on production of products, which have internationally known standards on product quality and dimensions. Early steel stockists started with steel products available from foreign sources. Their breadth of product choices was low and depended totally on the services by the foreign sources mainly mills (Figure 4-3).

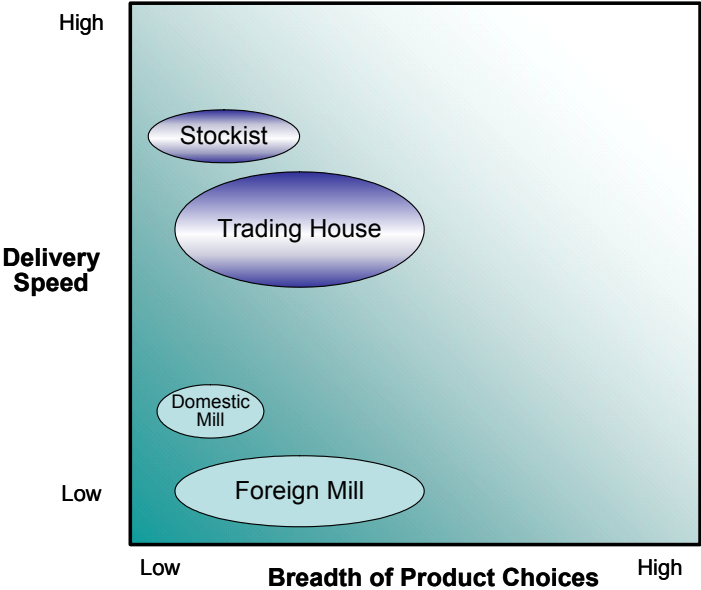


Figure 4-3 Service Capabilities: The Period of Imports

First steel stockholding services in Finland started officially by a trading house *Starckjohann & Co*. The following advertisement describes their specialization on steel and iron product-mix and services:

“Swedish or Russian steel in the 1870’s and English and Scottish pig iron and round, flat and square iron, axle steel, bore steel, anchor steel and further ship plates, tank plates and steam boiler plates in 1918” (Viitamo 1998, 15).

Valtameri started steel stockholding in the 1930’s as the Finnish industry needed steel in manufacturing. In the 1920’s *Valtameri* had its own fleet of six ships, foreign offices in different continents and own forwarding transportation and stockholding facilities. International organization focused in paper, foodstuffs, other raw materials and machines. Steel became to *Valtameri*’s product offering in the 1930’s as it was a natural new opportunity for an established trading house (Paavilainen 1998).

Entrepreneurs react on opportunities and events as something new appears and it seems possible to combine new services on present core capabilities. Kuosmanen (2001) confirms, “*Valtameri* as a trading house realized the opportunities of steel using industries in Finland after the war as mechanical engineering industry urgently needed steel”.

As an example, the shipyards needed plenty of steel sheets and plates for which there was no local production. After the Second World War Finland paid most compensations of war in steel and metal products to Soviet Union. This gave impulse to enlarge former co-operation with European steel mills and mechanical engineering companies. Product choices based on long profiles, plates and metal working machines (Paavilainen 1998, 258-266).

Product choices of *Valtameri* were limited to few suppliers of tubes and plates. First foreign steel contacts were signed with steel mills in Belgium, France and the USA. Stockholding services were started with Comptoir Belgofrance (tubes) and US Steel (plates). Beside stockholding, some customers in furniture manufacturing (tubes) and bus manufacturing (plates) ordered mill-directly via *Valtameri* as an exclusive importing agent.

Valtameri enlarged product choices in long products to other European tube, bar, angle, precision tube hollow section, door and window profile manufacturers. Ordinary lead-times in sourcing were 2-3 months and even longer. Lead-times were generally long and deliveries to stocks took place by sea freight. For customer deliveries, *Valtameri* established its own truck fleet.

At the end of the Import period, product choices of Valtameri were typical for an ordinary stockist of long profiles: standard and special products, different dimensions in steel, aluminium and stainless steel (tubes, bars, angles, hollow section and special tubes). Suppliers were steel mills and trading companies from the UK, Germany, France, Sweden, Switzerland, Austria, Italy, South Africa, USA, Russia, Poland and Romania. Foreign sourcing by intermediaries continued until local production changed the roles of intermediaries during the 2nd period.

4.1.3. Processing Services

OEMs manufacturing processes based first on man paced manufacturing systems and small batches. Most OEMs manufactured parts and components and assembled end products. Value-added input was high in the imports and stockholding. Sourcing of raw materials was a major concern among the OEMs. Products were delivered from mills in large and small quantities. Trading houses had high capabilities in international trade. Foreign mills and local OEMs had insufficiently own experience in trading. During the Import period, foreign sources were dominant. Product bulkiness not yet high as products were sourced mainly in container sizes (less than 6 m) and delivered from stockists in small quantities. Stockists acted as sourcing agents and importers between foreign suppliers and local customers and offered limited processing capabilities if any. Core capability based on sourcing, stockholding and break-bulk delivery. Distribution and production were separate business processes. Trading houses and stockists performed break-bulk services as independent intermediaries for the OEMs (Figure 4-4).

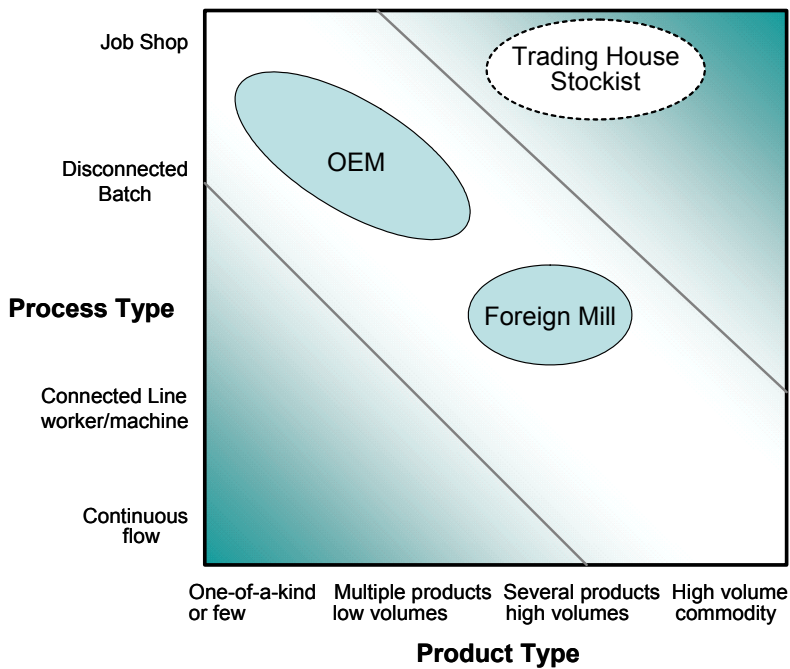


Figure 4-4 Processing Capabilities: The Period of Imports

4.1.4. Product Characteristics

Stockholding and delivery of standard products remained as the core capabilities of the intermediaries throughout the Import period. Conventional stockists realized that OEMs will in the future require higher value-added services. Product bulkiness and complexity were apparently low during the Import period. There are only a few documents about product characteristics in the history of steel distribution.

Product characteristics were dependent on technology and infrastructure, which was used in production, transportation and stockholding of products. Early steel and metal mills had diverse products developed for customer applications. Product bulkiness and complexity were low. Finnish Dalsbruk steel mill had a furnace which produced 4-5 tons steel a day in 1927. Product range was large in the late 1930's. Dalsbruk had 350 products in stock. Round bars were produced from 5.5 mm up to 100 mm and square bars from 8 to 100 mm. Products of 5-6 meter or 10-12 meter long were delivered in 60-100 ton lots (Nirkko et al. 1990).

Product bulkiness was in a key role in early distribution and stockholding. Valtameri represents typical profile of an early stockist, which had capabilities on handling

standard products up to 6 meters length and container sizes. It was a common standard in most ordinary steel profiles.

During the 1st period, sourcing and stockholding at Valtameri based on 4 - 6 meter long products and especially tubes and special profiles. Weight of one stock order from a foreign mill was 500-1,000 kg. Such product bulkiness was low. Stockists had low capacity for lifting heavier products and limited space for stockholding of larger quantities. Service capabilities by intermediaries were based on negotiation, international product sourcing, stockholding, break-bulk deliveries and financing of the goods. Normal delivery was one or few products and in standard form and dimensions. Stockists practically had no processing capabilities (Kuosmanen 2003).

Mills produced standard products in plates, sheets and profiles packed at the mill. Products were in palette- and container-sizes. Stockists acted as a connecting link between the producer and OEM customers. The roles of intermediaries in steel distribution were clear. Each operator had own core capabilities in a value chain. Those capabilities and services between upstream and downstream operators supported one another (Figure 4-5).

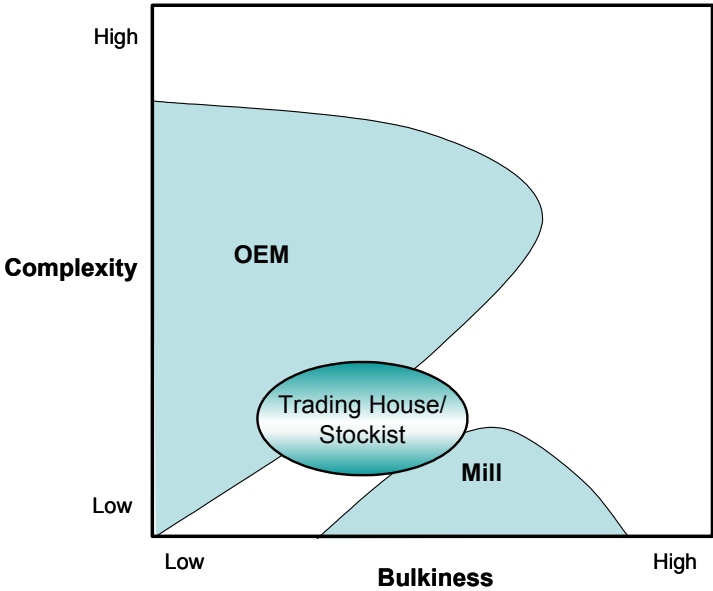


Figure 4-5 Product Bulkiness and Complexity: The Period of Imports

Mapping of product characteristics indicates that at the mill-level the product bulkiness and complexity were low. Production technology, logistic infrastructure, lifting of packed goods, transportation and stockholding limited product sizes maximum to container-size and even palette-size products. OEMs were capable to operate with high complexity and bulkiness products, such as vessels, rail wagons or vehicles.

4.2. The Period of Domestic Production

The 2nd period introduced the domestic production at a full scale resulting in a reallocation of the intermediary roles. Product choices on standard and special products were rather broad. Number of stockist was high and major European and importers and agents in Finland represented even Russian and other eastern block mills. Major transformation in product choices occurred as stockists started investments in processing services.

4.2.1. Intermediaries

The period of Domestic Production started from 1970 onwards. Demand of products and raw materials turned to market saturation and total supply exceeded the demand. Sourcing practices changed from imported products to domestic suppliers. The availability of steel was no more a bottleneck. Local stockists had dense nation wide market coverage. Competition on price was fierce as products were abundantly available from different sources.

Domestic mills Rautaruukki, Outokumpu and Ovako (Imatra Steel) had many operative advantages in product sourcing, communication, stockholding and transportation of deliveries. Transportation by sea from foreign steel mills took a long time. Exclusivity in distributorship limited other sourcing alternatives in practise. Local sourcing had advantages in safe and reliable sourcing against controlled imports. Distances to Raahe, Hämeenlinna and Tornio mills were short, communication frequent and producers supported know how for intermediaries and OEMs.

Share of intermediary services has generally been higher in Finland than in most West European countries. The role of stockists has long time been stable at the level 30% or more. Analysis of the Finnish steel distribution reveals the stable role of stockists in demand fluctuations. Steel consumption increased substantially in 1987-89 until a

drastic fall in demand volume started consolidation of stockists in 1990-92. Stockists and SSCs have distributed annually between 400-600 tons from 1978 to 1995 (Figure 4-6) (STKL 1978-95).

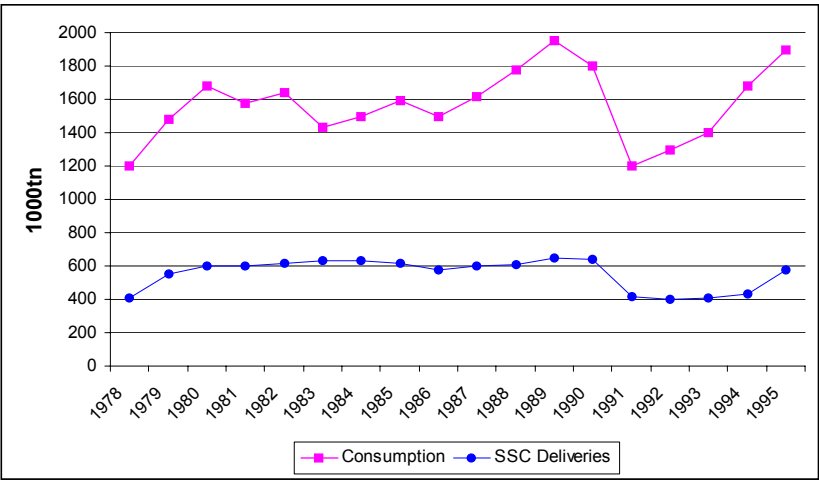


Figure 4-6 Intermediary Deliveries of Steel Consumption in Finland 1978-95 (Viitamo 1997, 60)

Finnish stockists have lost some of their volume from 1991 onwards for two reasons: Steel deliveries through SSCs stocks have gradually decreased since the early 1980's. However, as reinforced bars are excluded (regarded as a building material) changes (%) are much lower. Secondly, the level of total steel demand and intermediary deliveries has fluctuated. In the 1980's intermediary stock deliveries were stable in volumewise, as total annual steel consumption fluctuated between 1.2 - 1.9 million tons.

Analysis of deliveries confirms that stockholding has increased its role as direct deliveries and agency deliveries have declined in the intermediary deliveries (Figure 4-7).

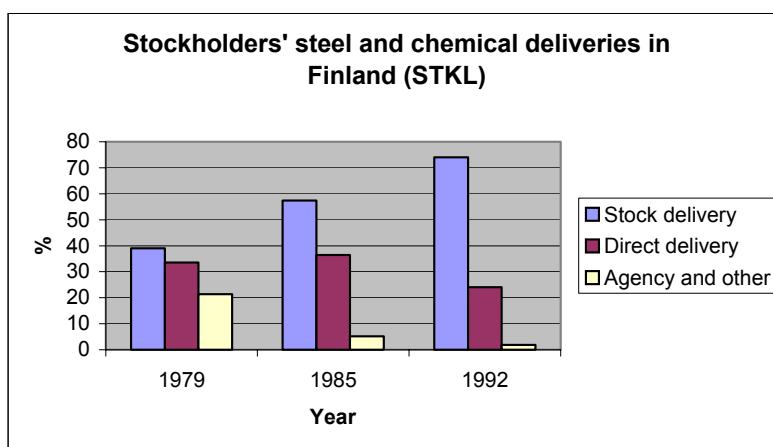


Figure 4-7 Intermediary Steel and Chemical Deliveries by Finnish Stockists (STKL Statistics 1979, 1985, 1992)

Finnish stockists' deliveries consisted dominantly of standard products. Share of agency and direct deliveries was declining while stockists estimated the share of processed products to 25% in 1991-1992. Stockists actively planned investments to new value-added processing capabilities (STKL 1992).

Business climate was rather tight for stockholding and processing services and investments to processing capabilities were low. Stockists became cautious for many reasons. Stockists and wholesalers were little worried about future of technical trade and role of intermediaries (Hämäläinen 1991). Conventional stockists realized that need to invest in processing services and to renew logistic systems was at hand. Service performance was not anymore satisfactory and financial background in 1990 among Finnish steel stockists was not so solid: Inventory turnover and profitability among steel stockists were low. Steel stockists confirmed that inventory turnover 1989-1992 was about 60 days, which decreased to 40 days in 1993. Sales margin of 21.7% showed slight decline but generated gross profit after short-term expenses of 5.3%. Receivables were 53 days with 14 days payment terms. Suppliers financed stockholding as purchases were to be paid in 70 days. Turnover of capital (total sales per working capital) among larger stockists was 1.2 and minor stockists 1.8. This kind financial data indicated poor circumstances for future investments (STKL 1993) Steel stockholding was undoubtedly a low profit service in the end of the 2nd period (Table 4-2).

Table 4-2 Return on Investments (%) among Major Steel Stockists in Finland 1985-1990 (Based on Talouselämä Analysis)

| Company | 85 | 86 | 87 | 88 | 89 | 90 |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Algol | 11 | 10 | 9 | na | Na | 6 |
| Kesko | 9 | 8 | 10 | 10 | 7 | 4 |
| Kontino | 11 | 12 | 11 | 10 | 10 | 3 |
| Mercantile | 15 | 9 | 9 | 14 | 7 | 6 |
| Onninen | 5 | 3 | 10 | 10 | 12 | 11 |
| Starckjohann | 8 | 8 | 6 | 11 | 8 | 3 |
| Tallberg | 4 | 2 | 4 | na | na | na |
| Valtameri | 9 | 6 | 9 | 14 | 11 | 1 |
| Aspo | 15 | 11 | 7 | na | 10 | 10 |

Sourcing strategies transformed during the Domestic Production period as well. Most stockists changed sourcing to domestic mills and sourced additional product choices from international suppliers. Rautaruukki targeted to local OEMs and took an active step that changed sourcing practices.

Rautaruukki “invited steel stockists/wholesalers to a meeting in which Helge Haavisto, President and CEO of Rautaruukki informed that Rautaruukki shall in the near future conquer the Finnish markets” (Seppälä 1985, 84). Stockists had to choose either between imports or between exclusive sourcing with Rautaruukki. This resulted to 11 exclusive distributors and over 80% market shares on all Rautaruukki products in Finland (Seppälä 1985, 85-86).

Structural change in sourcing happened fast in Finland as most of the dominant stockists and some large OEMs turned their sourcing on Rautaruukki, Outokumpu and Ovako. On products with no local production were sourced from international sources. Distribution channel separated to the one based on domestic production (supported by special product choices imported) and the one based totally on imports. The distributorship was based on exclusive rights on particular product choices in Finland.

Rautaruukki had in 1975 eight distributors in Finland: Kesko, Kontino, Renlund, SOK, Tallberg Valtameri, Starckjohann and GHH (Aspo). Distributors gradually consolidated and Rautaruukki had in 1980 seven distributors, in 1985 six, in 1990 five and 1995 three distributors namely Asva, Keskometalli and Kontino. Similar development happened in pvc-coated sheets. Finally, Kontino was the only distributor beside the key player Asva. Starckjohann decided to terminate Rautaruukki

distributorship in 1977 and focused totally on the imports. Algol and Mercantile focused also on imports later on.

In tubes, Rautaruukki had seven distributors in 1975: Kesko, Kontino Renlund, SOK, Tallberg, Valtameri, and GHH. This increased to nine as Onninen and Huber joined Rautaruukki in 1980. Rautaruukki had eight distributors in 1985 and only seven in 1990 and 1995.

Outokumpu had fewer distributors than Rautaruukki for domestic markets. In 1985, Outokumpu had in 1985 four distributors: Aspo, Keskometalli, Renlund and Tallberg. This decreased to three in 1990: Aspo, Keskometalli and Valtameri. Five years later there were left only Asva and Keskometalli (later Asva). *Helsingin Rauta* has limited choices on Outokumpu PoriCopper products.

Exclusivity meant that distributors were competing on service and price. Distributors and large OEMs were granted an annual allowance depending on the annual quantity purchased. Only distributors and large OEMs were able to meet such quantities. Smaller OEMs sourced from regional distributors and local distributors and stockists (LDC).

The role of domestic mills became strong as Rautaruukki and Outokumpu enlarged their production capacity. Domestic steel mills produced approximately 55% (and Rautaruukki alone 50%) of steel consumption in Finland 1990-1995 (Viitamo 1997). Only Starckjohann Steel was able to compete successfully in the imports against distributors of the local mills. Number of steel stockists diminished especially during the 2nd period. Thirteen members had consolidated first to six 1981-1993 and down to four at the end of the 2nd period namely Asva, Starckjohann Steel, Kontino and Algol. The number of Finnish stockists increased to five as Tibnor Oy (SSAB) became a member in 2002 (Table 4-3).

Table 4-3 Member of the Finnish Steel Stockists 1981-1995

| Stockholder/SSC | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | Sourcing | Role 2003 |
|--------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----------|--------------|
| Algol | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | Import | Onninen |
| Aspo | x | x | x | x | x | x | x | x | x | x | x | x | | | | Domestic | Asva |
| Asva | | | | | | | | | | | | | x | x | x | Domestic | Rautaruukki |
| Keskometalli | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | Domestic | Asva |
| Kontino | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | Domestic | Independent |
| Mercantile | x | x | x | x | x | x | | | | | | | | | | Import | Starckjohann |
| Rauta ja konetarve | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | Import | * |
| Renlund | x | x | x | x | | | | | | | | | | | | Domestic | Asva |
| Salon K. ja Rauta | x | x | x | x | x | x | x | x | x | x | | | | | | Import | * |
| Starckjohann Steel | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | Import | Independent |
| SOK/Sokmet | x | x | x | x | x | x | x | x | x | | | | | | | Domestic | Asva |
| Julius Tallberg | x | x | x | x | x | x | | | | | | | | | | Domestic | Asva |
| Telko | | | | | | | | | | | | | | | | Import | Starckjohann |
| Teräs | x | x | x | | | | | | | | | | | | | Import | Starckjohann |
| Valtameri | x | x | x | x | x | x | x | x | x | x | x | x | | | | Domestic | Asva |
| <i>Number of Stockh.</i> | 13 | 13 | 13 | 12 | 11 | 11 | 9 | 9 | 9 | 9 | 7 | 7 | 6 | 6 | 6 | | 5 |
| Explanations: | | | | | | | | | | | | | | | | | |
| <i>Focus on local mills=Domestic</i> | | | | | | | | | | | | | | | | | |
| <i>Focus on imports =Import</i> | | | | | | | | | | | | | | | | | |
| <i>Member of Stockholders=x</i> | | | | | | | | | | | | | | | | | |
| <i>No or nominal role = *</i> | | | | | | | | | | | | | | | | | |

The key intermediaries were large one-stop-shoppers and service centers. Middle-sized stockists have disappeared or consolidated with larger nationwide enterprises. Consolidation process among the stockists took place in 1986-1993. It is much later than in Sweden or the rest of the West Europe. Consolidation in Sweden realized from 1976 to 1979.

The 2nd period was an active stage for local mills that both expanded and integrated. Rautaruukki Raahe mill (plates) started in 1967 and Hämeenlinna expanded stepwise first in 1972 (hot and cold rolled sheet) then in 1977 (pvc-coated sheet) and in 1983 (steel profiles). The annual capacity of Raahe mill was planned at 300,000 tons. Domestic consumption was that time 200,000 tons. Rautaruukki completed investment program in 2000, which increases the capacity in flat products up to 2.8 million tons by the year 2003 (Rautaruukki 2000).

Rautaruukki expanded especially in the export markets: Rautaruukki integrated first to tube manufacturing by acquisitions of international manufactures and service centers. Rautaruukki became a minority shareholder in a tube specialist *Helens Rör* (Sweden) having acquired totally *Helens Rör* in 2002. Rautaruukki bought *Wirsbo Stålrör* (Sweden), *Nordisk Simplex A/S* (Denmark), *Carl Froh* (Germany), *Schmacke Rohr* (Germany), *CCB* a steel distributor (Norway) and former distributor in long profiles *Star Tubes* (UK).

In Finland Rautaruukki integrated to downstream by acquisitions of mills, OEMs, distributors and logistic companies: Acquisition of (*Tammet Oy*) enlarged product choices (wire nets). Minorities in a specialized tube stockists (*Polarputki Oy*) and own distributor (*Valtameri*) gave a foothold to steel distribution. Rautaruukki became engaged in OEMs which were heavy steel users (*Rannila, Mäkelä Metals, Toijalan Teräsprofili*). Vertical integration continued as the first large scale service center Asva was established in 1993 based on a strategic alliance between two distributors (Aspo and Valtameri) and local mill (Rautaruukki).

Rautaruukki started manufacturing of *containers* in Rovaniemi and train wagons in Otanmäki and Taivalkoski (*Oy Transtech Ltd*). Container manufacturing proved a failure, Transtech was sold later on and Simplex tube manufacturer in Denmark was closed down (2003). Acquisitions in building industry *PPTH* was a foothold in a steel using customer segment. For transportation of goods Rautaruukki established own logistics company *JIT Trans* in 1988. JIT Trans benefited from economies of scale as it co-ordinated both inbound logistics and deliveries to the distributors. JIT Trans was a separate logistics service provider (3PL) in the Rautaruukki Group.

Local steel producers had a good coverage already in the beginning of the Domestic Production period. Rautaruukki had almost all leading stockists as its distributors. It was no wonder that the market coverage for Rautaruukki's became broad and dense already in the very beginning. Market shares averaged 50-80% depending on the product. Rautaruukki and other domestic mills represented 50-60% of total steel volumes delivered by their distributors.

Distributors had a declining role in Rautaruukki's domestic deliveries as producer integrated to the downstream. Rautaruukki distributors delivered more than 80% of total turnover in 1990. Half of this consisted of mill-direct deliveries. This share decreased to 62 % in 1993 and 55% in 1995. Share of direct ex-mill deliveries have accordingly increased in the 1990's (Figure 4-8).

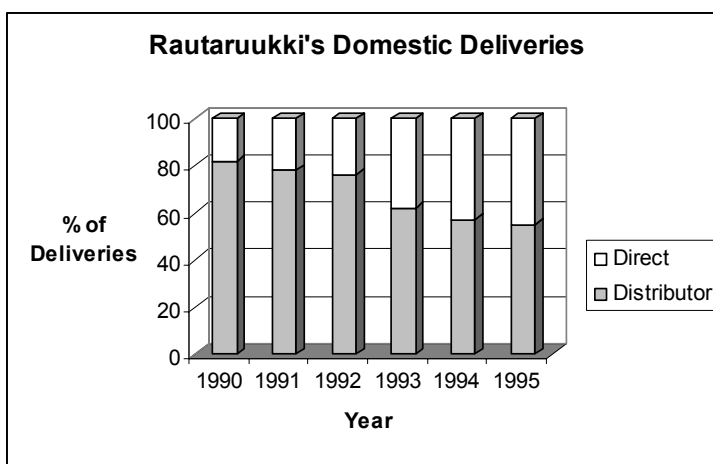


Figure 4-8 Structure of Deliveries of Rautaruukki in 1990-1995 (Viitamo 1997)

Role of Rautaruukki's distributors generally decreased and mill-direct deliveries increased. In tube deliveries, the stockists had a dominant role until late 1980's. Mill-direct deliveries by Rautaruukki were only 2% in 1990. Mill-direct deliveries exceeded 10% in 1993, 11% in 1993 and 20% in 1994 (Viitamo 1998, 100). Distributors financed business operation, communicated with customers and processed the order to the mill for a mill-direct delivery. Value-added input from this intermediary service was low.

Stockists lost their market share in tube distribution as Rautaruukki renewed terms of deliveries by shorter lead times and lower minimum order quantities to the OEMs. As a result, Rautaruukki won 300 new direct OEM customers. Direct deliveries had a share of 37% of distributors' total deliveries in 1995 (Viitamo 1997, 90). This trend refers to a declining role of steel stockists in steel distribution.

Outokumpu Tornio mill started with a new production technology in 1976, which was a fully integrated system. Prior to the start-up of Tornio mill, the Swedish Avesta had almost a monopoly in stainless steels. Logistically production and sourcing had a competitive advantage as raw material came from the local mine directly to the production process. Export markets are important for Outokumpu. Local consumption of stainless steel is low being 30,000 tons a year. By the end of 1980, Outokumpu Tornio Mill produced 80,000 tons of stainless steel, of which they exported 60%. At the early 1980, Outokumpu had a dominating market share of 70% in Finland. Next

Outokumpu integrated downstream by acquiring a tube mill. It enlarged operations to processing in 1980 with an acquisition of one of its biggest customers JA-RO stainless steel pipe mill in Pietarsaari. Rautaruukki and Outokumpu have continuously high market shares on the domestic markets. Both producers have, nevertheless enlarged their international investments through acquisitions, strategic alliances and international co-operation.

Outokumpu has similar structure in domestic deliveries as Rautaruukki. In 1995, distributors delivered 55% and the mill-directly 45% of all deliveries to the OEMs. Share of distributors has stabilized to more than 50% of deliveries as agency deliveries stopped in 1992 (Figure 4-9).

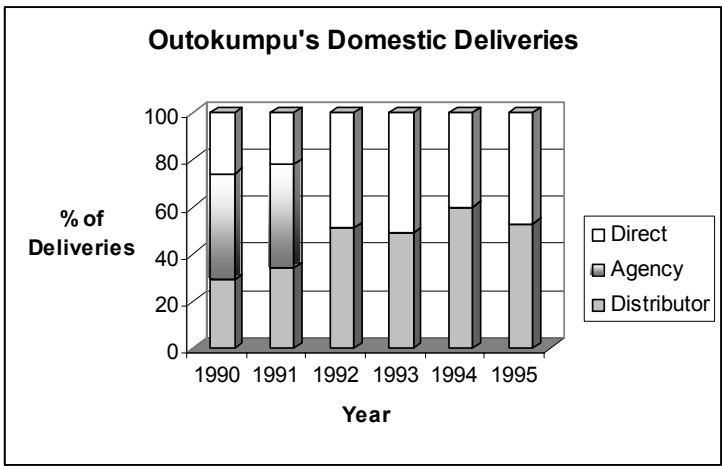


Figure 4-9 Structure of Deliveries of Stainless Steels of Outokumpu in 1990-1995 (Viitamo 1997)

Imatra Steel, the third Finnish steel mill produces special steels for automotive and engineering industries. Products are highly differentiated according to customer requirements. Imatra Steel is a division of Wärtsilä Corporation. Imatra Steel was a joint Nordic venture. Pohjoismaiden Yhdyspankki, a Finnish bank started transformation process with Vuoksenniska steel mill in 1967. Åminnefors Mill was removed from Fiskars and combined with Vuoksenniska in 1971. New name was Ovako Oy. Ovako acquired shares of Koverhar Mill from its Nordic co-operator Stora Kopparberg Ab. Three years later Ovako acquired Taalintehdas Mill from Wärtsilä. Åminnefors and Taalintehdas were moved in 1987 to a new company Dalsbruk. The

owners were Rautaruukki (80%) and Ovako (20%). Ovako merged with the Swedish SKF Steel Ab in 1986 as Ovako Steel Ab.

Owners of Ovako Steel Ab were Swedish SKF (50%) and three Finnish companies namely Wärtsilä, Fiskars and SYP (Union Bank of Finland) (50%). This new company was divided in 1991 to two parts: Imatra Steel Mill and Billnäs Spring Mill in Finland and Swedish Forge. Finnish Metra Corporation acquired them and the new name was Imatra Steel Works. The rest stayed in the Swedish SKF ownership under the name of Ovako Steel.

Starckjohann and Kontino operated as distributors for Ovako steels in Finland (Imatra Steel). Exports have a dominant role in highly specified steel product choices of Imatra Steel. Ovako (Imatra Steel) has transformed its distribution from a focused to a multi channel distribution.

Ovako concentrated intermediary services to Turenki. Distribution of special steels was arranged with two distributors: Kontino and Starckjohann in 1981. Ovako Teräsmarkkinointi Oy owned this stockholding facility after a merger of SKF Steel and Ovako. This was rearranged with distributors two years later under the new name of OKS Teräs Oy. Owners were Ovako, Kontino and Starckjohann with one-third shares each. This joint venture ended in 1991 as Metra Corporation acquired Imatra Steel. Number of distribution increased later by Algol and Keskometalli (later Asva) (Viitamo 1997).

The Domestic Production period transformed the roles of intermediaries. In this stage intermediaries consolidated in order to strengthen their role in steel distribution and services. Growth was possible by acquisitions and integration. Other ordinary stockists specialized on limited product choices or regionally.

Intermediaries were classified in two competition groups: domestic distributors and importers. Main reason for this development was the exclusivity of distribution rights. This compelled stockists to choose between domestic sourcing and imports. Normally market area was limited to Finland. Importers consolidated to group of few wholesalers of which the largest *Starckjohann* operated nationwide. Swedish SSAB was one of their main suppliers.

Most importers remained as middle sized or small stockists or concentrated foreign sourcing on products with no local production. *Mercantile* focused on stainless steel plates and aluminium profiles and *Algol* on long profiles, structural steels, and *Sten & Co* on special steels. They were middle-sized stockists. In the imports, *Polarputki* focused totally on sourcing and stockholding of special tubes and *Aluma* in different type of aluminiums. Regional or local stockists *Teräs* in the southwestern Finland, *Salon Kone ja Rauta* and *Rauta ja Konetarve* in Southern Finland sourced from importers and wholesalers.

Ordinary stockists also enlarged to processing services. Early investors were Kontino, Aspo, Starckjohann and Keskometalli. Starckjohann invested in value-added processing and erected a new SSC in Turku in the early 1980’s. Starckjohann entered into severe financial problems in late 1990’s (Figure 4-10).

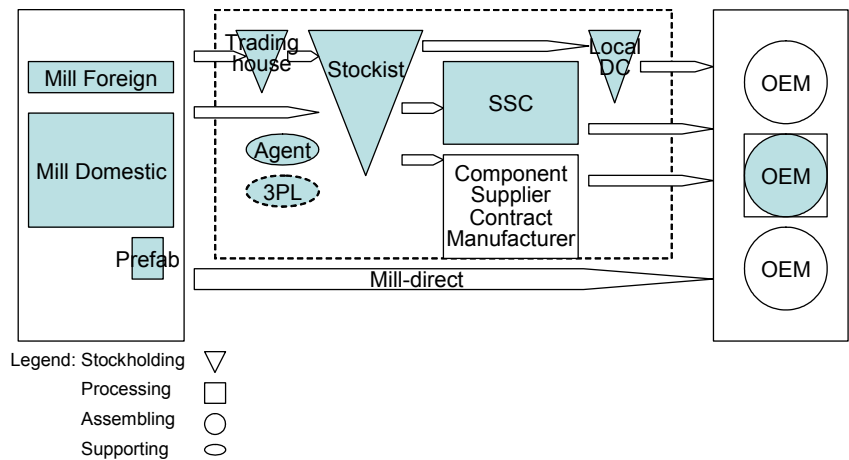


Figure 4-10 Channel Structures during the Period of Domestic Production

During the 2nd period, the roles of intermediaries were still dominant in heavy logistics. Local mills changed sourcing practices from imports. Vertical integration by mills changed channel structures. Number of intermediaries was high. The role of stockholding specialized. Larger stockists consolidated to larger intermediaries. Value-added processing moved from OEMs to service centers. Outsourcing encouraged intermediaries to make investments to value-added capabilities. First service centers emerged and ordinary stockists invested to processing services. It seems that companies having invested in processing capabilities were larger and could compete on broader product-choices than ordinary stockists could.

4.2.2. Distribution Services

During the period of Domestic Production, product choices on standard and special products were rather broad. Number of stockist was high and major European and importers and agents in Finland represented even Russian and other eastern block mills. Major transformation in product choices occurred as stockists started investments in processing services.

Key intermediary operator in the 2nd period was still an ordinary stockist with limited processing capabilities. The OEMs or other subcontractors often provided processing services. Such an ordinary stockist as Valtameri had a delivery speed capability of immediate or overnight delivery on most ordinary stock items. This kind of delivery speed was a standard service among stockists.

Intermediary services based on broad product choices and high delivery speed to the OEMs' manufacturing processes. Service model excludes a time-based delivery, in which the time of arrival of the delivery is a critical factor. This issue was an integral part of the service concept of the reference company Valtameri. Valtameri developed its service concept both on high delivery speed and especially on accurate arrival of the delivery. Key business processes focused on customer delivery and responsiveness. Delivery brand name was called the "micro-precise" delivery, which included fast and precise delivery on broad product choices. A micro-precise delivery was a promise of the timing of delivery according to the OEM's manufacturing processes.

Service centers have a high service level due to value-added input of processing. In value-added processing deliveries, lead times are longer than in order picking by a stockist. Processing time ranges from a few days to 2-3 weeks depending on customer requirements.

Major part of material flow is delivered mill-directly and in large quantities. Due to long and costly set-ups, steel mills tend to run production batches. One batch may include several custom orders that on the other hand delays the average delivery time of one order. Producers have traditionally delivery lead-times from one to several months. Delivery lead-times, however, shortened drastically at the mill-level too. As an example, Rautaruukki has decreased delivery times for cold rolled coils from 12 to 5 weeks in 1980-1995. Delivery lead-times are expected to shrink further. Delivery lead-

time for hot rolled coils has decreased from 9 weeks to 2 weeks in 1980-2000, while the European average lead-time was 4-6 weeks (Figure 4-11).

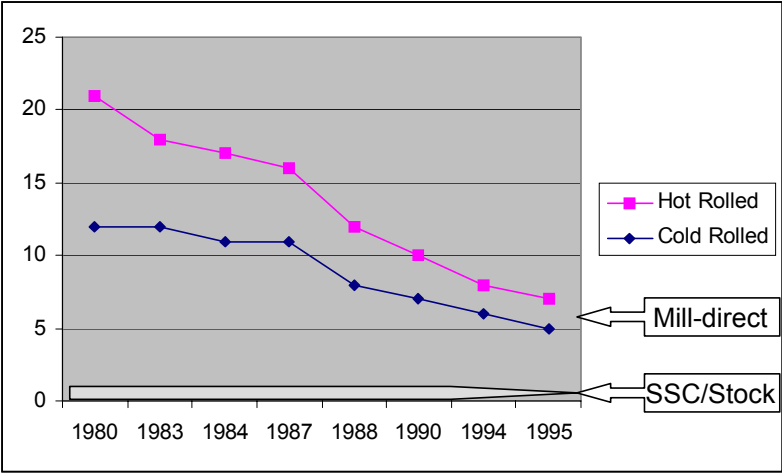


Figure 4-11 Delivery Speed Capabilities (weeks): Rautaruukki vs SSC and Stockist

Delivery lead-time of two weeks by mills is rather fast and competitive against stockists. On the other hand, customers are in many cases able to plan their manufacturing processes up to one month ahead.

The gap between mills and intermediaries in delivery lead-times has shortened drastically. Producers are able to meet competitive delivery lead-times on limited product choices. Delivery lead-times in mill-direct deliveries are short enough for many OEMs. Mills are very competitive against intermediaries in delivery lead-times especially in bulky deliveries. Their product choices are yet limited. Mills often regulate the delivery sizes with minimum quantity orders in order to avoid small orders. Mills have direct OEM customers that order large quantities annually. It is, additionally, possible to deliver one plate or a prefabricated part in reasonable time to ahe OEM.

Value-added processing by service centers, component suppliers and contract manufacturers enlarged capabilities among the downstream operators. Main difference between the 1st and the 2nd period in sourcing was transformation from foreign to local steel mills (Figure 4-12).

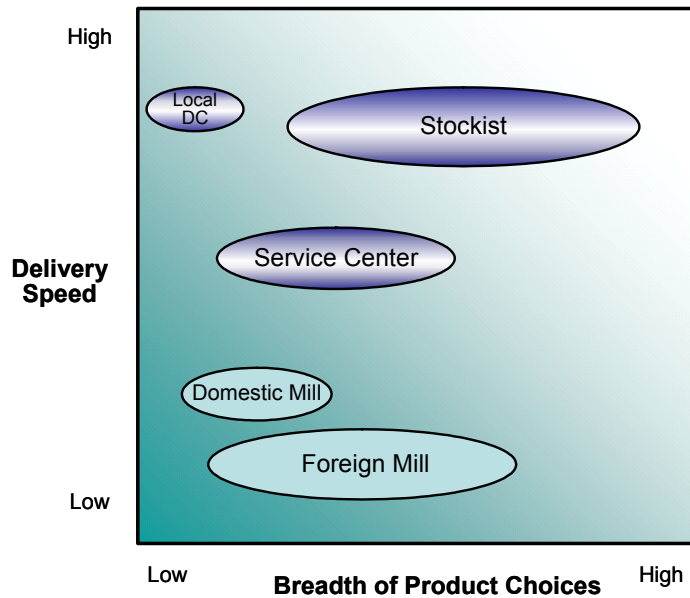


Figure 4-12 Service Capabilities: The Period of Domestic Production

Large-scale steel production started in Finland during the 2nd period. *Rautaruukki* started from plates and has today broad product choices of steel plates, tubes, building elements, cover ends, other special profiles and components.

In 1960, Rautaruukki planned a steel mill with annual capacity of 300,000 tons. First blast furnace, which was large in those markets, was 1,033 m³. This blast furnace had a technical capacity of 450,000 tons and it was possible to run at higher capacity of 600,000 tons (Seppälä 1985, 66). This capacity was enough to start local production of steel plates that could compensate imports.

After plates Rautaruukki integrated to a higher value-added production namely, to steel tubes and pvc-coated sheets. Rautaruukki acquired two local tube manufacturers Paltek Oy from Huhtamäki in 1973 and Etnarör Ab in 1975. Product choices were increased by integration to high value-added products.

Next integration to profile manufacturing and OEM products was performed by acquisitions: Mäkelä Metals, Rannila Steel, Verho Metalli and Suomen Metalcolor. Terästaive Oy (nowadays Plannja Oy) in Joutseno was acquired by Swedish steel mill SSAB. Only one OEM, Weckman Oy, has remained as a mill-independent profile manufacturer.

Rautaruukki acquired also other family owned component manufacturers in order to broaden their product choices: Toijalan Teräsprofili (form profiles), Halikon Tehdas (steel covers, boiler ends) and Liljendahl (packing strips). Rautaruukki had also a foothold in the building companies PPTH Oy and YIT Corporation, which eventually motivated product development in construction industries.

4.2.3. Processing Services

Processing services in the Nordic countries took two path alternatives. First, conventional stockists offered a limited choice of processing services. Second alternative was the emerging role of coil centers. Major stockists were able to offer processing cut-to-length services, primering and painting services. Coil centers with a high share of processing had made both green field investments and enlarged processing capabilities. Stockists estimated in 1987 that roughly 30% of the volume was processed in Finland, which compares 40% in Sweden and 13% in Norway. Further estimation was that outsourcing continues and share of processed deliveries will by far increase later on (Figure 4-13).

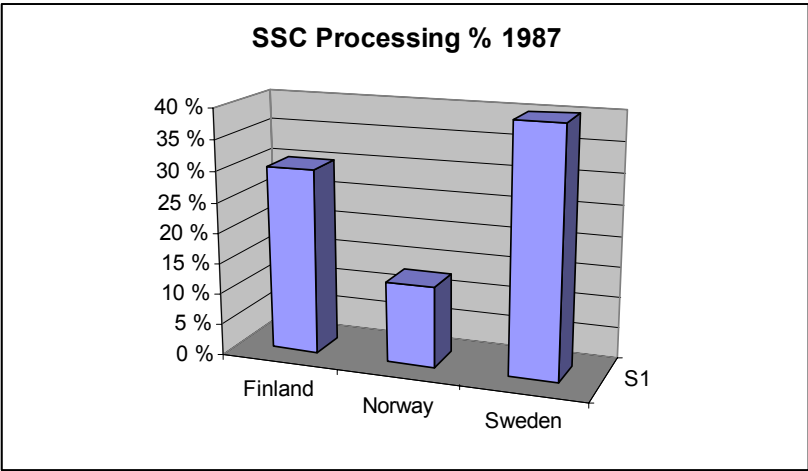


Figure 4-13 Share of Processing Services in 1987 (Nordic Steel Stockists 1988)

Value-added processing started as complementary service to stockholding. Main impulses for processing services came from the OEMs as they asked services first from ordinary stockists. Investments to processing lines turned easily expensive and required much volume for break-even. Increased outsourcing of processing by OEMs accelerated the investments of intermediary operators. Valtameri invested substantially

to flame-cutting, priming and cut-to-length services as largest OEMs asked such services.

Processing capabilities in the early stages were possessed by the OEMs. Intermediaries had capabilities in product sourcing and producers in production technology during the 2nd period. OEMs buy value-added processing services from other operators in a supply channel. Service centers, contract manufacturers, component suppliers and producers interested to invest in these capabilities (Figure 4-14).

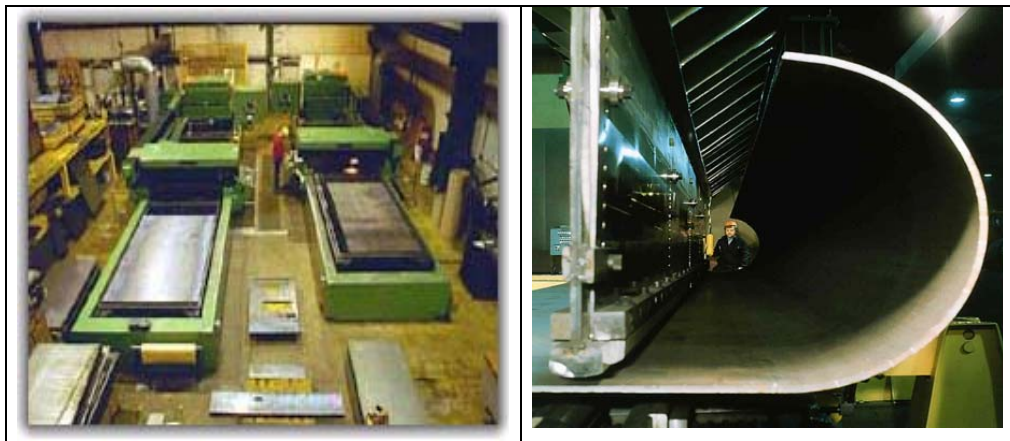


Figure 4-14 Processing Capabilities in Flat Products: Plasma Cut-to-length (SSC-job shop) and Bending of Plates at Rautaruukki

The role of service centers increased in value-added processing by transforming from stockholding to processing or starting coil slitting as a new service. Coil centers are specialized service centers capable in processing bulky coils. They decoil bulky master coils to smaller coils or shear and slit coils according to customer requirements. Coil centers possess capabilities of manufacturing customized products on diversified product choices. Processes are either batch type or job shops type depending on customer requirements.

Finnish service centers emerged during the 2nd period. First service center in Finland started in 1975 as GHH (Aspo) invested to a slitting line in Järvenpää (Tanttu 1979). Such an industry was new as an intermediary service. Keskometalli (earlier Kimport) started as a “green field” coil center in Naanatali. Service concept included coil slitting, searing and cut-to-length services in batches and as job shop operations. Other stockists (Kontino, Starckjohann, Tallberg, and Valtameri) united interests and formed a joint

service center *Mittalevy* to compete with new coil centers. Finally, these three coil centers concluded under one roof: Valtameri, Aspo and Keskometalli consolidated to a one-stop-shop type service center called *Asva* today operating under Rautaruukki’s Steel Service operations.

The 2nd period enlarged operative domain of intermediaries and producers. New service centers and specialized subcontractors in processing services increased their role and importance in steel distribution (Figure 4-15).

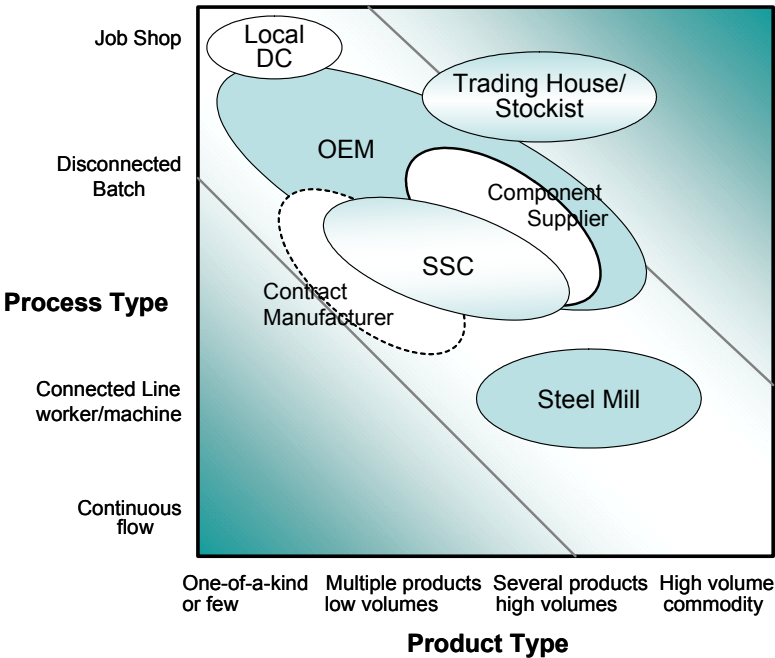


Figure 4-15 Processing Capabilities: The Period of Domestic Production

Ordinary stockists in Finland offered in the first hand few cut-to-length services to standard products. Increasing demand for value-added services started planning to expand the role of intermediary services. Main impulses came from OEMs while they planned disinvestments or outsourced of processing to a higher degree.

Valtameri Oy started first cut-to-length services of long profiles in 1983 and continued into flame cutting, priming and painting services. One of the key customers Kone Cranes started the outsourcing of processing of crane components. This transformed the scope of services and the role of Valtameri from stockholding to value-added services.

Aspo, Kontino, Keskometalli and Starckjohann, four largest intermediaries, had own processing lines including flame cutting, priming, sawing, bending, notching and punching services. These services covered broadly the processing services of a typical service center. Cut-to-length services increased as Kontino and Starckjohann formed a joint venture with Ovako Steel. Ovako had started own stockholding for special steels in Turenki in 1981. These three formed *OKS Metalli* in 1986 for stockholding and cut-to-length services. *Algol Oy* on specified product choice in stockholding and has added cut-to-length services in long profiles. Polarputki as a specialized tube stockists had broad cut-to-length capabilities.

These examples explain that processing capabilities introduced during the period of Domestic Production was an essential part of intermediary services. Conventional stockists specialized or joined forces and invested in processing services.

4.2.4. Product Characteristics

Trading houses and stockists acted as independent intermediaries linking mills with the OEMs customer needs. Product bulkiness and complexity increased rapidly during the latter part of the period as processing services became available. Standard products were sourced dominantly in the lengths of 6 meters, which was practical length in stockholding and handling.

Towards the end of the period of Domestic Production product bulkiness increased due to more economical production technologies and possibility to cut-to-length services. Product lengths increased to 10-12 meters. Plates, sheets and coils were sourced in larger sizes as well. Processing capability enabled higher product bulkiness in sourcing and increasing flexibility in product customization. Products are delivered normally in mill-packages to a stockist. Bulkiness is dominant in the stockholding services. Customers, however, began to order either one or a few standard products or processed parts and components for their manufacturing processes. The examples on the earlier days of the 2nd period are from Finland and Germany give indication of product bulkiness at the ordinary stockholding. Cut-to-length services were minimal or non-existing at that time.

Valtameri Oy was a good example of an ordinary stockist. Products delivered by Valtameri were even of lower bulkiness than in the average in Finland. More than half

of all deliveries were below 100 kg and 90% (80% in the industry average) below 500 kg each (Hämäläinen 1991). Product choices consisted of carbon steels, stainless steels and aluminiums as flat and long products (Figure 4-16).

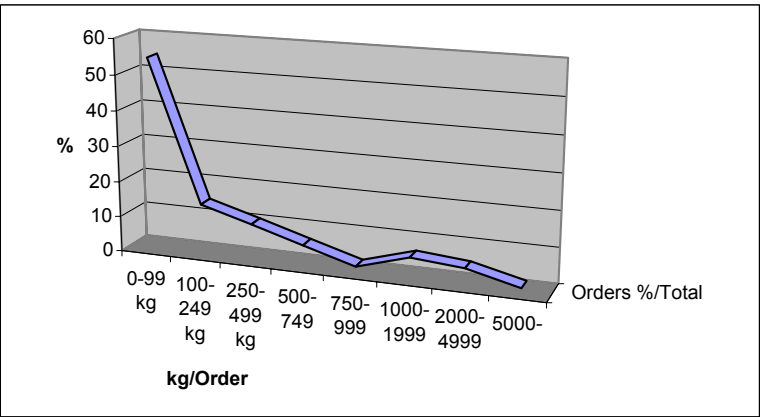


Figure 4-16 Differentiation of Orders (%) by Weight of Valtameri in 1987

Order sizes and product bulkiness decreased even further as Valtameri invested in processing and cut-to-length services enabling the delivery of customized products in a less bulky form than standard size products. Situation in 1991 indicated that almost 90% of all deliveries were below 500 kg, which represented 24% of total tonnage delivered and 37% of total turnover. The highest delivery frequency was for orders below 100kg. Such small deliveries represented 5% of total tonnage and 13% of total turnover (Figure 4-17).

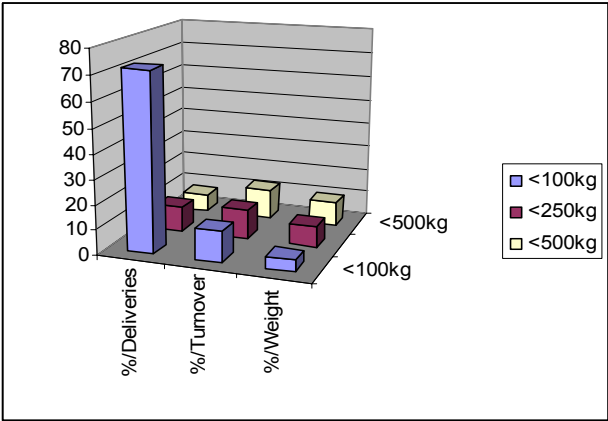


Figure 4-17 Distribution of Orders (%) by Weight Categories: Valtameri 1991

Stockists, such as Valtameri Oy, order products from mills in large quantities and deliver to customers in 100-250 kg lots in general. Mill orders are typically 1-5 tons in the inbound logistics depending on product. Mills tend to increase product sizes to a higher bulkiness level. Main reason to this low product weight and size is the low capacity of operative technology in the past product handling. Stockists occupied that time forklift trucks and conveying systems with the said capacity. This kind of break-bulk capability is based on broad product choices and high delivery speed.

Benchmarking with other steel stockists indicates a low product bulkiness and high number of deliveries. Comparison between Valtameri and Carl Christensen (CCB) the 2nd largest stockist in Norway indicated that service profiles are almost equal. Both stockists had similar type of product choices (CCB 1988).

Product complexity increased during the 2nd period. Customers requested increasingly processing services from conventional stockists. Service centers, subcontractors and prefabrication services of producers enlarged their operative area to higher product complexity. Meanwhile the operational gap of handling bulky and complex products decreased between a mill and an OEM customer (Figure 4-18).

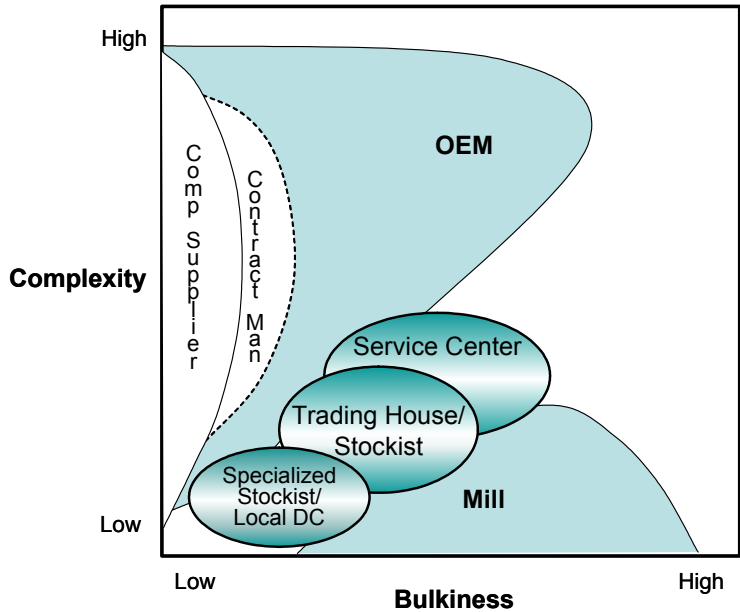


Figure 4-18 Product Bulkiness and Complexity: The Period of Domestic Production

Main differences between the Import period and the period of Domestic Production are in the roles of intermediary services. Earlier service concepts were based on stockholding and sourcing services. During the Domestic Production period, the total number of product choices increased at the stockists. Market coverage was dense as there were high number of stockists and a few local distributors on the market.

New entrants, the service centers were capable in decreasing product bulkiness to palette and letter sizes. Another group of new entrants, mini-mills, were established first in the US markets. They were more flexible in production regarding the speed of delivery and the product mix. On the other hand, integrated steel mills enlarged their business scope to prefabrication services. Value-added processing started growing the role of service centers and subcontractors. These services in the latter part of the 2nd period lowered product bulkiness further.

4.3. The Period of Open Markets

The 3rd period of Open Markets introduced new practices and opened export markets for local stockists and distributors. Many restrictions on competition were lifted off. Finland joined the European Union (EU) as a full member in January 1 of 1995. This changed practices in heavy logistics. Steel mills integrated vertically to the downstream and improved their service and prefabrication (processing) capabilities.

4.3.1. Intermediaries

Today the business environment is much different from the two previous periods. Intermediaries had maintained their strategic position in the supply chain. The intermediary has built its services on such strengths as flexibility in new situations, information of the customers, co-ordinator of information and logistic processes, as well as responsiveness to specific customer needs.

During the 3rd period, market channels are becoming more dominated by producers. Local producers seem to aim at vertical integration and acquire largest steel service centers. The largest Nordic steel producers are Rautaruukki, Outokumpu, Avesta Polarit, SSAB and specialized Norsk Hydro (aluminium), Imatra Steel and Sandvik. Nordic producers are dominant in the domestic and neighbouring markets. Nordic producers are hungry after growth in the exports to the neighbouring markets.

Rautaruukki is aiming for growth in the Nordic markets and enlarging their customer services in the downstream. Rautaruukki puts its vision as follows (Rautaruukki 2001):

“Tomorrow’s Rautaruukki is a leading company in its main market, the Nordic countries, and nearby emerging markets delivering value added steel products combined with comprehensive customer service and based mainly on its own cost-efficient steel production.”

Transformation of services and products is stated in the visions of both Rautaruukki and Outokumpu. In his statement, the president of Rautaruukki Mikko Kivimäki informs shareholders (Rautaruukki 2001, 2002):

“Over the past five years Rautaruukki has transformed itself from being a manufacturer of products to become a company that operates in the processing and service sector. The share of highly upgraded, prefabricated and service-intensive products has already grown to 50 percent of our turnover. We are increasing the proportion of the business that produces added value for Rautaruukki and customers”. “At the integrated flat products units, specialty products presently account for a quarter of deliveries, and this proportion will be raised over next few years to a third of total deliveries. Part of specialty products are marketed as brands: Laser, Optim, Litec, Silver and Hiarc.”

Both notions refer to value-added services and product differentiation. Rautaruukki’s production has generally a high degree of upgrading. This means also increasing of product complexity in future. Rautaruukki has established Steel Service Group where Asva is one essential operator. Steel Service Group had a turnover of €646 million in 2002 (702 million 2001) with 1,204 employees. Their operating profit was €23 million and return on assets 10.4%. Some 44% of turnover came from the sales of Group’s own steel products (Rautaruukki 2002).

Rautaruukki has today key markets in Europe and role of the domestic markets has declined. Nordic countries cover 55% of the turnover and only 5% are exported outside Europe. By year, 2000 Rautaruukki is selling 95% of products to Europe and focus is in the Nordic countries and countries around the Baltic Sea. It represents 65% of total sales. In 2002, Rautaruukki had its backbone on the neighbouring markets: Finland (27%), Scandinavia (28%) and other EU countries (32%). Outside Europe Rautaruukki delivered only 3% of its turnover of €2, 844 million (Rautaruukki 2000, 2002).

Outokumpu has similar visions with clear targets in the strategies. The basic elements of Outokumpu’s strategy are growth and transformation. Company is mirroring visions and core competencies in the Annual Report as follows (Outokumpu 2001):

“Our core competence is in production of metals, metals products and fabrication and in service of related customer applications. Our aim is to double the volumes and profits of our operations by 2004-2005 and transform from a capital-intensive into a knowledge driven company-to become the leading metals and technology group. Our strategy is based on customer orientation, a high level of technological expertise, efficient business processes and responsibility for our operating environment based on sustainable development.”

Outokumpu had targeted for growth by doubling its turnover. New strategic decision was to operate again in the production of stainless steels. Outokumpu acquired AvestaPolarit from Corus in March 2003 (www.avestapolarit.com 2003). This enlarged product choices beside copper and other metals. AvestaPolarit had a market share of 28% of the stainless steel coil market in Europe and 8% worldwide (Outokumpu 2002).

Today exports have a high role in production of copper products and stainless steels. Outokumpu represents 10% of the global production capacity. With an annual capacity of 450,000 tonnes, Outokumpu exports to North and South America (45% of net sales), Europe (40%) and Asia (14%). Outokumpu delivered to Finland only 3% of its copper products and 6 % of stainless steels (Outokumpu 2002).

Imatra Steel focuses on low alloy engineering steels and steel products to the automotive industries. These companies export most of their production and pay much attention to the customer service. Mission of Imatra Steel is linked with customer relationship and service in the following way (www.imatrasteel.com, 2002):

“Our aim at Imatra Steel is to be the best supplier in the supply chain through consistent profitability, top quality and first-class performance. We place heavy priority on developing our operating efficiency, customer partnerships and networking abilities in order to create added value and ensure continued customer satisfaction with our service.”

Exports have been dominant to a specialized mill. Most OEMs are abroad. Imatra Steel exported 86% and delivered 14% of its net sales to domestic customers in 2002 (Wärtsilä 2002). Main export markets in 2002 were Scandinavia (38%) and other EU countries (46%) (imatrasteel.com/group info 2003).

During the Open Market period, steel distribution has focused to fewer intermediaries and become more international. In the Finnish steel distribution, Asva and Starckjohann Steel have a dominant role as One-Stop-Shop service centers. The Finnish market leader *Asva Oy* employs 900 people and operates in all North European

countries including Baltics, Poland and Russia. Total revenues accounted for €420 million ([www.rautaruukki.com/ asva](http://www.rautaruukki.com/asva) 2003). Starckjohann Steel informed of total turnover of €201 and €7.1 million profit with 392 employees. The 3rd largest service center Kontino totalled turnover of €57 million with 162 employees (www.kontino.fi 2003). If ranked by their turnover the largest Nordic service centers in the Northern Europe were among 21 largest SSCs in the North America; Asva number 21 and Tibnor number 17 (Figure 4-19).

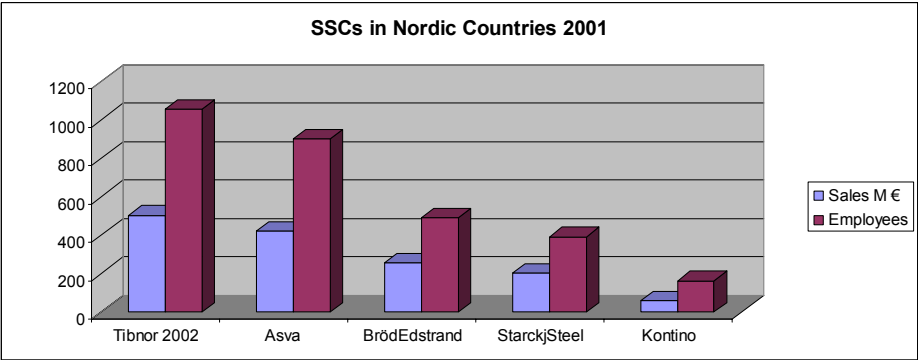


Figure 4-19 The Largest SSCs in Nordic Countries 2001

In Norway Tibnor (SSAB) and Asva (Rautaruukki) operate through daughter companies. Tibnor operates in twenty locations in Sweden and with subsidiaries in Finland, Denmark, Norway and Poland (Tibnor 2002). Asva operates in Finland, Estonia, Latvia, Lithuania, Poland and Russia (www.asva.fi 2003). Bröderna Edstrans and Starckjohann Steel operate in Sweden, Finland, Denmark, Estonia, Latvia and Lithuania (www.starckjohannsteel.fi 2003). Kontino has operation only in Finland with two service centers and five sales offices (www.kontino.fi 2003).

New alternative in ordering is e-Commerce. It supports conventional ordering channels. Asva and Tibnor have their own e-Commerce. Rautaruukki and SSAB have actively developed own e-commerce solutions. Rautaruukki has five e-Commerce services for customers: e Rautaruukki.com, Asvanet (service center), funSi (Fundia products), RanNet (Rannila products) and Build Forum (Information Technology and Know-how services). Customers were able to source directly from digital market place and have information on products and applications.

During the Open Market period, intermediaries have maintained their role apparently due to processing capabilities and specialization. The Finnish intermediaries delivered 670 kt of steels and metals in 2002. Deliveries had decreased from 700 kt of the peak years 2000-2001. Intermediaries represent 30% of all deliveries and their role has remained stable during 2000-2002 (STKL 2003).

In Finland Asva, Starckjohann Steel and Kontino operated as One-Stop-Shop service centers. Tube distributor Onninen intends to become a One-Stop-Shopper after acquisition of Algol Oy (steels) in April 2003 and Teräskonttori Oy (metals and special steels) in 1998 (www.onninen.fi/news 2003). During the 3rd period Finnish steel distribution entering to a similar business concept as was familiar in other Nordic and most European countries. Due to the consolidation, the number of operators in the Finnish steel distribution has decreased to a few ones shown in Table 4-4.

Table 4-4 The Current Finnish Operators in Steel Distribution

| Intermediaries/Stockist,SSC | Mills | Agents |
|--|--|--------|
| Asva Kontino Onninen (Algol) Starckjohann Steel Tibnor | Imatra Steel Outokumpu Rautaruukki | |

The Open Market period has integrated services and linked channel operators in close co-operation. Intermediaries are large SSCs or specialized operators. Some specialize on a particular business process or service. Such are contract manufacturers, component suppliers, logistic co-ordinators (3PL or 4PL), e-Commerce and specialized know how consultants (Figure 4-20).

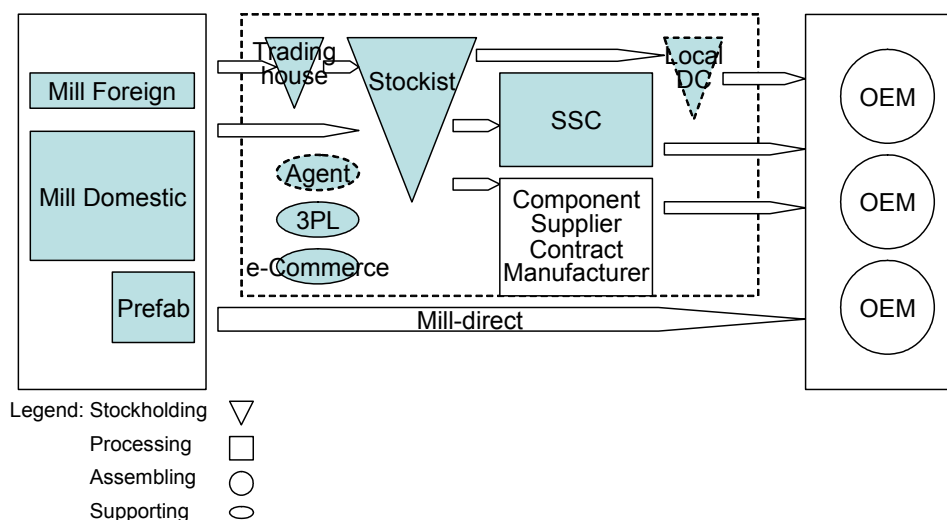


Figure 4-20 Channel Structures during the Open Market Period

Service centers have high capabilities in value-added processing services and bulk-break deliveries. Stockists have core capabilities on stockholding and break-bulk deliveries. Upstream has integrated vertically to downstream intermediaries and OEMs. This has made difficult to identify distinctly the core capabilities between logistic operators.

The 3rd period opened markets to international competition and exclusivity of distributorship was lost. New operators in the markets have added number of alternative services offered by specialized service centers, stockists, component suppliers, contract manufacturers, e-commerce, logistic co-ordinators etc. All these are with different type of business issues. Their core competencies have new service inputs depending on chosen service concept. Number of operators has decreased to 2-3 dominant service centers and specialists. New and differentiated service providers increase specialization between channel operators.

4.3.2. Distribution Services

Product choices during the period of Open Markets are limited (focused) in the upstream and broad in the downstream. Production technology is still a dominant attribute factor for certain products. Description among the Nordic producers confirms that the number of product applications might be high but number of product choices is

fairly rigid and low. Intermediaries are more flexible in operation being either specialized or offering broad product choices.

Nordic steel mills specialize in few product areas (for example steel plates) or diversify on many product choices (for example steel plates, tubes, other high value-added products). Swedish SSAB has focused on sheets, plates, and Sandvik on special alloys and stainless steels. Imatra Steel Works has focused on specific product applications: low-alloy engineering steel bars in rounds, flats and squares; forged engine and front axle components serving the truck and car industry and other advanced sectors of the mechanical engineering industry. Rautaruukki and Outokumpu are integrated steel mills with broad product choices. Product choices of Rautaruukki are broader than SSAB. Rautaruukki upgrades products after plate rolling and strip rolling. Higher value-added products are tubes, pipes, steel roofing, facade elements and other prefabricated components. Number of product choices of Rautaruukki is accordingly high. Rautaruukki has enlarged its service scope by acquisitions. It has integrated from standard base products to special applications and prefabrication of components and parts. Vertical integration has resulted in a complete supply channel from raw materials to value-added services and OEMs (Figure 4-21).

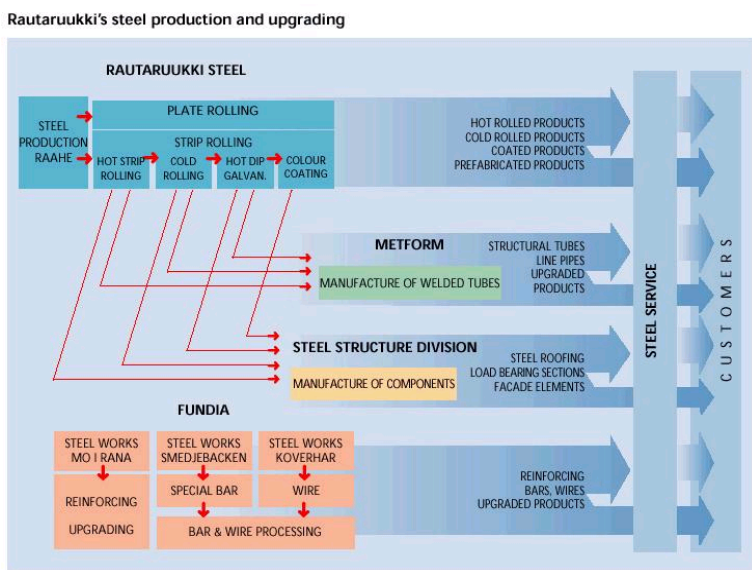


Figure 4-21 Product Choice Capabilities in Flat and Long Products (Rautaruukki 2002)

Rautaruukki's degree of value-added is one of the highest in the European steel industry. The Rautaruukki Group's units (Rautaruukki 1999) upgrade more than 60% of the hot-rolled flat steel. Rautaruukki has broad product choices among producers. Rautaruukki Steel informs that it has altogether 1,700 products of which 600 are according to customer specifications (Norberg 2000). Number of products has increased as in 1997 Raahe mill had 1,200 different products (Viitamo 1997).

A product choice includes accordingly high number of standard and customized products. Rautaruukki has expanded number of specialty products for different product applications, which are recognized as brands. New brand products are particularly Laser (for laser cutting), Optim (for engineering), Litec (for automotive industry safety components) and Hiarc (for building facades) (Rautaruukki 2002).

Car industry is one of the largest customer segments for steel and metal producers. In car manufacturing super alloys and high durability steels for car bodies are developed. Metal industries have developed special grades with more durable and light materials. Car industry is important for Rautaruukki and Imatra Steel Works too.

Outokumpu has broad product choices covering copper, stainless steel and zink. Number of copper products alone is high as most products are manufactured to customer requirements. Outokumpu has, however, quite a number of standard and branded products. Customization degree is high especially in mill-direct OEM deliveries, in which copper coil or sheet is customized into a part or component; electronic components, valve parts, communication technology appliances. Electronics industry is important to Outokumpu. Products have a high complexity and low bulkiness.

Imatra Steel has chosen a focused product choice according to customer segment and product application. Company serves truck, car and engineering industries in round and square profiles, flat products, forged engine and front axle components (www.imatrasteel.com 2003). Product choices are highly specialized.

In steel distribution, Rautaruukki and Outokumpu apply mill-direct deliveries and distributors. Rautaruukki-owned Asva Oy is the market leader in Finland with the highest capabilities in the Nordic countries. Asva has built product choices on the One-Stop-Shop service concept. Product choices over 15,000 products cover steel sheets,

coils, tubes, profiles, expanded metal mesh and gratings, stainless steel sheets and coils, form bars, tubes and tube components, aluminiums in different forms and copper products.

Asva has subsidiaries in Poland, Russia, Estonia, Latvia and Lithuania. Asva has e-commerce Asvanet available for communication and order processing. Turnover of €420 million and volume of 420,000 tons covers many international suppliers (www.rautaruukki.com 2002). Key suppliers for Asva are local producers Rautaruukki and Outokumpu. Asva in Finland, CCB Stål (Carl Christensen og Brødre) in Norway and Rautaruukki Stahlservice GmbH in Germany belong today to Rautaruukki's Steel Service Division. CCB Stål is Norway's second largest metal SSC. The focus is in Southern Norway and its northernmost depot is located near Trondheim. CCB has 5,000 products in its stock list with a turnover of € 113 in 2002. This will increase after the acquisition of Johan Vinje Stål (€ 13.6 m). "This enables us to offer customers a better and wider range of services," says CCB Stål's Managing Director John Børge Halvorsen in September 2003 (Rautaruukki.com 2003).

Starckjohann Steel Oy Ab is part BE Steel Group (Brøderna Edstrand). Starkjohann informs of 5,000 products in their stock list and BE of 15,000 products. Both service centers have processing capabilities on broad product choices. BE Steel Group is mill-independent operator in the Northern Europe and Baltics. Turnover of Stackjohann Steel is €201 million (Profit €7.1 million) and BE €253 million (Profit €6.8 million) in 2001 (www.starckjohann/keyfigures 2003).

Kontino operates only in Finland as a mill-independent SSC. Kontino with its product choices is comparable with Starckjohann Steel. Turnover of Kontino is €57 million (Loss €0.02 million) in 2001 (www.kontino/talous 2003).

Market analysis indicates that during the Open Market period the value-added processing capabilities have become more important for the intermediaries. Outsourcing has especially stimulated intermediary services to high complexity products and processes. Intermediaries' service capabilities (the product choices and delivery speed) have continued to progress during the Open Market period. The 3rd period has enlarged service capabilities in the product choices and delivery speed. Value-added processing and high product complexity has increased in steel

distribution. Upstream operators have increased capabilities by shorter delivery lead-times and broader product choices. Product choices have become broader at the mill level including prefabrication capabilities of components and parts (Figure 4-22).

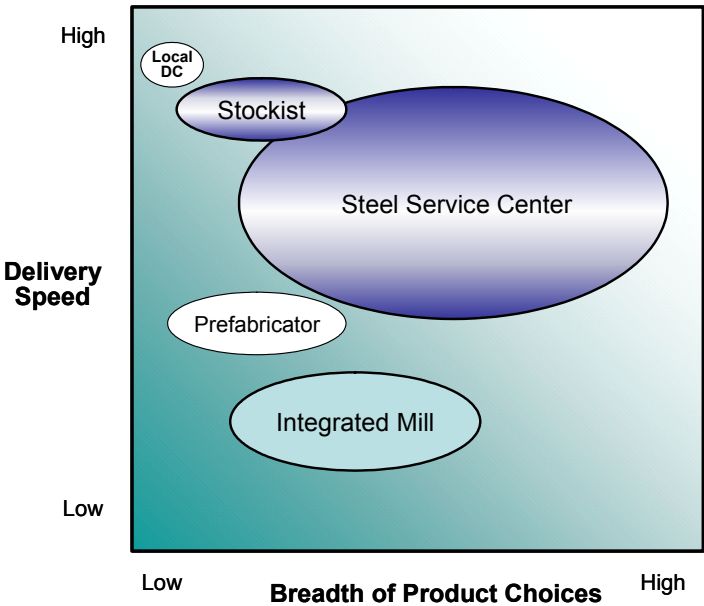


Figure 4-22 Service Capabilities: The Period of Open Markets

The roles of intermediaries (service center, stockist, component supplier, contract manufacturer, local distribution center) have polarized. Service centers have grown even larger with product choices and processing capabilities. Stockholding has specialized. Local DCs have capabilities on very limited choices of standard products. They are sourcing from larger stockists and importers.

4.3.3. Processing Services

The role of processing by intermediaries has increased in Finland as OEMs have outsourced processing to service centers. The key operators call themselves service centers offering broad product choices with processing capabilities and logistic management. Finnish steel stockists estimate that volume of processing is today roughly 50% indicating the trend of growing role of steel service centers in steel supply (STKL 2003).

It seems that the 3rd period will further grow the importance of intermediaries. Relocation of intermediary services has changed the roles of conventional stockists.

They have specialized either in limited product choices or in high delivery speed. Stockholding is a specialized logistic capability or an integrated service capability by service centers. It seems that ordinary stockists have lost ground in favour of the SSCs during the last two periods (Figure 4-23).

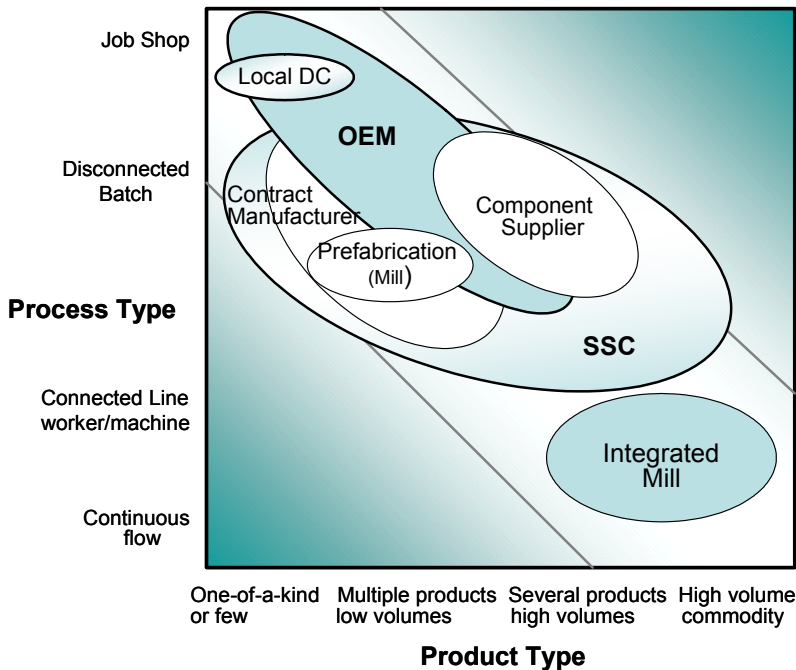


Figure 4-23 Processing Capabilities: The Period of Open Markets

4.3.4. Product Characteristics

The Open Market period strengthens the role of value-added operators. Product bulkiness is expected to decrease and complexity increase further. Service centers, component suppliers, and contract manufacturers seem to have a dominant role in processing of parts and components as OEM increasingly outsource intermediary services. OEMs are able to process high mechanic systems with a high value-added input. Operative business scope of stockists’ decreases as value-added processing increased. Producers in the upstream continue to integrate to prefabrication of parts and components.

During the 3rd period product bulkiness increases significantly. Products are becoming oversized and with high weight. On the other hand cutting products to standard sizes at the mill enables mill-direct deliveries to OEMs. In the outbound logistics, upstream

operators tend to combine orders on full truckloads (FTL) from mills to intermediarie or OEMs. The examples of POSCO, Rautaruukki and AvestaPolarit indicate that product bulkiness has increased drastically. POSCO is one of the world’s largest steel producers with 26 mt of the annual output. POSCO has developed a two-dimensional Bin packing system for outbound logistics. Dimensions are simply the weight and the length of the product. POSCO delivers approximately 80,000 tons steel each day. POSCO uses the following transportation modes and infrastructure: 2,000 truckloads, 5,000 tons on rail, and 30,000 tons on ship from 100 warehouses to 20 intermediary storages and to 500 destinations (Chang et al. 2002).

Production starts from a smelting furnace. One smelting input is bulky ranging between 100-400 tons and produces several master coils. Master coils are still in a bulky form with a weight from 10 to 30 tons each. Product bulkiness decreases steeply as coil is cut to plates. In container-sizes, products are in standard forms as base products.

Rautaruukki and Avesta Polarit (Outokumpu) both manufacture hot rolled and cold rolled coils. Initial raw material inputs in smelting are 125 tons at Rautaruukki and 150 tons at AvestaPolarit. Nowadays one smelting input produces approximately five master coils with a weight from 26 to 30 tons each. Product bulkiness in the upstream has accordingly become high (Figure 4-24).

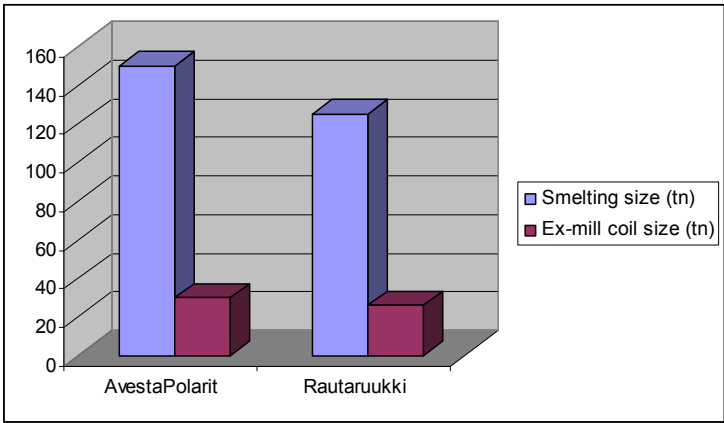


Figure 4-24 Product Bulkiness in Rautaruukki and AvestaPolarit 2002

The size of an average order in Rautaruukki is 11 tons in plates and 70 tons in coils and in shearing. Rautaruukki's Raahe Mill has a bottleneck in smelting at the converter (Rautaruukki 2000).

AvestaPolarit has increased converter input from 95 tons to 150 tons in 2002. Production throughput time has decreased to 40 days, which is still longer than in steel production in general. Rautaruukki reached two weeks in hot rolled coils in 1995. Coil size of AvestaPolarit of 30 tons is also bulky. Service centers and OEMs, their customers, are ordering 1-5 ton coils at a time (Metallinjalostajat 2002).

Benchmarking product bulkiness against new investment projects gives similar experiences. Galvex is opening a coil center in Estonia in 2003, which has a close logistic location with the Finnish SSCs and Rautaruukki. Steel terminal Galvex in Estonia Muuga port is specialized in galvanized steel coils. Coil weights are from 18 to 25 tons with outside diameter of 1,000-1,950 mm (Galvex Material Specification 2002). Galvex is a new sourcing alternative, however, not yet in operation in May 2003.

Steel mills have increased converter input and coil sizes for one smelting in order to benefit from economies of scale. Deliveries ex mill are stipulated with minimum order quantities. Product bulkiness is still too high for many OEMs. Mills aim at reaching lower bulkiness in plates and processed parts. There is, however, a gap between upstream and downstream operators concerning product bulkiness. Product bulkiness and complexity have grown during the Open Market period. In value-added processing, product complexity is more dominant than bulkiness. Complexity often requires high investments to manufacturing technology with high tolerancy requirements.

OEMs started with own manufacturing lines but using intermediary services with a growing rate. Service centers emerged to markets as OEMs began outsourcing. Particularly service centers increased their role in value-added processing services. Contract manufacturers and component suppliers enlarged choices in processing services. Mills provided limited prefabrication of parts and components. Logistic flow of a product from a coil to a high mechanic system illustrates how product bulkiness and complexity can be linked to the intermediary roles (Figure 4-25).

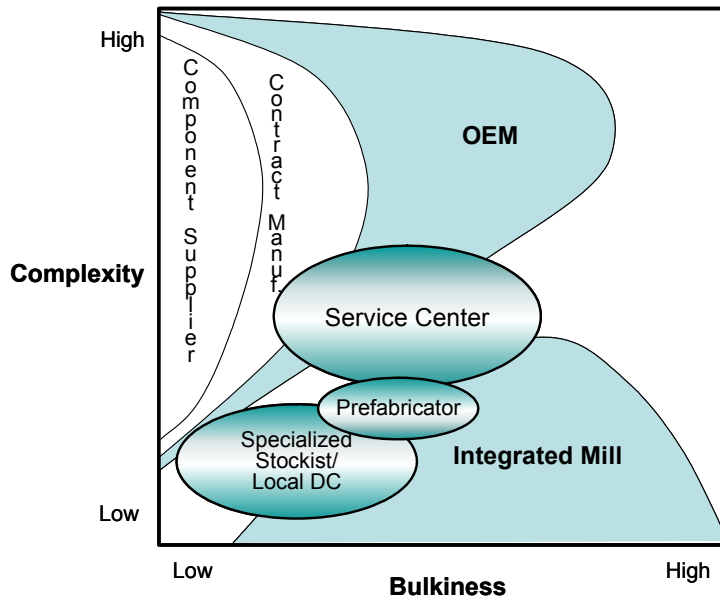


Figure 4-25 Product Bulkiness and Complexity: The Period of Open Markets

Such a part as a car body or a door is customized depending on the model of a car. Tolerances are high with specific requirements for product shape, size and quality. Coil size in the upstream is from 25 to 30 tons. Service centers are operating with 3-5 tons coils. Shearing of coil decreases the product bulkiness to 50-300 kg depending on the degree of customization. In customization, product bulkiness decreases substantially while complexity increases. Highly differentiated products such as electronic components with gold plating, precision parts and components are examples on products of high complexity and low bulkiness used in the assembly of modules or systems.

During the 3rd period, service centers will apparently increase their role as distributors of processed parts and components. They are responsive to the demands of product complexity and bulkiness. Coil centers process coils in stripes and small plates mainly in batches, flame cutting lines parts and components (project, job shop) for OEMs (Figure 4-26).

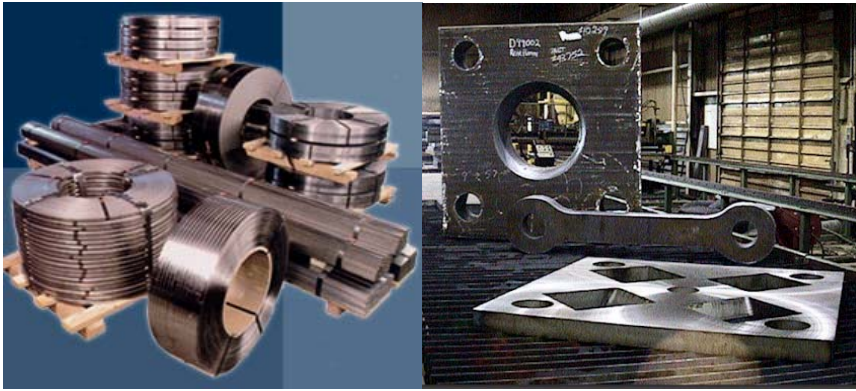


Figure 4-26 Components and Parts after Processing to Pallette- and Container-Sizes

Products of high complexity and low bulkiness have developed especially during the 3rd period. Such items are electronic components, small precision parts and one-of-a-kind applications mainly made of copper. These may be produced in long batches or as a few test items.

4.4. Summary of the Evolving Roles of Distributors

Here the transformation of the intermediary roles of steel distributors is summarized by period of evolution in Finland. During the Import period, there was no major domestic production wherefore imports had to be relied on in balancing demand and supply. Entrepreneurs, importers/stockists and trading houses, opened the distribution channels for standard products through their core capabilities on international trade and partner networks. Other operators were agents and joint marketing and purchasing organizations. Service by these operators consisted mainly of sourcing, stockholding, the choice of products was narrow, and deliveries to OEMs were fast for those products they had in stock. Production processes were not automated; mills produced in long batches, handling of products by stockists was manual and they were able to handle products with medium bulkiness. The intermediaries, trading houses and stockists, did not provide much of processing services apart from break-bulk operations and manual cutting, handling items of limited size and relatively low tolerance (Table 4-5).

Table 4-5 Summary of Evolving Logistics Roles of the Finnish Steel Distributors over Three Development Periods

| <u>Attribute</u> | <u>1st: Import Period</u> | <u>2nd: Domestic Production</u> | <u>3rd: Open Market Period</u> |
|---|----------------------------------|--|---------------------------------------|
| <i>Market Description</i> | Import dominant | Local production | International and local |
| <i>Channel Co-ordinator</i> | Trading house, stockist | Service center | Vertically integrated producer |
| <i>Product Bulkiness</i> | Container size | Palette, container size | Letter, palette, container, over-size |
| <i>Product Complexity</i> | Low | Medium | High |
| <i>Delivery Speed Capability</i> | Months | Days, weeks | Hours, minutes |
| <i>Product Choice Capability</i> | Limited standard choices | Diversified product choices | Diversified and customized |
| <i>Processing Capability</i> | No processing services | Additional processing services | Broad and specialized processing |

The period of Domestic Production saw an increase of the number of intermediaries. Stockists, local DCs, component suppliers and service centers sourced mainly from the domestic mills and only products not manufactured in Finland were sourced from the foreign suppliers. Due to the better availability of products (the breadth of product choices) and shorter transportation distances (delivery speed) combined with the increased number of intermediaries the service level to OEMs improved remarkably. Size of ordinary stockists increased due to consolidation and several family-owned operators disappeared as the result of exclusive distribution granted by domestic producers and even vertical integration. The co-ordination of the distribution channel, achieved earlier almost solely under the control of the stockists, became a responsibility split among specialized stockists, SSCs as well as global and international producers. The OEMs started sourcing of components and modules from external suppliers, and the first SSCs invested in processing capacity. Automation allowed processing of higher precision and handling of larger units. The pursuit of economies of scale forced manufacturing to expand to export markets and to build distribution networks, sometimes through forward alliances or integration.

The Period of Open Markets provided additional opportunities for export operations as well as vertical integration for the steel mills, and the competition from imports was still limited mainly to the complementary products. Due to the dominance of the mills, the number of intermediaries in Finland and in other Nordic countries decreased to a few dominant SSCs and stockists specializing regionally or by product lines. Many

intermediaries have found growth in the markets of Baltic Sea Region. There have been signs of supply channels diversifying while new participants have entered to steel distribution, such as Third-party logistics operators, channel integrators (4PL), e-Commerce operators and others with services focusing on customer relationships and financing. The impact of the new entrants on the market structure has been so far rather limited.

The competitiveness of the mills and integrated chains of SSCs is reflected in the faster service provided, and wider selection of products. Typical to this period of Open Markets, OEMs increasingly outsource logistics and manufacturing services, creating need for new component suppliers and contract manufacturers that partially compete with the SSCs. This evident especially in terms of the level of automation in the production processes and storage technologies enabling the participation in supply chains requiring extreme tolerances even in oversized modules such as boiler tanks or turbines.

4.5. Comparison to the General Trends and International Development

It seems obvious that the trends derived from the theoretical analysis of the underlying models hold in all markets studied, but the evolution is faster and the separation of roles more complete in large competitive markets. This means that the trends – establishment of fast and diversified distributors (adding selection of products through versatile automated processing), and separating roles of different operators in terms of the service capabilities – will take shape faster in the biggest domestic markets, i.e. the US that also has opened up for international competition at a relatively early stage. To round up the reviews, the changes occurred in Finland are compared with the general trends of service capabilities and current distribution practices in Western steel industries.

Mini-mills, a tradition in the Japanese steel distribution, was adopted next by the US steel industry. To the European steel markets, mini-mills have not entered yet – perhaps due to the small market size but more likely because of the protectionistic policies of the European countries. Finland the network of SSCs has developed later than in the US, yet on par with other West-European countries. In the US market SSCs

have taken over half of the distribution, volume and succeeded in remaining competitive while pursuing the multi-location and high selection strategy. The 100 largest SSCs have a combined market share of only 50% in the US. In Europe, stockists and importers still have a large share in steel distribution supported by the direct deliveries from mills. It may well be that the intermediary roles will transform eventually only after the multinational producers have emerged.

In Finland, SSCs were established some 15 years later than in the U.S. and the share of sales of processed products is lagging even that of Sweden and UK. Regulation and concentration during the early days are obvious reasons for this, and true international operations have started only with the period of Open Markets. Similarly, the outsourcing of operations to SSCs, component suppliers and recently to contract manufacturers has taken place later, by some 10 years, in Finland than in the major European markets. Finland has been a relative laggard in Europe, also compared to Sweden, owing mainly to the lack of mass producers of cars, home appliances and the like as well as on the natural isolation of the market favoring domestic operators.

4.6. Analysis of Distribution of Paper and Sawn Goods

Finland has traditionally produced paper products from domestic (or imported) raw materials. Both industries have raw materials locally and abundantly for production. Evaluation of these industries is descriptive of services, products, processes and channel operators.

4.6.1. Paper Industry

The forest industry had worldwide sales of approximately \$450 billion in 2001, of which paper and board account for 58%, the sawn wood for 38%, and pulp for the remaining 4% (Finnish Forest Industries 2002). The four largest companies (International Paper, Georgia Pacific, Weyerhaeuser-Willamette and Kimberly Clark) accounted for over one fifth of the total sales, and Stora Enso was the 5th in the world (and the largest in Europe) with sales of \$11.9 billion. International Paper had the highest production capacity (15,1 mt/year), Stora Enso the 2nd largest (15,0 mt/year) and UPM-Kymmene the 3rd (11,6 mt/year) (Finnish Forest Industries Federation 2002). In Europe, Stora Enso is the largest, UPM-Kymmene the 2nd and Metsäliitto the 4th largest.

Products in paper and steel industries have some similarities in view of service, production processes and product characteristics. A paper roll is similar to a steel coil, heavy and large. At the mill-end papers are produced in jumbo rolls which then are cut to smaller rolls and processed further to small parts or components such as a book, an envelope, a paper bag, a sticker or a box. Paper products are standard commodities or differentiated products according to customer requirements. Total number of paper products is high and increasing as new products, paper grades and special applications are developed. The most common types of paper are newsprint, magazine paper and cardboard product. Three Finnish producers - Stora Enso, UPM-Kymmene and M-Real - have broad product ranges. The size of a product is designed according to the dimensions of the OEM's printing technologies. UPM-Kymmene delivers almost all paper in rolls (2000 different product types) which are already customized at the mill-end against customer orders. UPM-Kymmene has practically no stocks at the mill. Any need for safety stock is postponed close to a customer (Sarvikas 2003).

Paper machines are designed with a width of 15-10 meters, even 20 meters. Jumbo roll is cut into smaller rolls (5-6 tons) or sheets of paper depending on customer requirements. In other words, the product bulkiness transforms from an over sized jumbo roll to a number of container/pallette size reels or letter-size paper sheets. Cutting of a paper rolls at the mill-end is a similar type of value-added processing service as steel mills or steel service centers provide.

Finnish paper industry started distribution by joining their common efforts under one marketing organization (Finnpap) in 1918 to take care of the sales both in the domestic markets and in the exports. The members had 23 mills and 63 paper machines with total capacity of 190,000 tons (Heikkinen 1999, 33). The same kind of centralized associations (Finncell and Finnboard) were established for pulp and cardboard as the non-profit marketing organizations. Manufacturers used also Finnish intermediaries in distant countries, where Finnpap was not present. Finnpap had a dominant role as the key intermediary in paper distribution. Finnpap was even able to control and co-ordinate production capacities between the member mills. The operation of Finnpap ended in 1996 due to the Finnish membership in the European Union.

4.6.2. Sawn Goods Industry

The Finnish saw mill industry is today the 3rd largest in the EU, representing 18% of total West European production. Germany and Sweden are the largest European producers. Sawn goods industries are focused on a few saw mills as the four largest countries represent 60% of the total production in the EU.

The saw mill industry is more fragmented than the steel industry in Finland. Majority of saw mills are small with limited product choices and processing capabilities. According to Finnish Forest Industry Map Finnish saw mill industry consists of 212 saw mills, planning plants and impregnation plants. Number of entrepreneurs is high. Finnish saw mill industry has a few dominant operators. The largest saw mills typically belong to some international group that operates also in pulp and paper production for example Stora Enso, Finnforest (Metsäliitto) and UPM-Kymmene.

Product characteristics in sawn goods are similar to steel products: flat (plywood, floor) and long products (planed timber, panel, profiled product). Primary measure in product bulkiness is length (m) and area (m²). Product bulkiness depends on length and thickness of a forest tree. In a sawmill timber is cut to a container-size or palette-sized products.

Service concepts focus dominantly on processing of standard products, such as planed goods and related services, such as shot blasting, joints of two products, component manufacturing for the building industries and others. Saw mill is a mechanical processing center. Products of a saw mill may range from ordinary sawn softwood to processed parts, components and special products. Wood products are sawn goods, panels and components and products made of plywood. Innovative products are further developed for various customer segments: strength-graded goods, planed goods, fiber boards produced as by-products, gluelam beams, Oriented Strand Boards (OSB) which is chip board made of large chips, particle boards in which wood chips and small quantities of sawdust are the raw materials. Mechanical wood processing develops new materials for building and furniture industries. Further processed and engineered wood products are highly differentiated products. In plywood industry, the products have a high value-added input. The total number of products in saw mill industry is increasing as sawmills develop customized and branded products.

Sawn goods industries have no centralized distribution channels. Saw mills prefer to design logistics individually both for home markets and for exports. Distribution is diversified with independent or mill-owned vertically integrated channels. Every company had to establish their own distribution channel either alone or with a competitor. In the mid 1970's domestic distribution had two basic channels: Mill-direct deliveries from the saw mills or specialized channels. The share of specialized channels accounted for 81% of the total distribution of sawn goods in 1975. The number of specialized distributors was 80. Most of them had started as entrepreneurs in the 1920's, 1930's and 1950's.

In 1972, the Finnish saw mill industry accounted for 8,600 saw mills. Most of them were small and local family entrepreneurs with the output below 5,000 m³. In the domestic markets their role was, however, very important with a market share of 35%. By the year 2000, Finland had many international saw mills in saw goods (Metsäliitto, Stora Enso, UPM-Kymmene). Small and middle sized sawmills use marketing channels of large sawmills or other independent channels. Timber and sawn goods industries have also flexible channel alternatives. Saw mill industry favoured private entrepreneurs, which had own facilities for stockholding and marketing network. In the exports, the traditional distribution channel included many types of operators: Agents, importers, national or regional wholesalers, small local wholesalers, specialized timber distributors and big customers. These operators were in most cases independent companies irrespective of the producers (Itkonen 1979, 169).

4.6.3. The Analysis of the Logistic Operations in Paper and Sawn Goods

Based on the short description above, the allocation of logistic services and processing capacities in paper and sawn goods industries can be translated into the language of the Service model, the Product-Process model and the Product Complexity model analogously to the steel distribution to find any similarities or differences among the industries characterized by heavy logistics. It should be noted that neither the individual roles of intermediaries nor the trends of capabilities are studied in this case.

In terms of the distribution services, paper and sawn goods industries have reached the delivery speeds comparable to those of steel industry (Figure 4-27). Mills are able to produce with lead times of the order of weeks, even days, and local or regional DCs

deliver stock items to customers in days or hours. However, the selection of products is somewhat more limited especially in paper because of the limited forms of profiles and assemblies, but to some extent also in sawn goods industry.

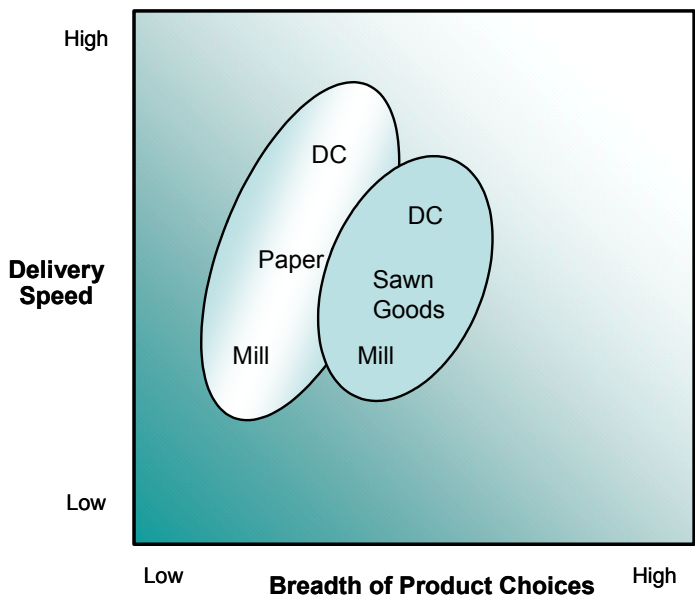


Figure 4-27 Service Level Within Paper and Sawn Goods Industries

For manufacturing capabilities, the Product-Process model (Figure 4-28) locates the sawn goods industry in the middle of the diagonal of the matrix, indicating the need for mechanized processing, on one hand, and the limited applicability of fully automated flow, on the other. Paper mills provide examples of automated flow, often including the sheeting operations. Distribution centers tend to be operated based on manually operated material flow.

The product-process matching of sawn goods industry in the matrix is much like that of a SSC's in steel distribution. Paper mill and steel mill take on nearly identical product-process locations. Closer to customers a paper roll is processed in batches into smaller rolls or sheets, and often stored in a DC. Again, such processes correspond, largely, those of the SSCs.

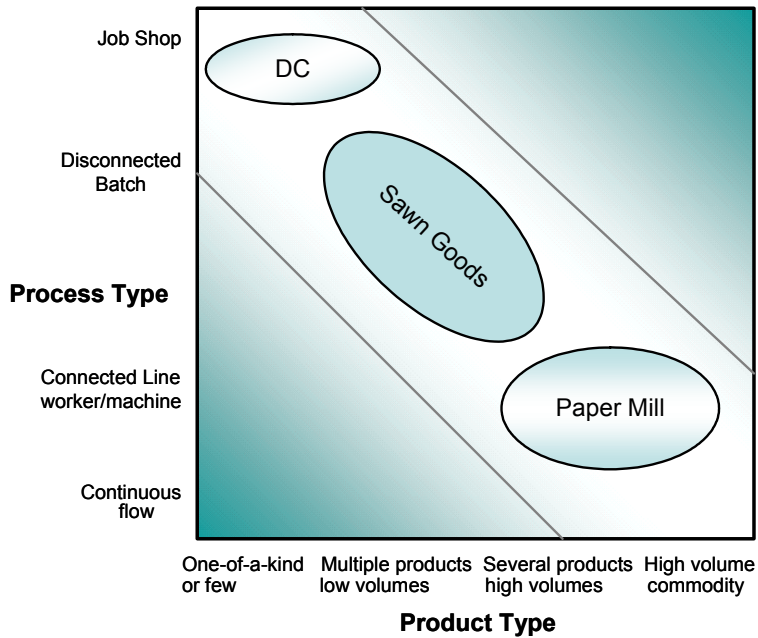


Figure 4-28 Product-Process Analysis of Paper and Sawn Goods Industries

Product characteristics in paper industry are polarized to those of a paper roll (bulky and non-complex) and a sheeted paper for printed products (less bulky but complex, perhaps with tighter tolerances; see Figure 4-29). Sawn goods take differing sizes and degrees of complexity, however, excluding small and extremely complex products comparable to high precision metal products. The complexity of sawn goods may reach rather high level when considering wide glued beams or assembled structures, hence requiring high bulkiness as well.

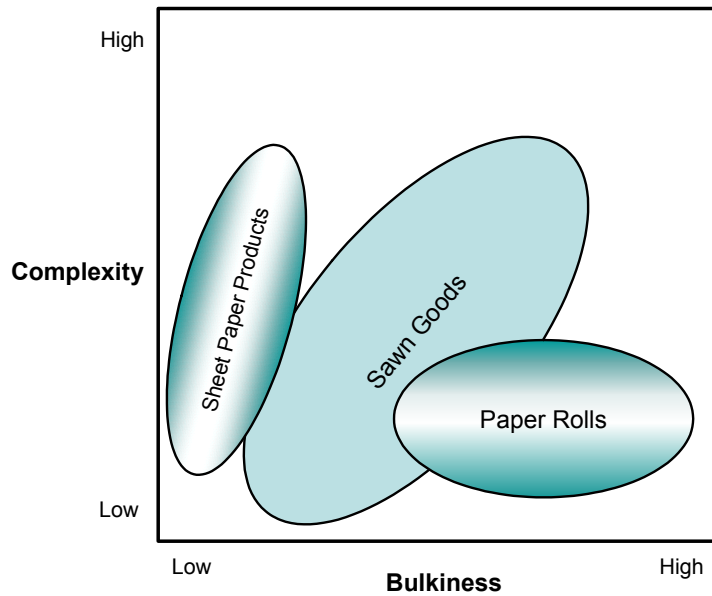


Figure 4-29 Product Characteristics in Paper and Sawn Goods Industries

The above analyses confirm that steel and paper industries seem to have many analogies in distribution due to similar capital-intensity and large scale of production of base products (such as coils and rolls) and rather radical reduction of bulkiness at some stage of downstream chain. In paper industry, however, the subsequent assembly to physically larger dimensions is seldom needed.

It may be concluded based on the rather superficial analysis above that the three models of distribution have potential in analyzing various industries of heavy logistics. Interesting findings concerning the differences between the paper and sawn goods industries and vis-à-vis steel industry could be identified. Analogies and generalization of the structural trends seem apparent. It remains as a future challenge to repeat the analysis of the role determination in other industries.

5. Conclusions

This chapter summarizes the contribution of the thesis and provides some managerial and theoretical implications. Directions for the future research are discussed as well.

5.1. Summary and Implications

The overall objective of this research was to describe the characteristics of steel distribution, to identify the various operators and their roles in terms of service, processing and products they handle. Further, generic trends were to be proposed in steel distribution supported by the findings of the historical review on international and domestic markets.

The contribution of this thesis is rather a composite of many issues than one major finding. The systematic application of the two existing models of Distribution Services and Production Capabilities worked rather well for the industry-level analysis. Because of the domain of the models, however, there were limitations in proper estimation of the services and production capabilities in channels dealing with assembled goods and pure stocking operations, respectively. Therefore, a new model of Product Characteristics was added to the analysis framework that brought the dimensions of product bulkiness and complexity, the special characteristics of heavy logistics, into the discussion. This model, tested by analyses in international and domestic markets, was found successful in separating the roles of most operators in steel industry. Moreover, the model seems promising for applications in other industries.

Three general trends were proposed from literature for finding the direction of evolution of steel distribution. These trends point towards higher levels of service, investment in automated processing, and more complicated designs of products. The support for these trends was sought and found from a historical review of the Western steel markets. This review was summarized as the findings concerning two stages of the evolution, early development by 1960'ies, and a later stage by 1990'ies. The findings indicate that transformation from ordinary stockholding to value-added processing and specialization has taken place in steel distribution. The differentiation of the logistics roles has created a competitive market of regional, multi-location SSCs

with a full-line availability and versatile processing service and stockists each specialized on a narrow range of product lines.

The evolution of steel distribution in Finland over several historical periods was examined next. Three periods, determined by external market conditions, were identified as the Import period, the Domestic Production period and the Open Markets period. Moreover, the development of the Finnish steel distribution was compared to to the general trends in the international markets. The findings confirm that the evolution of the roles of steel distributors follows the international trends, however, with a considerable time lag. In addition, the SSCs that had emerged as the key operator in the US steel distribution has had a lesser role in Finland and in Europe. Moreover, the reasons for not having mini-mills in the Finnish and in European steel markets were identified. The key roles for coordination have changed from entrepreneurial importer or trading house to producers closely associated with the steel mills, balanced by consolidation of stockists and steel service centers. Eventually vertical integration and international trade have dominated the operations as elsewhere in Scandinavia. A preliminary application of the framework was carried out in two other industries of heavy logistics, those of paper and sawn goods. The analyses resulted in intuitive identification and separation of the roles of operators also in these cases.

The applicability of the framework for the analysis of logistic operations and corporate roles in distribution was proven satisfactory. The fact that the roles of intermediary companies were diffuse in the matrices in the early stages of industry seems to reflect the type of integrative strategy fashionable at that time rather than too low a resolution of the matrices. One implication is that the structural properties of the companies, manifested in the development of different logistic capabilities and differentiation of the roles of the operators, may be a prime factor determining the direction of evolution of the industry. This is in contrast with the emphasis on the operational methods of cooperation and performance measurement now fashionable in research.

The recent development in steel industry does indicate that suppliers and service centers are differentiating and expanding their logistic roles further, thereby narrowing down the domain of mills and OEMs within the distribution channel. This is another

implication of division of service observed earlier in the context of information intensive processes of customer service (Tinnilä 1997). The question may be raised whether the synthesis of the history of heavy logistics indicates any progress that will be realized later on in the businesses of light logistics. There is a preceding analogy in the evolution of digital services first introduced in the financial sector now emerging into the industrial service processes. Hence, the evolution of the roles of operators in steel distribution may well illustrate the basic principles of networking for modern supply chain management.

The managerial implications stress the importance of the logistic roles for strategic management. It is the consistency between the services provided, production processes available and the types of products to be offered that can and should be checked before any investment in new technology acquisition or new market launch. These analyses should be routine part of reviewing the competition and configuring global supply networks.

5.2. Direction for Further Research

The transformation of intermediaries will be a major concern for years to come. In order to fully understand the evolution of logistic capabilities the descriptive case analyses, conceptual models and illustrative trends above should be restated in terms of testable hypotheses concerning the evolution of the roles of distributors in given industries. The quantitative scales of the matrices facilitate, in principle at least, the measurement for statistical testing of the capabilities and roles if the obvious aggregation problems can be dealt with.

Some other natural extensions of this exploratory research would be generalizations into other industries and into international and global markets. The analysis in heavy logistics could be extended quite easily into other bulky products, such as paper distribution and sawn goods, as suggested above, and with some ingenuity into entirely different distribution services in more fluid types of logistics processes. Perhaps the trends of evolution illustrated in the three matrices could be synthesized into general principles of the role evolution even within modern supply chains.

This research has discussed mainly the roles of the mills, stockists, SSCs and OEMs leaving the roles of the newcomers, such as contract manufacturers, component suppliers and mini-mills, for further studies. The research also concentrated in explaining the roles of operators in physical channels of distribution. Marketing, ordering or financing channels were only discussed marginally. Such alternatives as e-commerce or Third-party logistics (3PL) or Fourth-party logistics (4PL) are some examples of new alternatives. The questions of ownership of channel operators or the impact of market dominance or monopolistic competition have not been addressed directly. There has been a trend towards fewer independent channel alternatives. Market leaders are growing more global and tend to integrate both horizontally and vertically along the supply channel. It would be of interest to examine the logistic roles of the operational units in integrated channels with comparisons to networking solutions.

Finally, such issues as green values or reverse logistics are sure will have an important role in logistics and sourcing of raw materials in future. Steel industry is facing problems of air and water pollution. Recycled materials will increasingly become the raw materials of new products. Paper industry, among many others, is facing similar challenges justifying the efforts to explore the evolving services and the future charter of different intermediaries within the distribution channels.

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Appendices

Appendix 1: Top 100 SSCs in North America 2002 (Purchasing 1, May 2003).

| Service Center | Sales \$ M | Stocks | Space | Thft | Fleet | ProdC | ProcC | Mrkt | Exprt |
|-------------------------|------------|--------|-------|-------|-------|-------|-------|------|-------|
| Ryerson Tull | 2 240 | 57 | | 10000 | 500 | 11 | 13 | 12 | yes |
| Thyssen North Ame | 2300 | 75 | | 3500 | 170 | 8 | 8 | 11 | yes |
| Integris Metals | 1700 | 88 | | 6000 | 255 | 6 | 7 | 13 | yes |
| Reliance Steel&Alu | 1660 | 88 | | 7300 | 535 | 7 | 7 | 7 | |
| Metals USA | 1600 | 55 | | 2100 | 240 | 5 | 14 | 7 | |
| Carpenter Technology | 1169 | 9 na | | | 80 | 6 | 5 | 9 | yes |
| Worthington Industries | 1150 | 10 | | 3800 | na | 1 | 5 | 3 | |
| Earle M Jorgenson | 1050 | 34 na | | | na | 7 | 11 | 11 | yes |
| Samuel, Son & Co | 1020 | 34 | | 2500 | 192 | 5 | 7 | 12 | yes |
| 10.MacSteel Service Cen | 1000 | 22 na | | | 185 | 4 | 12 | 7 | yes |
| Russel Metals | 905 | 57 | | 2100 | 225 | 8 | 9 | 9 | yes |
| Namasco Corp. | 827 | 25 | | 2600 | 175 | 3 | 8 | 9 | yes |
| Preussag North Ame | 750 | 28 | | 2500 | na | 1 | 7 | 7 | yes |
| O'Neal Steel | 742 | 38 | | 5400 | 300 | 5 | 10 | 5 | |
| McJunkin Corp. | 731 | 115 na | | | na | 5 | 7 | 9 | yes |
| Central Steel & Wire | 630 | 6 | | 2000 | 100 | 6 | 13 | 3 | |
| Marmon/Keystone | 571 | 35 | | 2800 | 154 | 3 | 4 | 15 | yes |
| A.M. Castle & Co | 571 | 19 | | 2500 | 80 | 8 na | | 14 | yes |
| TW Metals Inc. | 500 | 29 | | 3600 | 200 | 8 | 8 | 10 | yes |
| 20.Leroux Steel Inc. | 497 | 27 | | 2730 | 135 | 1 | 5 | 7 | yes |
| Novamerican Steel Dor | 417 | 23 | | 1430 | na | 4 | 7 | 5 | yes |
| Olympic Steel Inc. | 416 | 13 | | 1700 | na | 2 | 9 | 5 | |
| Heidtman Steel Prod | 416 | 11 | | 1500 | na | 1 | 6 | 3 | |
| Alro Steel Corp. | 400 | 40 | | 3000 | 140 | 9 | 5 | 3 | |
| Kenwal Steel Corp. | 380 | 7 na | | | na | 1 | 3 | 2 | |
| Southwestern Ohio St | 350 | 7 | | 600 | 15 | 2 | 5 | 2 | |
| Transtar Metals Inc. | 278 | 24 | | 800 | 43 | 6 | 4 | 8 | yes |
| Majestic Steel Service | 265 | 1 | | 500 | na | 2 | 5 | 1 | |
| Steel Warehouse Co. | 210 | 5 | | 800 | 55 | 1 | 7 | 2 | |
| 30. Edgen Corp. | 203 | 16 | | 190 | 25 | 4 | 5 | 6 | |
| Primary Steel | 200 | 6 | | 875 | 35 | 1 | 8 | 5 | |
| Maksteel Inc. | 189 | 1 | | 200 | 300 | 1 | 3 | 1 | |
| Pacesetter Steel Ser | 182 | 4 | | 550 | 90 | 1 | 5 | 4 | |
| Eaton Steel Corp. | 175 | 8 | | 550 | 25 | 1 | 5 | 5 | |
| Baldwin Steel Co. | 170 | 6 | | 600 | 16 | 1 | 4 | 4 | |
| Chicago Tube and Iron | 170 | 11 | | 1200 | 40 | 4 | 5 | 3 | |
| Kerry Steel Inc. | 175 | 4 | | 279 | na | 1 | 3 | 3 | |
| Mill Steel Inc. | 145 | 4 | | 300 | 15 | 1 | 4 | 3 | |
| Yarde Metals Bristol | 158 | 6 | | 650 | 42 | 5 | 7 | 3 | |
| 40. Tubular Steel Inc. | 130 | 8 | | 700 | 8 | 2 | 2 | 5 | |
| Brown-Strauss Steel A | 125 | 6 | | 100 | 14 | 1 | 1 | 3 | |
| Friedman Industries | 120 | 3 | | 161 | na | 1 | 2 | 2 | |
| Norfolk Iron & Metal | 119 | 3 | | 495 | 70 | 1 | 6 | 2 | |
| Eastern Metal Supply | 116 | 4 | | 345 | 42 | 1 | 2 | 3 | |
| Crest Steel Corp. | 109 | 4 | | 200 | na | 2 | 4 | 3 | |
| Kasle Steel Corp. | 104 | 4 | | 600 | na | 1 | 3 | 2 | |
| Trident Steel Corp. | 101 | 9 na | | | na | 1 | 7 | 4 | |
| Lapham-Hickey Steel | 100 | 6 na | | | | 3 | 8 | 3 | |
| McNeilus Steel Inc. | 100 | 3 | | 50 | na | 3 | 6 | 2 | |
| 50. McNichols Co. | 96 | 16 | | 320 | na | 6 | 3 | 8 | |

| | | | | | | | |
|------------------------------|-------|-------|-------|------|------|-----|-------|
| Century Steel LLC | 90 | 1 | 100 | 10 | 1 | 2 | 1 |
| Action Steel Supply | 83 | 7 | 550 | 42 | 3 | 4 | 2 |
| Ulbrich Stainless&Spe | 82 | 12 na | na | | 5 | 7 | 8 yes |
| Magic Steel Sales | 81 | 5 | 160 | 22 | 1 | 1 | 1 |
| Aerospace Tube&Pipe | 80 | 1 | 101 | 29 | 6 | 1 | 1 |
| Chapel Steel | 78 | 5 | 350 | na | 1 | 1 | 5 |
| Petersen Aluminum | 76 | 4 | 300 | 6 | 5 | 10 | 4 |
| Saginaw Pipe Inc. | 75 | 4 | 300 | 7 | 1 | 3 | 4 |
| 60. Admiral Metals | 72 | 4 | 150 | 25 | 10 | 3 | 1 |
| Miami Valey Steel Ser | 71 | 6 | 170 | 7 | 1 | 5 | 1 |
| Cambridge-Lee Industr | 70 | 12 | 400 | 10 | 7 | 6 | 9 |
| Corus Metals Delta | 67 | 8 na | na | | 5 | 4 | 3 |
| Kelco Metals Inc. | 65 | 1 | 110 | na | 1 | 1 | 1 |
| Titanium Industries Inc. | 65 | 12 na | na | | 2 | 7 | 7 yes |
| Ugine Stainless&Alloys | 64 | 8 | 300 | 7 | 3 | 2 | 5 |
| Atlasa steel Products | 60 | 5 | 120 | na | 3 | 7 | 2 |
| Gerrard Steel&Tube | 60 | 3 na | na | | 1 | 1 | 1 |
| MST Steel Corp. | 60 | 8 | 170 | 5 | 1 | 6 | 2 |
| 70. Pierce Aluminum Co. | 60 | 3 | 180 | 15 | 1 | 8 | 3 |
| Block Steel Corp. | 58 | 6 | 165 | 4 | 1 | 5 | 3 |
| Triumph Group | 56 | 2 | 300 | na | 1 | 7 | 2 |
| Alliance Metals Inc. | 52 | 5 | 200 | 10 | 2 | 9 | 4 |
| DuBose Steel Inc | 49 | 1 | 360 | 32 | 1 | 3 | 1 |
| Metal Services Internat | 47 | 9 na | na | | 4 | 6 | 3 |
| Certified Steel Co. | 45 | 1 | 250 | 30 | 2 | 4 | 1 |
| Westfield Steel Inc. | 44 | 2 | 155 | 12 | 1 | 4 | 1 |
| Winston Steel Inc. | 75 | 2 | 156 | 12 | 1 | 3 | 1 |
| Charter Steel Trading | 43 | 12 | 165 | na | 1 | 1 | 1 |
| 80. O'Brien Steel Service | 43 | 1 | 170 | 25 | 1 | 4 | 1 |
| State Pipe & Supply | 42 | 4 | 20 | 12 | 1 | 4 | 1 |
| Berlin Metals | 40 | 7 | 120 | na | 2 | 2 | 4 |
| Lancaster Steel Service | 40 | 1 | 250 | na | 1 | 5 | 1 |
| Central Plains Steel | 39 | 2 na | na | | 1 na | | 1 |
| Lee steel Corp. | 39 | 2 | 8 | 147 | 1 | 2 | 1 |
| Mid-West Materials | 39 | 12 | 240 | | 1 | 3 | 4 |
| Basic Metals Inc. | 38 | 1 | 80 | na | 2 | 3 | 1 |
| Denman & Davis | 37 | 3 | 180 | 14 | 3 | 5 | 2 |
| Precision Steel Wareh | 37 | 2 | 200 | 4 | 3 | 6 | 2 |
| 90. Turrett Steel Industries | 37 | 3 | 270 | na | 1 | 3 | 3 |
| Almetals Co. | 36 | 2 | 60 | 4 | 5 | 2 | 2 |
| Sabel Steel Service | 35 | 5 | 280 | 34 | 3 | 3 | 1 |
| Stripco Inc. | 35 | 1 | 170 | 12 | 1 | 4 | 1 |
| Hadco Aluminum&Met | 33 | 3 | 135 | 12 | 1 | 4 | 3 |
| High Steel Service Cen | 31 | 1 | 145 | 14 | 1 | 6 | 1 |
| Clad-Tex Metals Inc. | 30 | 1 | 150 | 6 | 1 | 6 | 4 |
| Erickson Metals Corp. | 28 | 3 | 170 | 10 | 1 | 6 | 3 |
| US Brass & Copper | 28 | 2 | 85 | na | 4 | 6 | 1 |
| Farmer's Coppers&Ind | 27 | 3 | 246 | 9 | 4 | 5 | 1 |
| 100.Action Stainless&Alloys | 26 | 6 | 130 | 11 | 1 | 2 | 2 |
| | 5 274 | 1332 | 89096 | 5100 | 290 | 511 | 404 |

Appendix 2: Glossary

| | |
|--|--|
| Agent | Intermediary and facilitator in negotiations between a supplier and a customer. |
| Base product | Product is produced and packed in the upstream in mill packages and in standard form and dimension for despatch. |
| Break-bulk | The separation of a single consolidated bulk load into smaller individual shipments for delivery to the ultimate consignees (Supply Chain Visions 2002). |
| Carrier | Intermediary in the transportation of the goods. |
| Cold rolling | Passing unheated, previously hot-rolled steel through a set of rolls to reduce thicknesses and produce strip in coil form. |
| Component | Material that will contribute to a finished product but is not finished product itself (Supply Chain Visions 2002). |
| Component supplier | Manufacturer of specialized components for OEMs and for open markets. They often carry own stocks. |
| Consultant | Intermediary service provider with particular know-how capabilities. |
| Contract manufacturer | Manufacturer of parts, component or sub-assemblies of modules. They seldom carry own stocks. |
| Decoiling | The process of unwinding of strip products, supplied in coil form, preparatory to cutting to length, forming sheets. |
| Distributor | Intermediary operator representing mill on defined markets. (For example stockist, wholesaler, local distributor) |
| Downstream | One or more companies or individuals who participate in the flow of goods and services from manufacturer to the final user or consumer (Supply Chain Visions 2002), |
| Hot-rolling | Passing heat treated slabs of steel through a set of rolls to reduce thickness and produce a flat product in coil. |
| Importer | Intermediary operator buying directly from a foreign producer or from a trading house into stock. |
| Inbound logistics | The movement of materials from suppliers and vendors into production processes or storage facilities (Supply Chain Visions 2002). |
| Integrated logistics | A comprehensive, system-wide view of the entire (complete; Mentzer) supply chain as a single process, from raw materials supply through finished goods distribution. All functions that make up the supply chain are managed as a single entity, rather than managing individual functions separately (Supply Chain Visions 2002). |
| Intermediary | All operators between a mill and an OEM customer. |
| Lead-time | The total time that elapses between the order's placement and its receipt. It includes the time required for order transmittal, order processing, order preparation, and transit (Supply Chain Visions 2002). |
| Mechanical wood-processing industry | Industrial production of sawn timber, plywood, particleboard, fireboard, wooden house components and joinery products. |
| Merchant bar | Small re-rolled products (small angles, small channels, flats, rounds and squares). |
| Mill | Producer of rawmaterials (For example steel mill, paper mill, saw mill). |
| Narrow strip | trip product (either slit or rolled) normally 500 mm wide. |
| OEM | Original Equipment Manufacturer. Customer, which is assembling or manufacturing end products (For example systems). |

| | |
|------------------------------------|--|
| Outbound logistics | The process related to the movement and storage of products from the end of the production line to the end user (Supply Chain Visions 2002). |
| Outsource | To utilize a third-party provider to provide services previously formed in-house (Supply Chain Visions 2002). |
| Plate | Product of hot-rolling an ingot or slab in a plate mill over 3 mm thick, much greater width than thickness. |
| Plywood | A wood-based panel product made by gluing together several sheets of wood (veneers). It is mainly used to make furniture, trailers, lorries and casting moulds. |
| Producer | Mills producing base products in standard forms (For example a steel producer) |
| Profiling | Producing a finished shape out of plate by use of flame cutting, being either straightforward profiling into smaller rectangles or squares or specialised profiling into irregular shapes. |
| Sections | Long hot-rolled beams, channels, angles etc other than flat or strip steel. |
| Service Center | (Steel Service Center, SSC) Service centers are the intermediaries between steel producers and finished product producers. Steel service center is a catchall name for an operation that buys finished steel, often processes it in some way and then sells it in a slightly different form. Service centers distribute the steel and other metal products in the exact quantities and the exact form at the exact time that customers require. Service centers are less capital intensive than steel mills because they do not need furnaces, casters, rolling mills, etc (Metal Service Center Institute 2003). |
| Slitting | Cut coil along its length to make narrow strip, or to trim edge of coil. |
| Stockist (Stockholder) | Wholesaler or distributor with own inventory of products. |
| Supply chain | A set of three or more companies directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer (Mentzer, 2001). |
| Third-party logistics (3PL) | Outsourcing all much of a company's logistics operations to a specialized company (Supply Chain Visions 2002). |
| Upstream | Principal direction of movement for customer orders which originate at point of demand or use, as well as other flows such as return product movements, payments for purchases, etc. Opposite of Downstream (supply Chain Visions 2002). |
| Value-added | Increased or improved value, worth, functionality or usefulness (Supply Chain Visions 2002). |
| Welded tube | Tubes formed by bending a flat product to tubular shape and closing the seam by welding. |

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