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COMPETITIVE ADVANTAGE

OF FINNISH STEEL INDUSTRY

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Kansallinen kilpailukyky ja teollinen tulevaisuus -projektissa tutkitaan, millaista teollista toimintaa voidaan harjoittaa Suomessa menestyksekkäimmin. Siinä tutkitaan menestyneitä vientiyrityksiämme ja pohditaan, miten niiden toimintaympäristöä tulisi kehittää, jotta ne pystyisivät saavuttamaan kilpailuetuja kansainvälisiin kilpailijoihin verrattuna.

Projektin päärahoittajina ovat Suomen itsenäisyyden juhlarahasto (SITRA), Elinkeinoelämän Tutkimuslaitos (ETLA), kauppa- ja teollisuusministeriö (KTM) sekä eri alojen tärkeimmät yritykset.

"The Competitive Advantage of Finland" research project evaluates the competitiveness of Finnish export industries and crucial elements behind their performance. The project focuses on what kind of industrial activities have the best possibilities for success in Finland.

The project is organised by Etlatieto Ltd and financed mainly by the Finnish national Fund for Research and Development (SITRA), The Research Institute of the Finnish Economy (ETLA), Ministry of Trade and Industry (KTM) as well as major companies in various fields.

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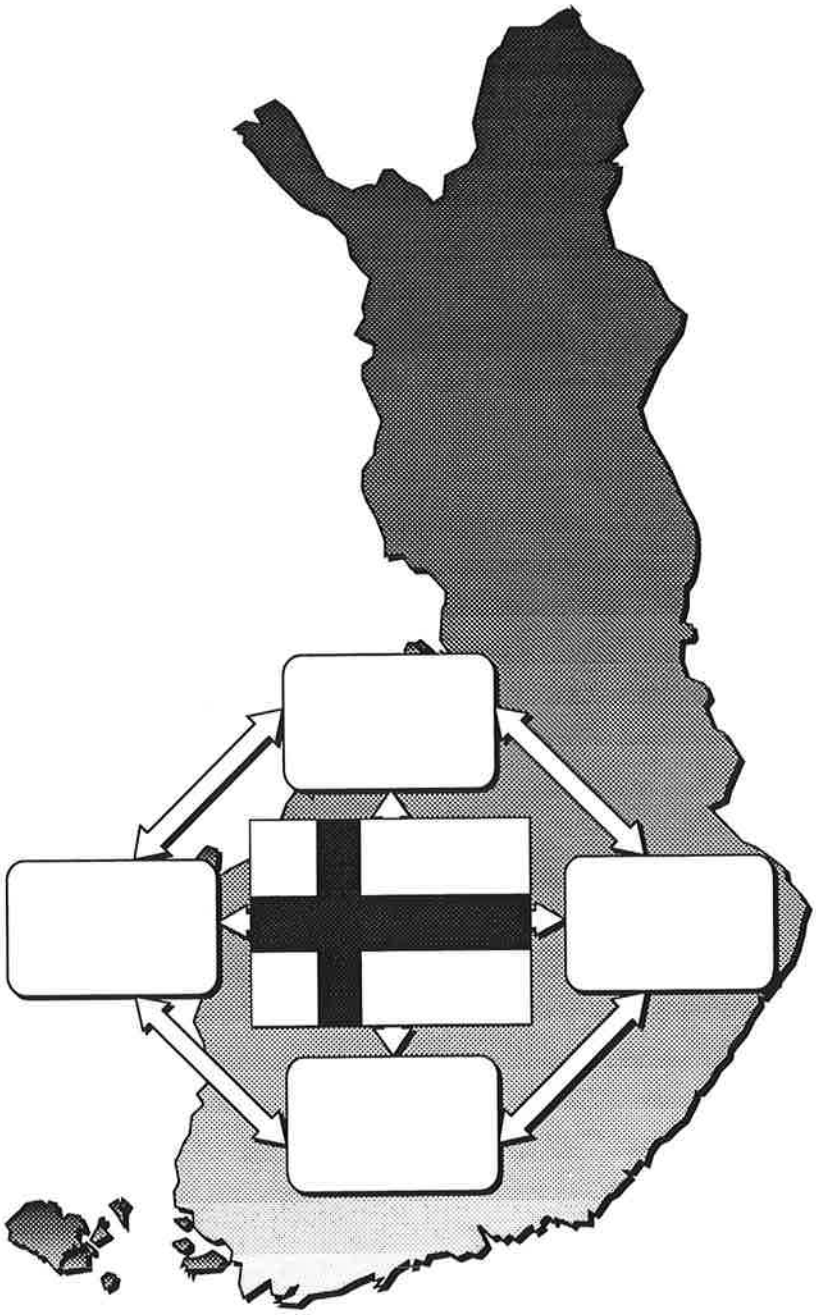
Kansallinen kilpailukyky ja teollinen tulevaisuus

The Competitive Advantage of Finland

COMPETITIVE ADVANTAGE OF FINNISH STEEL INDUSTRY



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ABSTRACT: This discussion paper is published as a part of "The Competitive Advantage of Finland"-research project, organised by Etlatieto Ltd. The objective of this study was to explain, which factors affect the real competitiveness of Finnish steel industry in the long run and how the individual steel firms have enhanced the competitiveness. The theoretical frame of reference was mainly based on Michael E. Porter's ideas. The most important source of information was the company interviews, which provided up-to-date information about the industry, rivalry and visions of the future development.

The strongest factors of the diamond model, which have affected the competitiveness of the Finnish steel industry, are demand conditions and firms' strategy and rivalry. The customers of the steel industry demand different properties of steel. This had led to the adoption of user-oriented manufacturing in the Finnish steel industry. The steel firms have named key buyer groups, with whom they do close R&D work in order to meet the demanding customer needs. In order to be competitive in the international markets the Finnish steel firms' strategic aims are to be both cost effective and to differentiate at the same time. This is only possible due to continuous innovation work.

KEY WORDS: steel industry, competitive advantage, steel technology, user-oriented manufacturing

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TIIVISTELMÄ: Tämä tutkimus on Etlatieto Oy:n "Kansallinen kilpailukyky ja teollinen tulevaisuus" - tutkimusprojektin osaraportti. Tutkimuksessa pyrittiin selvittämään, mitkä tekijät vaikuttavat Suomen terästeollisuuden reaaliseen kilpailukykyyn pitkällä aikavälillä ja miten yksittäiset teräsyritykset ovat luoneet itselleen kilpailuetua. Tutkimuksen teoreettisen viitekehyksen muodostivat pääasiassa Michael E. Porterin teoriat. Tärkeimmiksi tietolähteiksi osoittautuivat yrityshaastattelut, joista saatiin ajankohtaista tietoa toimialasta, kilpailutilanteesta ja kehitysnäkymistä.

Timanttimallin tekijöistä vahvimmin Suomen terästeollisuuden kilpailukykyyn ovat vaikuttaneet kysyntäolosuhteet sekä yritysstrategia ja yritysten välinen kansainvälinen kilpailu. Teräksen kysyntä on muuttunut. Siltä vaaditaan erilaisia mekaanisia ominaisuuksia, kestävyyttä, keveyttä ja hyvää hinta/laatu-suhdetta. Tämän vuoksi yritykset ovat siirtyneet valmistamaan terästä asiakaslähtöisesti. Yritykset ovat nimenneet avainasiakasryhmiä, joiden toimittajina ne haluavat olla parhaita. Ollakseen kilpailukykyisiä kovassa kansainvälisesssä kilpailussa yritysten tulee samanaikaisesti olla sekä kustannustehokkaita että pyrkiä differoitumaan tuotteillaan ja palvelutasollaan. Tämän mahdollistaa vain jatkuva innovaatiotoiminta.

AVAINSANOJA: terästeollisuus, kilpailuetu, terästeknologia, asiakaslähtöinen valmistus

YHTEENVETO

Tämä tutkimus on Etlatieto Oy:n "Kansallinen kilpailukyky ja teollinen tulevaisuus"-tutkimusprojektin osaraportti. Etlan loppuraportissa pyritään tuomaan esille suomalaisen teollisuuden menestystekijät ennen, nyt ja tulevaisuudessa sekä arvioimaan suomalaisen teollisuuden menestymismahdollisuuksia ja tulevaisuuden näkymiä projektissa tehtyjen klusteritutkimusten perusteella. Tämä toimialatutkimus on osa perusmetalliklusteritutkimusta. Keskeisenä tavoitteena oli selvittää, mitkä tekijät vaikuttavat Suomen terästeollisuuden reaaliseen kilpailukykyyn pitkällä aikavälillä ja miten yksittäiset teräsyritykset ovat luoneet itselleen kilpailuetua.

Tutkimuksen teoreettisen viitekehyksen muodosti Michael E. Porterin teoriat, joita laajennettiin myös muiden tutkijoiden teoksilla. Ulkomaankauppatilastot, aikaisemmat toimiala-analyysit ja yrityshistoriikit olivat hyödyllisiä tietolähteitä tutkittaessa toimialan kehitystä yli ajan. Tärkeimmiksi tietolähteiksi osoittautuivat yritys-haastattelut, joista saatiin ajankohtaista tietoa toimialasta, kilpailutilanteesta ja tulevaisuuden kehitysnäkymistä.

Tutkimuksessa olivat mukana Fundia Dalsbruk Oy, Imatra Steel Oy, Outokumpu Steel Oy ja Rautaruukki Oy Teräsryhmä. Suomen terästeollisuus rakentuu kahdesta pääasiassa valtio-omisteisesta yrityksestä (Outokumpu, Rautaruukki) ja kahdesta yksityisomisteisesta teräsyrityksestä (Fundia, Imatra Steel). Yritysten valmistamat tuotteet eivät kotimarkkinoilla kilpaile keskenään vaan kilpailua aiheuttaa teräksen tuonti. Kaikille teräsyrityksille oli ensisijaisen tärkeää omata vahva kotimarkkina-asema ja tarjota korkea palvelutaso kotimaisille asiakkailleen. Tärkeimmät kotimaiset asiakasryhmät olivat rakennusteollisuus, laivanrakennusteollisuus, ja kone- ja laitevalmistajat.

Kotimaisten teräsyritysten tuotannosta yli 50% menee vientiin. Tärkeimmät vientialueet löytyvät Euroopan Unionin maista. Tulevaisuudessa Itä-Euroopan alueet ja Aasia tulevat nousemaan myöskin huomattaviksi markkina-alueiksi suuren kysyntä-potentiaalinsa vuoksi.

Terästoimialan kilpailuetu perustuu jatkuvaan tuotekehitystyöhön, vaativiin asiakkaisiin, moderniin tuotantoteknologiaan ja osaaviin henkilöstövoimavaroihin. Timanttimallin tekijöistä vahvimmin Suomen terästeollisuuden kilpailuedun synty-miseen vaikuttavat kysyntäolosuhteet sekä yritysten strategiat ja kansainvälinen

kilpailu. Nämä tekijät vuorovaikutuksessa timantin muiden perustekijöiden kanssa ohjaavat terästeollisuutta kohti asiakaslähtöistä ja kustannustehokasta tuotantoa.

Teräksen kysyntä on muuttunut niin koti- kuin vientimarkkinoilla. Enää ei vain osteta terästä sellaisenaan, vaan siltä vaaditaan erilaisia mekaanisia ominaisuuksia, kestävyyttä, keveyttä ja hyvää hinta/laatu-suhdetta. Teräksen odotetaan luovan myös kustannussäästöjä käyttäjilleen heidän omassa tuotannossaan. Valitsemillaan strategioilla Suomen teräsvalmistajat pyrkivät tyydyttämään vaativat asiakkaansa. Yritykset ovat huomanneet, että ollakseen kansainvälisesti kilpailukykyisiä niiden tulee samanaikaisesti olla sekä kustannustehokkaita että luoda korkeaa hyötyä asiakkailleen differoinnin avulla.

Teräksentuottajat ovat siirtyneet asiakaslähtöiseen tuotantoon. Jotta paremmin saataisiin selville asiakkaiden tarpeet ja ongelmat, yritykset ovat nimenneet avainasiakkaita, joiden kanssa tehdään läheistä tuotekehitysyhteistyötä. Terästehtaan sisällä asiakas-tyytyväisyyden saavuttaminen edellyttää suoraa ja joustavaa yhteistyötä eri osastojen kesken. Päämääränä on myös tuotannon jalostusarvon kasvattaminen. Tuotanto suuntautuu entistä enemmän vaativimpiin, ohuempiin ja pinnoitettuihin teräslaatuihin ja terästuotteisiin.

Kotimaisten teräsyritysten välillä ei ole kilpailua kotimarkkinoilla, mutta tämä ei merkitse sitä, että yrityksillä olisi monopoliasema Suomessa. Kilpailua syntyy teräksen tuonnista. Teräsyritykset haluavat säilyttää vahvan kotimarkkina-asemansa, mutta kasvumahdollisuudet haetaan globaaleilta markkinoilta.

Kysyntäolosuhteet ja yritysten strategiat ovat vaikuttaneet tuotannontekijöiden kehittymiseen. Tuotannontekijöiden on oltava erikoistuneita vastatakseen vaativaan kysyntään. 1980-luvun aikana yritykset investoivat voimakkaasti koneiden ja laitteiden ajanmukaistamiseen. Tämän päivän Suomen terästeollisuuden yhtenä vahvuutena ovatkin modernit tuotantolaitokset, joissa sekä työn tuottavuus että automaatioaste ovat korkealla tasolla. Työvoima on osaavaa, ja yrityksissä on paljon kumuloitunutta tietoa teräksen valmistuksesta, jota hyödynnetään prosessi- ja tuotekehityksessä. Raaka-aineet joudutaan tuomaan Suomeen, mutta terästehtaat ovat logistisesti sijoittuneet edullisesti raaka-ainelähteisiinsä nähden, joten kuljetuskustannukset eivät nouse ylivoimaisiksi kustannustekijöiksi.

Terästeollisuuden kilpailuedun syntymiselle on tärkeää myöskin vuorovaikutus- ja yhteistyösuhteet teknillisten korkeakoulujen ja tutkimusinstituuttien kanssa niin

kotimaassa kuin kansainvälisestikin. Välillisinä tuloksina näistä yhteistyöprojekteista syntyy esimerkiksi terästeollisuuden tuntevia uusia henkilöstövoimavaroja sekä markkinointikelpoista uutta teknologiaa (esim. Rautaruukin masuuniteknologian vienti).

Julkisen vallan vaikutus kilpailuedun luomiseen tulee olla epäsuora. Julkista rahoitusta tulee käyttää hyvän perustutkimuksen ylläpitämiseen. Yrityksillä on keskeinen rooli julkisen rahoituksen suuntamisessa teollisuudenalan kannalta oikeisiin tutkimuskohteisiin. Mahdollinen Euroopan Unionin jäsenyys tulee avaamaan uusia mahdollisuuksia osallistua eurooppalaisiin teknologian kehitysprojekteihin. Tätä kautta on mahdollista saada myös EU:n rahoitusta tuotekehitykseen sekä markkinat yhteisprojekteissa kehitetyille tuotteille. EU-jäsenyys turvaa myös Suomen terästeollisuuden tuotteille tasavertaisen kohtelun EU:n sisämarkkinoilla.

Perusteollisuuden merkitystä Suomen kansantaloudelle on aliarvioitu viime vuosina. Kuitenkin esimerkiksi Suomen terästeollisuuteen on kehittynyt vuosikymmenien aikana korkeatasoista osaamista raudanvalmistuksen alalta. Ensisijaisen tärkeää terästeollisuudelle olisikin sen imagon nostaminen kansallisella tasolla. Hyvänä lähtökohtana imagon uudelleen rakentamiselle voisi olla ympäristöinvestointien korostaminen markkinoinnissa. Näin voitaisiin saavuttaa nk. first-mover-etuja myös kansainvälisillä markkinoilla.

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1. Introduction

1.1. Background of The Study

In recent years the word competitiveness has appeared in many books and articles. All these writings have in a way or other differed from each others. There is no common perception of what competitiveness is.

Some see national competitiveness as a macroeconomic phenomenon, driven by such variables as exchange rates, interest rates, and government deficits. Some argue that competitiveness is a function of cheap and abundant labour.

In 1990 Professor Michael E. Porter of the Harvard Business School introduced a new framework for an old problem. He explains the competitiveness through specific industries and industry segments. He began the international research project called *The Competitiveness of Nations* in 1986. The project focused on the growth of competitive firms and industries in ten different countries including in-depth studies. The results were published in the book *Competitive Advantage of Nations.*[1]

According to Porter at the heart of competitiveness must be a nation's chief economic goal which can only be a high and rising standard of living as measured by national per capita income. This is determined by productivity. A rising standard of living depends on the capacity of a nation's firms to achieve high levels of productivity and to increase productivity over time. Sustained productivity growth requires that an economy continually *upgrade* itself. A nation's firms must relentlessly improve productivity in existing industries by raising product quality, adding desirable features, improving product technology, or boosting production efficiency.[2]

Also international trade is an essential component of competitiveness because it allows the nation to concentrate on producing and exporting those goods and services in which it achieves the highest productivity while importing goods where it is less productive. Likewise, foreign investment allows focusing on high productivity sectors which yield high

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[1] Porter 1990

[2] Porter 1990, 6

income while shifting abroad production of those goods and services where the country is relatively less productive.

After the overheating phase in the late 1980s the Finnish national economy is now in the turning point. A new industrial strategy is needed in order to create a favourable industrial environment in Finland, which strengthens the position of Finnish firms in global competition. Porter's new approach to competitiveness aroused interests of some sectors of Finnish economy to carry out a same kind of study in Finland. Different kinds of industry analyses have been made during decades in Finland but they have concentrated on explaining the national competitiveness from a macroeconomic perspective. There is little knowledge about how things like technological capability, product quality and management practices, which are attributes of real competitiveness, affect the competitive advantage of an industry.

All this led to the initiation of *Advantage Finland* project in the spring 1992. The aim of this project is to draw up a report for Finnish decision makers and companies, in which are identified the successful clusters of industries of the Finnish economy as well as the important determinants shaping the competitiveness of selected industries in the 1990s. The project is carried out by Etlatieto Ltd together with The Research Institute of The Finnish Economy (ETLA), The Finnish National Fund for Research and Development (SITRA) and the research teams in Helsinki School of Economics (HKKK) and Helsinki University of Technology (TKK).

This study contributes to the project by applying Porter's theory as a main theoretical framework to explain the competitive advantage of Finnish steel industry. The research problem of this study can be formulated as a question: What are the determinants which have affected the success of Finnish steel industry and how the individual steel firms have enhanced the competitiveness? This study views the subject from the industry's standpoint.

2. The Historical Development of Steel Industry

This chapter describes the genesis and evolution of Finnish iron and steel industry and emphasises the role of technological innovations, which have allowed shifts in competitive position. The table 2.1. illustrates the major innovations in the production technology of iron and steel. The sections of this chapter have been organised according to these innovations.

2.1. Early Industry History: The 19th Century

The first ironworks were established in south-western Finland by the Swedish Crown during the seventeenth century. The reason for establishing these ironworks was that the Finland had plentiful forest resources which were needed in roasting of iron ore. The iron ore itself was imported from Swedish mines and the pig iron was shipped back to Sweden for further processing.

By the time Finland became an autonomous Grand Duchy of the Russian Empire in 1809, there were eight ironworks in production. In order to diminish the traditional dependencies from Sweden, the Finnish government made special efforts to promote own ore prospecting and mining. Although no big iron deposits were found during the 19th century, the Finnish ironworks started to use domestic lake and bog iron ore in the production. This raised the number of ironworks into 88 during the nineteenth century.[3]

The processes used in Finnish pig iron production were transferred mainly from Sweden. At first the iron ore was roasted in earth pits in which much of wood was needed to heat up the ore. Due to this dependence on wood resources the ironworks were connected to the Finnish saw mill industry.

The smelting technology started to advance after the 1850s. Technologically, the rise of the Finnish metallurgical industry was based on the puddling process, which was actually invented as early as 1784 in England (See table 2.1.). The puddling method was introduced first time in Finland in 1853 in Högfors ironworks. This method discharged the coal from the pig iron, and so the bar iron became more forgeable. With the puddling method the

[3] Laine 1950, 52-76

production capacity of ironworks rose. The production efficiency was also improved by introducing the rolling mills in the 1850s.[4]

Table 2.1. The Major Innovations in Production Technology of Iron and Steel

The Year of Invention	**The innovation**	**The country where first introduced**	**The Year when first introduced in Finland**
1784	Puddling method& rolling mills	England	1853
1830	Roasting furnaces	Sweden	1832
1849	Steel puddling furnace	Germany	1860
1855	Bessemer method	England	____
1864	Siemens-Martin method	France	1879
1878	Thomas-Gilchrist method	England	____
1910	Electric Arc Furnace	Norway	1915
1952	Basic oxygen process BOP	Austria	1968
1952	Continuous casting CC	Austria	1965
1970s	Mini Mills	USA	____
1970s	Thin slab casting	Germany	____

[4] Laine 1950, 213-238

In the mid 1870s there were 26 blast furnaces operating in Finland and the production of pig iron rose up to 25000 tonnes per year[5] Steel production was minimal in Finland until the 1860. In 1849 a German engineer invented a method to make steel in puddling furnaces and this method became known in Finland too. The first landmark step in large-scale steel production was the introduction of the Bessemer-method in England in 1855. This method could not be adapted in smelting in Finland, since Finnish iron ore contained too much phosphorus.

The second significant invention in steel production was the French Siemens-Martin method also called an open hearth furnace, invented in 1864. The first Finnish open hearth furnace was constructed at Högfors (Taalintehdas) in 1879. In 1885 this method was introduced also in Wärtsilä and in the 1887 in Åminnefors ironworks. The government supported especially R&D work in Wärtsilä ironworks, whose Martin-furnace was aimed to serve as a model for other Finnish ironworks[6]. The Siemens-Martin method made possible to use also scrap as a raw-material in steel making. Steel production began to displace pig iron making[7]. The table 2.2. gives a rough picture of the proportions in production, export, and in domestic consumption in 1870 in Finland.

Table 2.2. The Production of Some Iron Grades and Foreign Trade in 1870 in Finland (tonnes).

Iron Grades	Production	Export	Import	Domestic Consumption
Pig Iron	7740	7250	11250	11740
Bar Iron	10310	6970	630	3970
Manufactured Iron	600	280	1120	1440
Steel	3130	1270	1310	3170
Total	20780	15770	14310	20320

Source: Suomen taloushistoria 1980

[5] Finnish Steel in Figures 1992, 6

[6] Myllyntaus et al. 1986, 22

[7] Laine 1950, 451-458

It can be seen from the table that the Finnish ironworks were not able to meet the domestic demand, so a lot of iron was imported from Sweden and England. The quality of imported iron was also better, thus the engineering works preferred to use it. The Finnish ironworks mainly exported their production to the Russian market and they were depended heavily on these exports in order to survive in business[8].

From the 1880s, the output of ironworks began to decline. Reasons for the decline of the Finnish metallurgical industry were twofold. Firstly, Finnish ironworks were too small and technologically obsolete. Most of the plants could not adopt the new iron and steel technology, which was then advancing quickly in the major industrial countries. They generally lacked both the know-how and the capital resources for modernisation.[9]

Secondly, Finland lacked the favourable prerequisites for a modern metallurgical industry, such as good rocky iron ore and coal deposits. Also the mining methods used in the iron ore mines were old-fashioned and inefficient. These disadvantages in raw materials did not encourage foreign entrepreneurs and investors to set up plants in and to transfer up-to-date technology into the Grand Duchy.

Also the world-wide over capacity of iron and the collapse of exports to Russian market affected the Finnish metallurgical industry seriously at the end of the 19th century[10]. The strong dependence of Finnish ironworks on the Russian market and the technological gap between Finnish ironworks and their foreign competitors prevented the Finnish iron and steel industry from moving early into various segments of speciality steel in order to survive in the industry. The small iron and steel production plants e.g. in Sweden and in Germany adopted the strategy to move into speciality steel in order to survive in the competition[11]. By 1918 only five Finnish ironworks remained in operation and started to produce various kinds of products from pig and bar iron to nails, agricultural tools and simple machines[12]. The diversification of ironworks to metal product production and to engineering was necessary

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[8] Pihkala 1970, 116

[9] Myllyntaus 1989, 48-49

[10] Pihkala 1970, 115

[11] Sölvell, Zander &al. 1991, 71

[12] Raumolin 1986, 5

in order to stay in the industry[13]. These ironworks, Fiskars, Dalsbruk, Åminnefors, Wärtsilä, and Inha, formed the base for the Finnish modern steel industry.

2.2. Domestic Resources Develop: The 1910s-1950s

Although the production of iron and steel in Finland remained modest, compared to international producers during the 1900s-1920s (See table 2.3), Finland became an important pioneer in the field of electrometallurgy in that time. However, the efforts to introduce this originally American invention to Finland in the beginning of the 1900s were not successful since there was not enough hydropower available. A marked improvement was made in the supply of energy in 1929 by Valtion Koskivoimatoimisto (now known as Imatran Voima) that constructed the first large-scale power station in Imatra. This was a great stimulus to the Finnish iron and steel industry to continue to use the electro-metallurgical production methods.

Table 2.3. The Production of Steel by the World's Biggest Producers and by Finland, 1875-1913 (1000 tonnes).

Year	Great Britain	Germany	USA	Finland
1875	718	318	389	3,1
1885	1197	1203	1712	3,5
1895	3312	3891	6115	5,5
1905	5907	9669	20023	15,5
1913	7787	17609	31301	13[14]

Source: Myllyntaus 1986

The first step towards large-scale steel production was taken in 1937 when Vuoksenniska Ltd steelworks introduced the electrical steel furnace and the rolling mill[15]. By 1940 the total annual production in Finland climbed to 27000 tonnes of pig iron, 72300 tonnes of crude steel and 69300 tonnes of rolled products. The rolled products were bars, wires and

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[13] Myllyntaus et al. 1986, 18

[14] This figure also includes iron production, since there are only available data of total iron and steel production after year 1908.

[15] Honkasalo 1982, 9-12

shaped steels. The domestic demand for iron and steel continued to rise during the 1940s. The iron and steel imports had been cut by the World War II and the domestic war industry and engineering industry suffered from the shortage of raw material. The Finnish government encouraged the iron and steel industry to invest in a new production plant in order to meet the growing demand. This led to the establishment of Turun Rautatehdas in 1943 by Vuoksenniska Ltd.

The post-war years have affected the development of the Finnish steel industry significantly. After the World War II seller's market dominated in the world's steel industry. The export price of steel was nearly 30 % higher than the home market price. In that kind of situation countries like Finland, whose self-sufficiency in steel was low, suffered enormously. Only 1/3 of the domestic demand for steel could be covered with the domestic production. Also the war reparations had shown that the production of flat steel products was totally missing, which was a serious disadvantage considering especially the domestic shipbuilding industry.

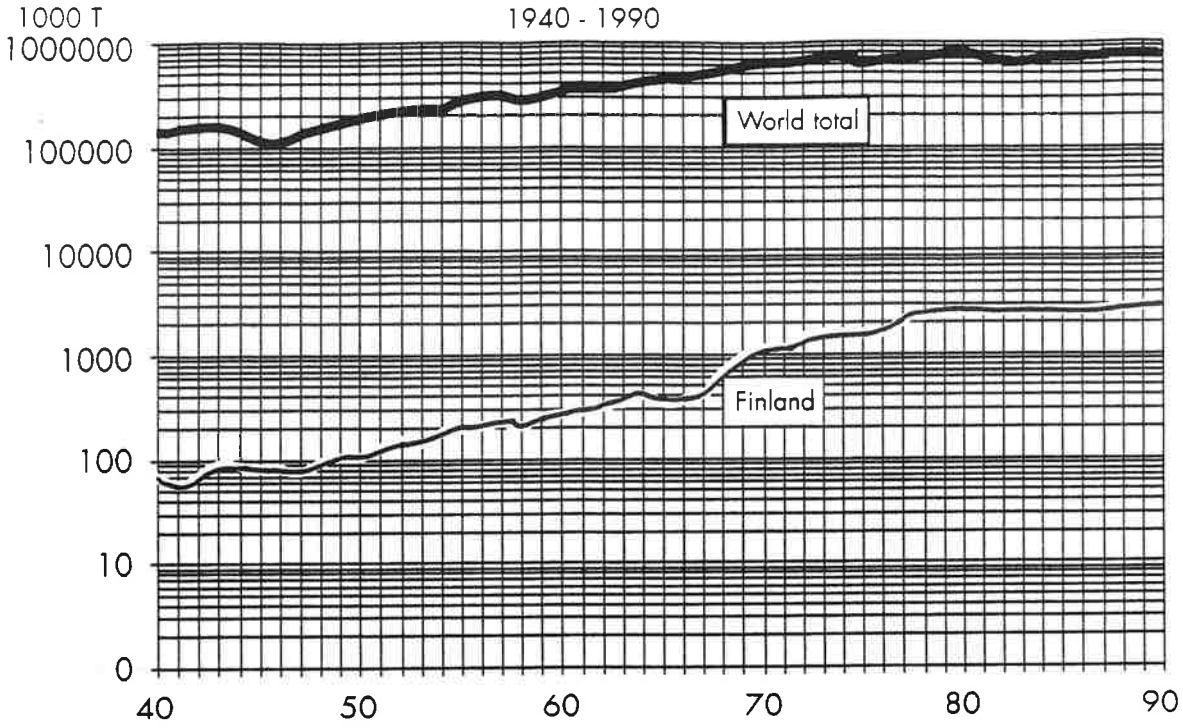
In the mid 1950s both government and the Finnish private steel industry were interested in establishing a new production plant producing flat steel products. The plans had to be postponed until 1960 because the world's steel industry was driven into a crisis in 1957, and also because the Finnish government removed restrictions on imports and allowed the imports of ordinary steels. By 1967 the Finnish steel industry produced only long steel products, such as bars, wire rods, and profiles.

2.3. From Growth to Energy Crisis: The 1960s-1970s

At the beginning of the 1960s the annual production of crude steel was about 300000 tonnes. In a world's scale the production capacity was quite modest (See figure 2.1.). The privately owned steel companies, Vuoksenniska, Fiskars Åminnefors and Wärtsilä Taalintehdas produced steel by using iron scrap as a raw material[16].

[16] Kivimäki 1990

Figure 2.1. World and Finnish Crude Steel Production



Source: Finnish Steel in Figures 1992

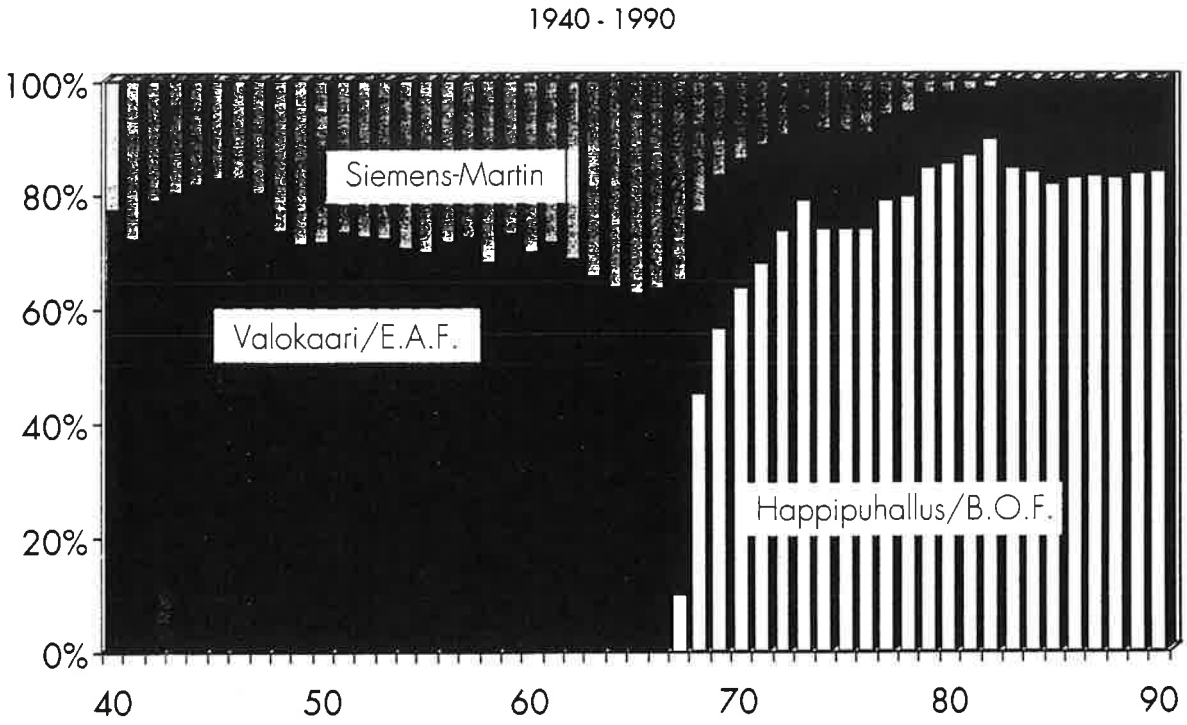
In 1960 the private steel companies got a competitor when the Finnish government came along into the steel business by establishing the company Rautaruukki Ltd. The production capacity of the Finnish iron and steel industry rose also since Vuoksenniska set up the company Koverhar Ltd in 1961.

In that time there was new technology available for steel production. Two major steel innovations, basic oxygen process (BOP) and continuous casting (CC) were introduced in 1952 in the state-owned steelworks of Austria. The basic oxygen process became the dominant method of integrated steel manufacturing in the following two decades. In Finland the basic oxygen process was introduced in 1968 in Rautaruukki steelworks.

Finnish crude steel output in 1969 was almost one million tonnes. 30% of that output came from electric furnaces (based on scrap), the new BOP converters produced 54% and the

remaining 16% was accounted for traditional open hearth plants (See figure 2.2.)[17]. BOP and open hearth methods use iron ore as raw material. By adopting BOP on a fairly large scale in 1968, the Finnish steel industry raised its technological level in a sudden jump. It compared favourably with other Nordic producers (See table 2.4.) and the new plants provided a good base for the industry's subsequent major expansion.

Figure 2.2. Processes Used in Crude Steel Production



Source: Finnish Steel in Figures 1992

The other major innovation of steel production processes, continuous casting (CC), was introduced in Finland first in 1965 at Vuoksenniska's Imatra steel works and in 1968 at Rautaruukki's steel plant. The CC machines complemented the new BOP installations. By 1975, three quarters of Finnish crude steel was continuous casted, the highest diffusion in the Nordic countries and probably in the world (See table 2.5.). In 1990 the CC method reached saturation in Finland. 100% of steel output was continuous casted. The basic

[17] Ray 1988, 19

Table 2.5. Continuous Casting in OECD Countries: percentages of crude steel output.[20]

Nordic countries	**1975**	**1980**	**1985**
Finland	76	90	94
Denmark	43	73	100
Sweden	22	49	81
Other countries in 1985			
Austria			93
France			81
Germany			81
Japan			91
Belgium			60
Italy			79
Spain			58
UK			55
Canada			44
Luxembourg			28
Netherlands			39
Portugal in 1984			43
USA			42

Source: Ray (1988a)

The Finnish steel industry expanded rapidly in the 1970s. The number of employees in steel industry culminated in the mid 1970s as the figure 2.3. shows. In 1969, Finnish crude steel production amounted to almost a million tonnes. After the expansion steel output in the early 1980s was closer to 2,5 million tonnes, rising at a time when the steel industries elsewhere in Europe and the US were struggling in an extreme depression (See table 2.6.)[21]. From 1973 to 1982 total crude steel output in the Western world fell by one fifth. This was due to the energy crisis in the mid 1970s, which decreased the consumption of steel in the world.

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[20] No CC has been reported for Norway and Switzerland.

[21] Ray 1988b, 53

oxygen process and the continuous casting gave competitive advantage for Finnish steel industry by increasing productivity and cost efficiency. The international competitors could reduce the lead only in the mid 1980s[18].

Table 2.4. The Nordic Steel Industry in 1969 and 1979. [19]

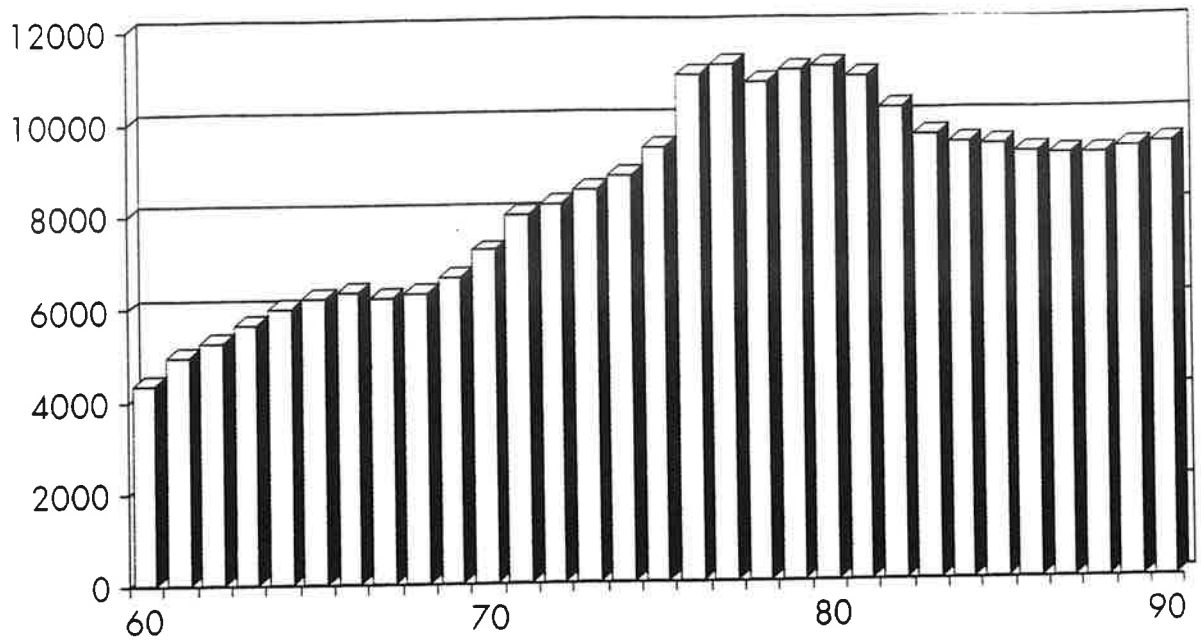
	Finland	**Denmark**	**Norway**	**Sweden**
Crude steel output, million tonnes				
1969	0.98	0.48	0.85	5.32
1979	2.46	0.80	0.92	4.73
Share in Nordic production %				
1969	13	6	11	70
1979	28	9	10	53
Share by technology %				
1969 open hearth	16	96	--	25
electric	30	4	54	41
BOP	54	--	46	33
1979 open hearth	--	39	--	6
electric	14	61	47	41
BOP	86	—	53	53

Source: Ray (1988). Figures taken from Annual Bulletin of Steel Statistics for Europe, UN, New York.

[18] Holappa 1989

[19] 1969 was the first year of fully operational BOP plants in Finland, and 1979 the first year without any output from the traditional (open hearth) method.

Figure 2.3. Employees in the Basic Steel Industry during 1960-1988



Source: Finnish Steel in Figures 1992

Table 2.6. Crude Steel Output in Finland during 1969-1989 (Million tonnes)

	1969	**1972**	**1975**	**1978**	**1981**	**1984**	**1989**
Total output of which	1.0	1.5	1.6	2.3	2.4	2.6	2.9
open hearth	0.2	0.1	0.1	-----[22]	-----	---	---
electric	0.3	0.3	0.3	0.3	0.3	0.4	0.5
BOP	0.5	1.1	1.2	2.0	2.1	2.2	2.4

Source: Ray (1988a)

[22] Less than 0.05

Modern technology, a flexible approach to market needs, and good labour relations, as well as the growing needs of the rapidly advancing Finnish engineering and metal using industries (especially construction industry and shipbuilding industry), provide the explanation for expansion in Finnish steel industry during 1970s. The expansion was also necessary in order to achieve economically sufficient production volume of steel.

In 1976 the number of Finnish steel producers rose by one. The state-owned company Outokumpu expanded its production line to stainless steels. Ordinary steels had dominated the production of Finnish steel industry from the beginning but the market changes in the world guided all the Finnish companies towards specialised steel products during the 1970s and 1980s.

2.4. Structural Changes and Internationalization of Steel Industry: The 1980s

The end of the 1970s and the early 1980s meant restructuring of the world's steel industry. The over capacity of steel and the decreasing steel prices forced the steel producers to shut down older ineffective steel plants especially in Western Europe. Also the demand for employees decreased. In 1974 there were 800 000 employees in steel industry in the EC countries, but in 1980 the number of employees had decreased to 600 000[23]. However, the restructuring was slowed down by the EC countries' governments' direct subsidies to the industry. It has been estimated that the EC subsidised the steel industry with FIM 175 billion during years 1980-1985[24]. This perverted the competition between steel companies in the world.

The restructuring affected also the Finnish steel producers. Structural changes took place already in 1979, when the Finnish private steel industry jointed forces. Wärtsilä Taalintehdas and Fiskars merged into Ovako Ltd. By 1985 the synergetic benefits of the restructuring of the Finnish private steel industry were exploited and Ovako was facing new challenges. The production scale of long special steel products was small regarding internationally. Also the production processes of Imatra steelworks needed upgrading. At the same time the Swedish special steel producer SKF Steel was facing structural changes. In 1986 Ovako and Swedish SKF Steel merged by establishing a Nordic steel company Ovako Steel. In 1987 Ovako

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[23] Rautaruukki Annual Report 1981

[24] Linna 1987

Steel sold production plants of Koverhar, Dalsbruk and Åminnefors to Rautaruukki Ltd, which formed the company Dalsbruk Ltd. Ovako Steel gave up its production of ordinary long steels because of the company's strategic move to focus on specialised engineering steels. At the end of 1980s and at the beginning of 1990s the reorganisation of steel industry continued. Metra Ltd bought the Finnish production units of Ovako Steel and set up a company Imatra Steel. Dalsbruk Ltd together with Swedish Fundia and Norwegian Norsk Jernverk formed a Nordic steel group Fundia (See figure 2.4.).

Characteristic of the 1980s has also been the internationalisation of Finnish steel industry. In the 1980 exports and international operations accounted for 44% of steel industry's total turnover but already in 1990 the share accounted for 59%[25]. Exports of steel started in 1950s, but the deliveries were occasional due to the home market oriented production. Exports have increased steadily since the end of the 1960s except during years 1974-1976, when the growing home demand decreased exports. In 1977 exports exceeded steel imports for the first time. Since then Finland has continued to be a net exporter. During the end of 1980s exports have accounted for 50% of Finnish steel production (See figure 2.5.)[26]. The share of steel exports of total Finnish metal industry exports has accounted for about 15% annually during the 1980s.

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[25] Finnish Steel in Figures 1992

[26] Finnish Steel in Figures 1992

Figure 2.4. Family Tree of the Finnish Steel Industry

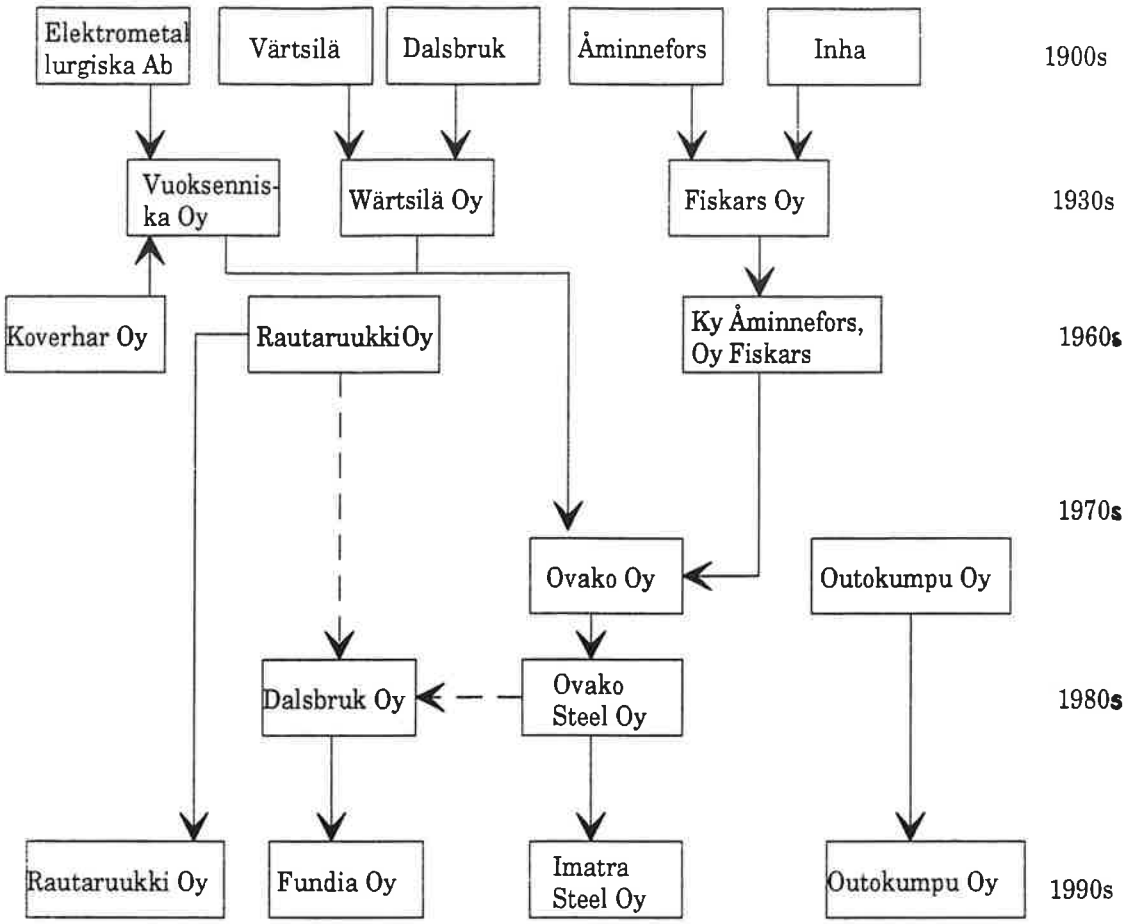
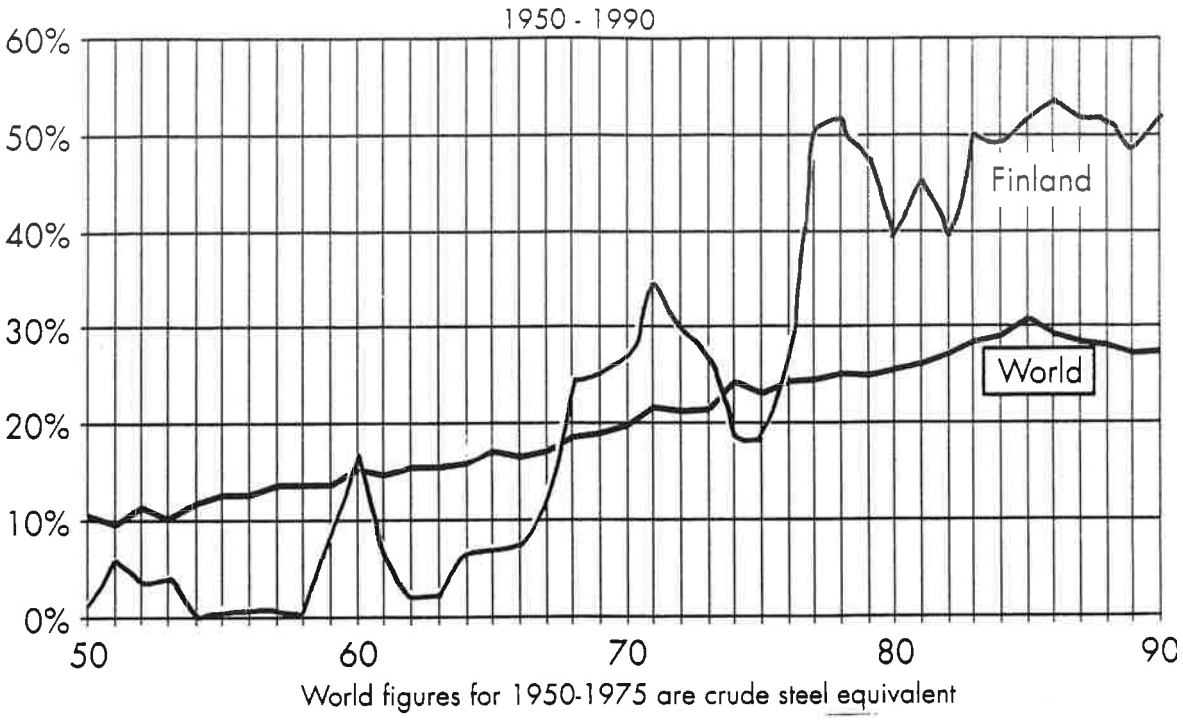


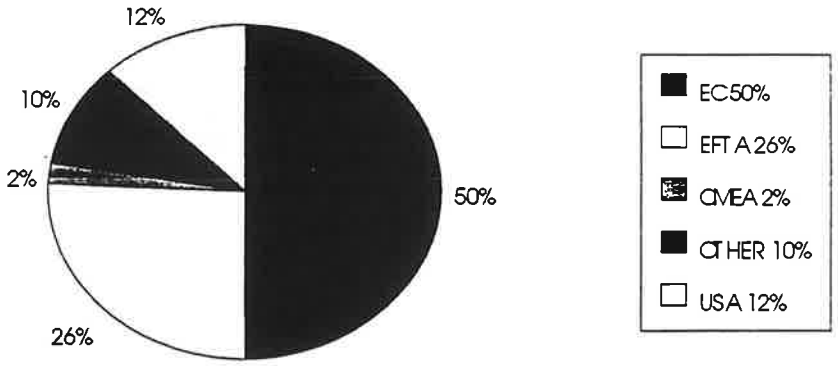
Figure 2.5. Finished Steel Exports as Percentage of Production in 1950-1990 in Finland and in the World.



Source: Finnish Steel in Figures 1992

The main export areas have been EFTA countries and the EC area, which together have accounted for over 50% of exports. There has been little export to Eastern Europe although imports from these countries have accounted for about 20%. In the end of 1980s Finnish steel has been exported to USA, whose share of total Finnish steel exports has been 10%. The figure 2.6. shows Finnish steel exports in 1990 by market areas.

Figure 2.6. Finnish Steel Exports in 1990 by Market Areas



Source: Finnish Steel in Figures 1992

Besides export operations the Finnish steel companies have strengthened their positions in international markets by establishing sales subsidiaries and service centres in the 1980s. Foreign acquisitions and investments have taken place in downstream industries, which support the core business, steel production.

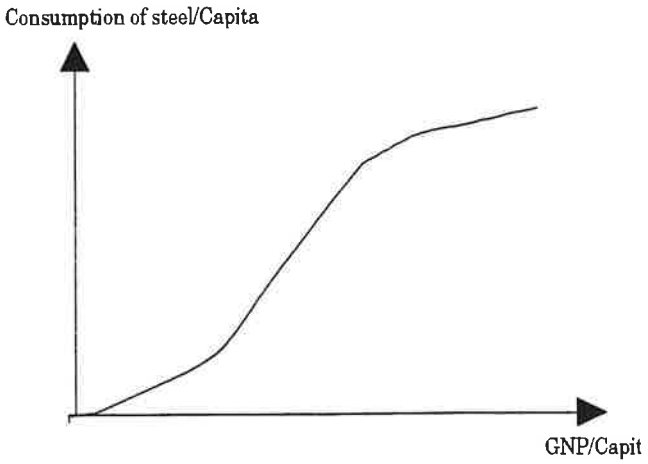
3. Characteristics of Today's Steel Industry

3.1. The 1990s

The steel industry is considered to be a necessary part of the basic production for the industrialised world also in the future. However, it must be noticed that the steel industry is in different development stages in different countries around the world.

In the old industrialised countries the steel industry is a mature industry segment. This means that the growth of consumption of steel is smaller than the growth of gross national product (GNP). In the developing countries and in the newly industrialised countries, like China and Taiwan, the situation is the other way around. There the growth of consumption of steel is rising faster than the growth of GNP. The figure 3.1. shows the dependence of the consumption of steel on GNP[27].

Figure 3.1. Dependence of the Consumption of Steel on Gross National Product (GNP)



The over capacity is also characteristic in today's steel industry. This has affected the price of steel. The prices have dropped by 20-30 % from the year 1989[28]. The over capacity has also pressured the steel producers to cut their production volumes. The structural change in steel industry is already going on in Europe, especially in Germany. Some production plants

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[27] Interview with K.Karjalahti, Rautaruukki Ltd.

[28] Tekniikka & Talous 11.3.1993, p.9

have been shut down and mergers between steel companies have occured in order to make the European steel industry healthier.

The steel industry is also sensitive to economic fluctuations since much of steel is used in capital goods. It can be said that the steel is an indicator of the health of the economy. The economic recession causes problems to the steel industry, but when the upturn of economy starts the steel industry can flourish.

Until the recent years the steel industry has been a home market-oriented industry segment. Now it is becoming more global. The steel companies compete with global strategies involving selling world-wide and sourcing raw materials and machinery world-wide, and locating activities in many nations. The globalization sets new requirements for the steel industry and its managers.

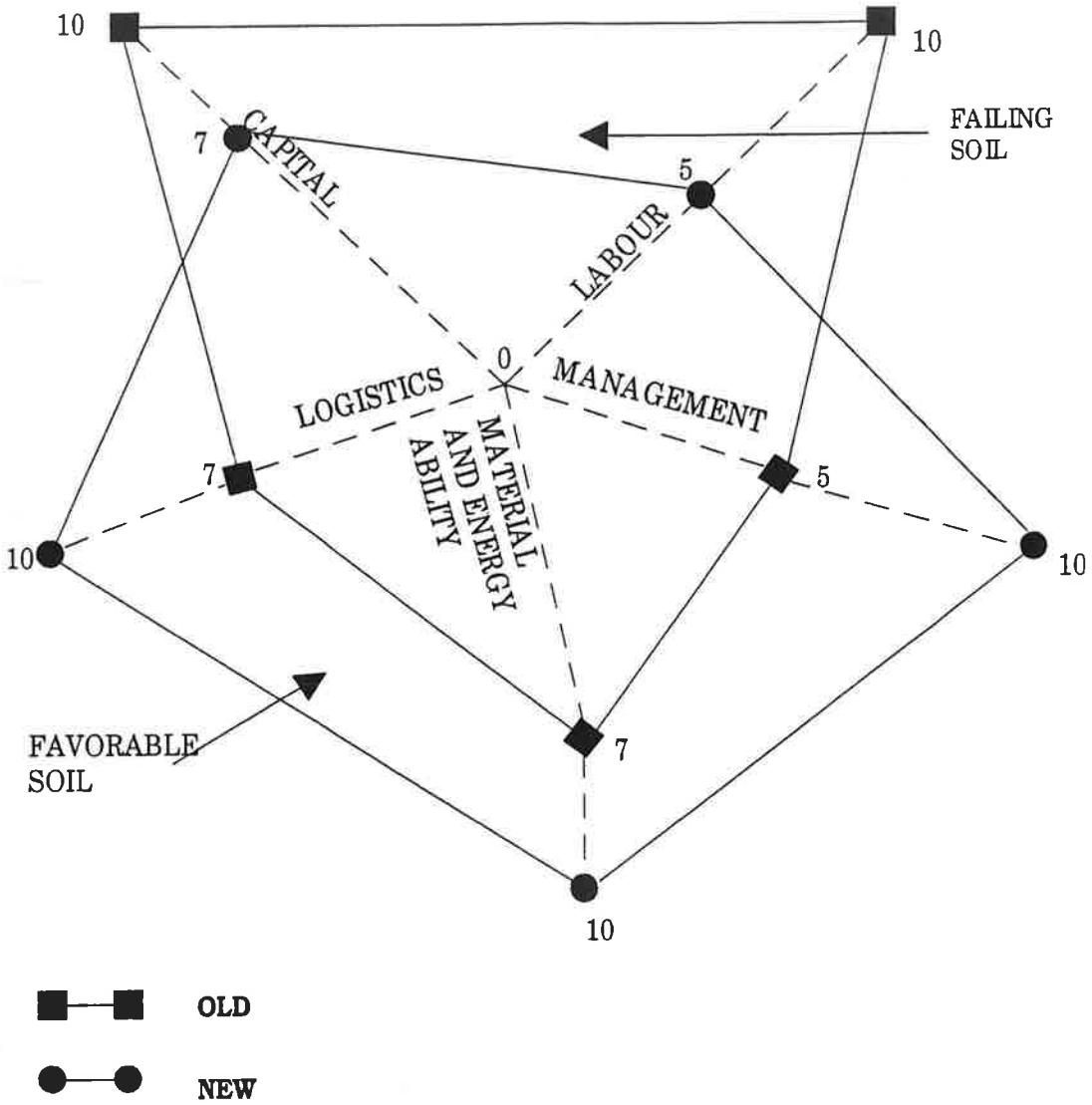
Due to the restructuring of the steel industry the number of employees in operational level is decreasing in the industry. In the future the steel industry will need more highly educated experts. The industry becomes more customer oriented and the experts of steel industry take part in customer's product development already at an early stage. Also the division of labour in the delivery of steel products will change. Earlier e.g. the steel company delivered only rolled steel sheets to the car industry. Nowadays the steel can be delivered already in formed pieces from the steel plant meeting exactly the needs of customer. To develop these kinds of services the steel industry needs competent and highly educated personnel which know well both the steel industry's and the customer's needs.

The environmental questions have made their breakthrough in the steel industry too. The steel producers have noticed that the environmental protection has to be taken into consideration if the industry is going to operate also in the future. This means not only diminishing the air and water pollution but also that the steel products must be effectively recycled back to the use of production. The steel industry, including the Finnish steel producers, has committed itself to the principles of sustainable development. The environmental effects of steel must be analysed during the whole life-cycle of steel products and also when they are abandoned from use. In this respect steel is competing with aluminium. Although about 65% of world's steel production is recycled and only 25% of aluminium production, the people consider that aluminium is better recycled and more

ecologically beneficial than steel[29]. That is why it is important to the steel industry to improve its image.

There is a new world for steel firms to explore in the future. A new fruitful soil is available for firms to set goals and strategies. However, the focus areas are found now from different sources than before, as the figure 3.2. illustrates.

Figure 3.2. The New World of Steel



Source: World Steel Dynamics 1992

[29] Kauppalehti 24.3.1993

The trend is towards slimmer capital and labour structures. Simplified process stages and new technology increase production efficiency, reduce capital employed and decrease environmental load[30]. The shift in technology towards cheap mini mills and thin slab casting seem to be the trend in steel industry because of low investment costs, rapidly increasing quality and the increasing probability of availability of cheap raw materials, various kind of scraps or DRI (direct reduced iron)[31]. Similarly, process automation and mechanisation reduce the number of personnel in the industry. This sets new challenges for training too. Linked with technological changes one of the main driving forces behind training in the steel industry is the need for flexibility. Each employee need to encompass a wider range of tasks. Multi-skilling involves training employees in areas of production beyond their own immediate field of expertise. Computerisation has also meant a need for higher general educational standards among steelworkers. Another cornerstone of training at steel makers is total quality performance (TQP). The aim is to improve communication between every level and department within a firm and to make each employee aware of the need to serve the customer, whether it is the end user of the steel or an internal customer. Likewise, logistics is an area to which steel firms must pay careful attention in the future, because the firm that is able to handle both inbound and outbound logistics efficiently will have competitive advantage. These are the challenges for the steel industry in the 1990s.

3.2. Industry Structure

3.2.1. Substitutes

There are a few substitutes for steel, such as aluminium, plastics and ceramics, but these substitutes do not constitute real threats to the steel industry. After the energy crises in the 1970s plastics were considered to take the place of steel especially in the car industry. However, the development of using plastics in the car industry have not been as quickly as was thought twenty years ago. These substitutes are not able to offer as versatile mechanical properties combined with advantageous price as steel does. The price trend of steel has been more advantageous compared to other construction materials. The development of more ecological production methods of steel and the recyclability of steel in production (e.g.

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[30] Steel News 1/1993, 4

[31] Monthly Metal Bulletin MBM August 1993, 64

more easily than in production of plastics) are factors which give a strong position to steel as a construction material in the world in the future.

3.2.2. Buyer Segments

The major buyers of steel industry's products both in Finland and in export markets are construction industry, car industry, engineering industry and shipbuilding industry. To some extent steel is sold to pulp and paper industry, chemical industry and to houseware industry. The first four major buyer groups have a very strong impact on steel industry's performance.

The steel products represent a significant fraction of the buyer's costs. For example the car industry and the construction industry, which have been strongly suffering from a world-wide depression, have become more and more price sensitive. They value a good price/performance ratio of steel products.

The quality of steel products is important to the buyers. In recent years the engineering industry and the car industry have especially attached weight to the quality of steel used. Good mechanical properties, strength, light weight and machinability of steel are quality factors which are highly appreciated in the car and engineering industry today. This has led to the adoption of user-oriented manufacturing philosophy in steel industry. Buyers and producers of steel operate closely together in order to improve existing steel grades or to invent new customer-oriented applications.

Since many buyers of steel have also introduced JIT (Just In Time) production philosophy, this has also increased requirements for steel producers to deliver promptly and to order. Also steel producers ability to be flexible and to react quickly to the market changes are qualities which have particular importance for buyers of steel products.

3.2.3. Distribution Channels

Steel is distributed through various kinds of channels. In the home market the steel producers sell directly to their big industry customers or through the steel wholesalers. Usually the small and medium sized steel using companies buy their steel from the wholesalers. This is because of steel wholesalers also perform a storage function and customers can buy steel in smaller quantities from wholesalers than directly from steel plants.

There are several steel wholesalers in Finland. Already in the end of 1980s it was seen that the development of steel wholesales would experience reorganisation in order to survive in tough competition[32]. The number of steel wholesalers in Finland will decrease in the future[33].

As the export sales of steel have grown in importance, the Finnish steel producers have established own sales companies in their most important marketing areas. The growing concern for closer contact with customers and to better be able to assess the foreign market conditions have also been factors which have contributed to this. However the Finnish steel producers also use foreign steel wholesalers as a sales channel. Especially the wholesalers with own steel service centres can be advantageous to Finnish steel producers as a source of valuable information for product development[34].

The growing number of JIT deliveries, the smaller transportation batches and the demands for frequent transportation frequency will bring changes into the steel's distribution. The steel producers' tendency will be to take the total distribution chain under control in order to intensify the distribution efficiency and to introduce logistics savings.

3.2.4. Production

Annual steel production is around 3 million tonnes in Finland. The table 3.1. shows the different steel products by the companies.

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[32] Suomen materiaalitalous 1989, 2: 6-9

[33] Kauppalehti 26.3. 1993, 6

[34] Steel News 1990, 3: 10-11

Table 3.1. Finnish Steel Producers and their Products

OUTOKUMPU STEEL - Stainless steels: hot and cold rolled sheets, coils, pipes	**RAUTARUUKKI** - Non- and low alloy steels: hot and cold rolled coils,sheets and plates, pipes and tubes,sections, steel construction products
IMATRA STEEL - Low alloy engineering steels: steel bars, springs, chains, nails	**FUNDIA** - Special steels: reinforcement products and drawn products, wire rods, rebars

The main steps in the steel production process can be summarised as follows:

1. Production of pig iron: the dressed ore from mining plant is reduced in blast furnace together with coke and chalk and it becomes pig iron.
2. Production of crude steel: pig iron is refined further in converters into crude steel. Crude steel is also made when steel scrap is smelted in electrical furnaces.
3. Injection of crude steel: By injecting different alloying metals into smelted crude steel, the properties of steel can be improved and different special steel grades can be produced.
4. Casting: all Finnish steel is continuously casted. This method is more advantageous compared to ingot casting regarding output, energy consumption, and capital need.
5. Rolling mill/ Drawing mill: After casting steel slabs are moved to the rolling mill (sheets) or to the drawing mill (coils).

The cost structure of a steel company is in particular determined by the age of its production plants. The table 3.2. shows how the main production costs are divided in the Finnish steel industry. Due to heavy investments in the modernising of steel processes and in environmental protection, the Finnish steel companies have higher fixed costs compared to European producers. The trend of raw material costs is expected to increase, because of the environmental concerns world-wide. Labour costs have decreased due to the investments in the automation of steel production processes. The upgrading of steel production technology is expected to decrease energy costs, although the steel industry still remains very energy intensive. Energy costs are affected also by the Finnish energy policy.

Table 3.2. The Main Cost Components in Steel Production

Cost category	Proportion %
Raw material	20-30
Labour	30
Energy	25-30
Fixed costs (interest, depreciations, etc.)	15-20

Considering the costs of production and the profitability of companies it is essential to the Finnish steel producers to be able to sustain a high production capacity utilisation in order to be profitable.

3.2.5. Competition

Due to the over capacity of steel, the competition among steel producers is strong in the world. The deep and long lasting recession in the industrialised countries has decreased the consumption of steel. Especially the European steel industry has suffered from the recession. The demand in the Western European markets has stagnated. This is because of the car industry is in deep difficulties globally and also high interest rates have decreased the demand of steel in the construction industry. However, new market areas for steel can be found in the newly industrialised countries, where capital investments are at a high level. In 1992 important increases in steel demand were registered in China and the Middle East where steel consumption rose by 15.4 and 17.8 per cent respectively[35]. However, the development of China has a lot of uncertainties. Even though the reform would continue without serious problems related to overheating of the economy, the congestion of harbours might create problems for Western exports[36].

The main competitors of the Finnish steel industry are found in the Western Europe. The figure 3.3. lists the leading steel makers of the world according to crude steel production. Rautaruukki is found from the sixtyfourth place with the crude steel production of about 2 million tonnes annually. The table 3.3. illustrates the figures of steel production in the world.

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[35] The steel market in 1992 and the outlook for 1993, OECD 1993

[36] AIECE raw material group, september 1993

Figure 3.3. Leading Steel makers of the World

(m tonnes of crude steel)		1991		1992	
		Rank	Output	Rank	Output
Nippon Steel	Japan	1	28.63	1	25.10
Usinor Sacilor	France	2	22.80	2	21.10
Posco	Korea	3	19.09	3	20.01
British Steel	UK	4	12.94	4	12.39
NKK	Japan	5	12.45	5	10.89
Ilva	Italy	7	11.00	6	10.60
Thyssen	Germany	6	11.13	7	10.13
Kawasaki	Japan	8	10.91	8	10.00
Sumitomo Metal	Japan	9	10.90	9	9.97
Sail	India	11	9.38	10	9.70
Bethlehem	USA	12	9.09	11	9.57
USS	USA	10	9.55	12	9.47
Iscor	S. Africa	13	7.59	13	7.74
LTV Steel	USA	14	6.94	14	7.52
BHP	Australia	17	5.72	15	6.68
China Steel	Taiwan	16	5.86	16	6.25
Kobe Steel	Japan	15	6.50	17	5.75
National Steel	USA	19	4.76	18	4.88
Hoogovens	Netherlands	18	4.94	19	4.85
CSN	Brazil	34	3.52	20	4.36
Cockerill Sambre	Belgium	20	4.43	21	4.35
Inland	USA	21	4.24	22	4.30
Stelco	Canada	38	3.36	23	4.25
Nucor	USA	31	3.82	24	4.22
Hoesch	Germany	22	4.19	25	4.18
Huta Katowice	Poland	32	3.69	25	4.18
Preussag Stahl	Germany	23	4.14	27	4.09
Usiminas	Brazil	24	4.13	28	4.03
Tokyo Steel	Japan	33	3.66	29	3.95
Riva*	Italy	36	3.50	30	3.90
Voest Alpine	Austria	25	4.11	31	3.77
VSZ Kosice	Slovakia	29	3.90	32	3.60
Ensidesa	Spain	26	4.06	33	3.49
Dofasco	Canada	34	3.52	34	3.42
HKM	Germany	30	3.84	35	3.41
Nisshin Steel	Japan	37	3.47	36	3.37
Klöckner	Germany	39	3.35	37	3.25
CST	Brazil	40	3.30	38	3.18
Sidmar	Belgium	28	3.93	39	3.15
Nova Hut Kuncice	Czech Rep	42	3.10	40	3.11
Arbed	Luxembourg	40	3.30	41	3.10
Armco Steel LP	USA	45	2.80	42	3.08*
SSAB	Sweden	43	2.96	43	2.96
Cosipa	Brazil	47	2.76	43	2.96
Nisco	Iran	59	2.20	45	2.94
Sidex SA	Romania	27	4.00	46	2.91
Krupp Stahl	Germany	44	2.90	47	2.74
Sidor	Venezuela	45	2.80	48	2.67
Gerdau	Brazil	60	2.10	49	2.65
Ahmsa	Mexico	48	2.66	50	2.55
Rouge Steel	USA	58	2.23	50	2.55
Tata Iron & Steel	India	52	2.40	52	2.49
Inchon Iron & Steel	Korea	66	1.90	52	2.49
TDCI	Turkey	49	2.48	54	2.43
Trinecke Zelezarny	Czech Rep	51	2.47	55	2.36
Toa Steel	Japan	56	2.30	56	2.31
Weirton	USA	60	2.10	57	2.26
North Star	USA	55	2.32	58	2.19
Huta Sendzimira	Poland	53	2.38	59	2.13
Açominas	Brazil	62	2.09	59	2.13
Wheeling-Pittsburgh	USA	63	2.02	59	2.13
Co-Steel	Canada	64	1.95	62	2.12
Nakayama Steel	Japan	57	2.29	63	2.11
Rautaruukki	Finland	49	2.48	64	2.09

Source: Metal Bulletin February 1993

Table 3.3. World's Steel Production in Figures

	1992	**1991**	**Change %**
EC	132	137	-4
Other western Europe	25	24	+3
Eastern Europe	140	166	-15
United States	83	80	+4
Japan	98	110	-11
World Total	714	736	-3

Source: Rautaruukki News 1/1993

Over the next few years the steel producers of the EC countries have agreed on cutting the steel capacity by some 20-30 million tonnes. The reductions in capacity mean that the number of producers of steel industry in the Western Europe decreases. The difficulties in European steel industry continue until the profitability of steel industry will increase markedly. This will be the case only if production capacity will be cut considerably in order to facilitate the price increases.

Although the number of steel producers in western Europe will decrease, there is a threat of new entrants in the industry from the ex-socialist eastern European countries pushed by the difficult transformation of economies. Especially Hungary, Poland and Czech and Slovak Federal Republic, whose total steel production capacity is nearly one fourth of the EC's producers' capacity, desire to gain market shares in the western countries. Due to the economies of scale in the steel production the eastern European countries have been able to affect the steel prices by cutting them down. This is also a threat for the Finnish steel companies, whose steel exports to the EC area account for 50%. Likewise, the eastern European countries have increased the share of imports of steel to Finland in the beginning of the 1990s.

The new entrants face some barriers to entry too. The western European steel producers, including Finland, have cost advantages in production technology and in learning. They have also brand identification and customer loyalties in the steel industry. The new entrants do not have large financial resources to invest in technology and R&D in order to get at the same level with the western producers. The EC has also imposed import restrictions on Eastern

European steel producers, which diminish the supply from these countries. The Eastern European countries face difficulties to meet the western quality standards of steel and they have also problems with accurate shipments.

The technical developments have enabled the small production units to compete more successfully with large integrated steel units. Traditional integrated steel producers have got new competitors from the mini mills (USA, Italy), which use steel scrap in production and whose investment costs are lower because of used technology. The minimill technology will be introduced also in the Eastern Europe because of the available scrap metal resources and since the old steel mills have to be replaced by new plants that cause less environmental load and tie up less capital[37].

3.3. The Competitive Advantage of the Finnish Steel Industry

3.3.1. Factor Conditions

Lean domestic iron ore deposits have created pressures on Finnish steel producers to innovate efficient production processes in order to get a profitable outcome of domestic iron ore. They have been able to introduce energy efficiency in processes and high automation level, which have improved profitability and quality of production. Innovative production processes have created competitiveness for firms also in international competition and the technological improvements have been exported abroad too (e.g. Rautaruukki's furnace technology).

By using scrap metal in steel production The Finnish steel firms have committed themselves in the world of sustainable development. Imatra Steel's production is totally based on scrap and other producers use scrap to some extent. 90% of domestic scrap is being recycled back into steel production by Teollisuuden Romu Osuuskunta. All steel producers are share holders in this company. It has been estimated that by using recycling scrap it can be achieved 75% saving of energy, 40% saving of water, 75% cleaner water, and 85% less emissions[38]. Recycling can be a potential asset for Finnish steel producers in competition in the future.

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[37] Steel News 1/1993, 5

[38] Steel News 1/1993, 6

Until the end of 1960s half of iron ore needed in the steel production was home based. Nowadays iron ore is imported mainly from Sweden (LKAB) and Russia. Scrap imports come also from Russia. The location of Finnish steel producers near harbours gives competitive advantage for firms logistically considering raw material imports. The deliveries come by rail or by sea.

In export deliveries Finnish steel producers have joined forces. Fundia and Outokumpu buy transportation services from Rautaruukki. This partnership between companies enables savings in logistics. The distance from export markets has forced the companies to improve information systems (e.g. EDI) too in order to be able to quickly react to changing market situations.

The higher education in mining engineering and metallurgy in Finland started in 1937 and this guaranteed the supply of skillfull engineers to the Finnish steel industry too. Ever since the connections between the industry, research institutes and universities of technology have been close. To ensure the supply of qualified specialists for the future, Rautaruukki, Outokumpu and Imatra Steel have funded a professorship of metallurgy at the University of Oulu in 1991.

Steel companies themselves have invested considerably in education by establishing vocational schools near the production plants. The companies have paid continuously attention to the upgrading of their personnel's working skills and to the safety at work.

The higher labour costs compared to foreign rivals pressured the Finnish steel companies to invest in the rationalisation of production in industry during the 1970s and the 1980s. Although the amount of personnel in operational level in Finnish steel industry has decreased, the need for higher educated and multi-skilled workers will increase in the future. This is because the production of steel industry becomes more and more customer oriented. Then competent and well educated personnel who know the needs of both the steel industry and its customers are highly valuable for steel companies' competitiveness.

3.3.2. Demand Conditions

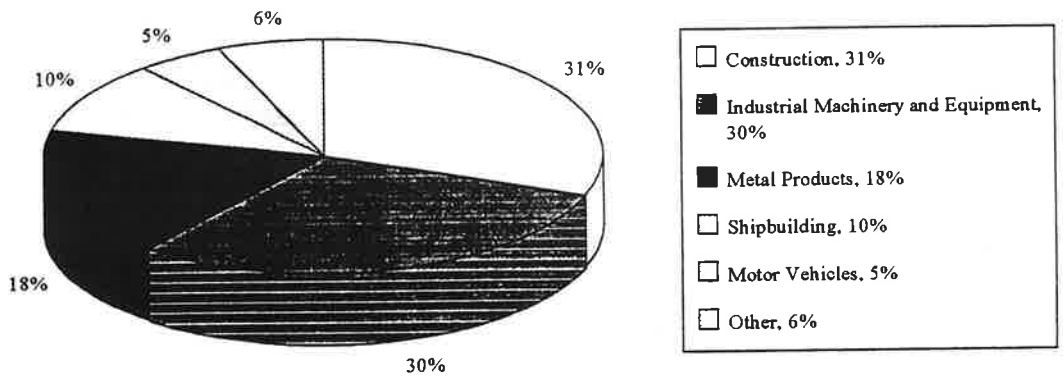
The buyers of Finnish steels are mainly industrial buyers both in domestic and export markets, such as machinery and equipment manufacturers, construction industry,

shipbuilding industry, car industry and the chemical and process industries illustrated in figure 3.4. Their needs have become more and more sophisticated over the years.

Today's steel using industries do not buy steel as such anymore. They individualise the task in which steel is used. They demand quality, good mechanical properties, strength and machinability among other things from the steel they use. The tightened cost competition among the steel users has forced the steel producers to take notice that the steels offered reduce also the user's costs. All these factors have pressured the Finnish steel producers to upgrade various kinds of speciality steel niches.

In order to meet the sophisticated buyer needs the Finnish steel producers have invested in the close co-operation with its customers. The close contacts in the development process have created opportunities to engage in joint development work. Besides the co-operation in R&D gives insight into the customer's markets and future changes which might have effect on the steel industry. The well established R&D with customers can be seen as a competitive advantage of the Finnish steel industry in international competition.

Figure 3.4. Finnish Steel Consumption in the 1980s

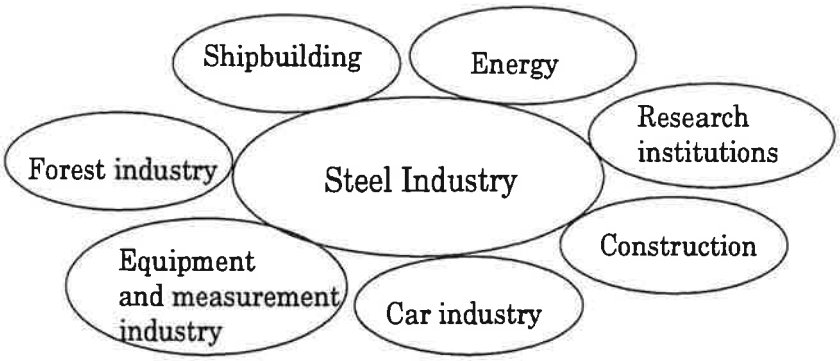


Source: Finnish Steel in Figures 1992

3.3.3. Related and Supporting Industries

Increasing demand sophistication throughout a number of related industries, in particular shipbuilding and engineering, has supported the upgrading of Finnish steel industry. The steel industry is strongly linked through vertical (supplier/buyer) relationships to other Finnish successful industries (See figure 3.5.).

Figure 3.5. The linkages between the Steel Industry and Other Competitive Finnish Industries.



The strong established user-producer relationships are important in the process of innovation and upgrading in the steel industry. Due to the existence of internationally competitive steel user industries in the home base, the steel companies have had a direct access to their needs and have been able to supply them with specialised steel grades. The close links between the steel industry and the related industries have also meant synergy advantages in joint problem solving and joint R&D.

There are also important links between the research institutions and the steel industry in Finland. The steel companies work closely with several Finnish universities of technology and the Technical Research Centre of Finland (VTT). The companies have sought to set up expert groups in universities to serve various sectors of the steel industry. The research institutions in Finland are internationally at a high level.

The steel companies in the Nordic countries have long worked in close co-operation too. The Swedish Steel Producers' Association (Jernkontoret) and a research centre in Luleå, Sweden, are examples of this joint research capacity.

The Finnish steel companies, especially Rautaruukki, have invested heavily in downstream activities. There can be found two main reasons for this development. Firstly, the growth of Finnish steel firms is primarily sought in the further processing of steel and in the business areas related to and supporting the steel production. Secondly, the steel producers' aim has been to rise continuously the value added of steel production.

The companies have strong positions in a number of downstream industries, which are interrelated with their basic business, such as tube and pipe industry, construction industry and as car industry's components. They have also gained strong international positions within these industries.

Also new business activities, which back up the basic steel business are in the interest of the steel firms. E.g. the attempts to solve the control and measurement problems involved in steel production have given impetus to new areas of business activity. An example is the technology business which strengthens the competitive advantage of a steel company and helps the company to stay a step ahead of competitors in the application of new technology to production methods. The new technology products can even extend beyond the steel industry and benefit other industry sectors in Finland.

Although there are no strong suppliers of machinery for the steel industry in the home base and although the importance of mining industry as a supplier has decreased due to diminished iron ore mines, there is one industry which is a strong supporting industry for Finnish steel producers. That is the energy industry. The energy intensive steel industry has gained competitive advantage in energy costs since the price of energy have been competitive in Finland compared to e.g. the European energy prices and also the supply of energy has been sufficient in Finland.

3.3.4. Strategy, Structure and Rivalry

The tough rivalry in the world's steel industry has forced Finnish steel producers to introduce both low cost and differentiation at the same time in firms' strategies. Innovations and upgrading of processes have enabled this aim. The producers have strong domestic market position but the growth potential is sought from abroad. The strategic aim of companies is also to increase value added of production by integrating into downstream industries. From these industries economies of scale can be reaped and they affect the profitability of the companies as well.

The Finnish steel companies have each specialised to produce different steel grades. The division of labour in Finnish steel industry has decreased rivalry between the steel producers. But this has not meant that the steel companies have a monopoly position in home market or that they have ignored the importance of innovation and upgrading. Since Finland has an open economy imports of steel are allowed to Finland. The competition felt by the Finnish steel companies comes through foreign competitors importing steel into domestic market. In order to be better than the foreign competitors and to be able to better serve the domestic customers the Finnish steel companies have continuously improved quality and service, and have created new products and processes.

The demand factors have influenced the Finnish steel firms to introduce economies of scope in order to survive in competition. The companies must introduce flexibility in production in order to adjust to today's changing market situations. This has meant that flow times of production have been cut and deliveries of products have been improved. Also co-operation between every level and department within a company has to be improved in order to get new product innovations quickly to the market. Finnish steel firms have selected key customer groups with whom they work with close co-operation and do joint R&D. In order to serve better their customers and to be competitive the steel firms have noticed that they must also take into account the customers' customers. This gives really competitive advantage to the companies.

After the World War II, the steel industry became a prestigious industry sector in Finland. This has had effects on the motivations of the individuals who manage or work in the steel firms and also on the firm's shareholders. The sustained commitment to the steel industry has been especially important in times of receding trade. The investments made into the steel industry in order to improve the productivity and to upgrade technological base and skills give competitive advantage to the Finnish steel industry also in the future.

3.3.5. Influence of Government Policy

Characteristic to the Finnish steel industry is that the two companies, Rautaruukki and Outokumpu Steel are owned by Finnish government. There can be found different reasons why the government has involved in Finnish steel business.

Firstly, the government saw that it was important that Finland could be a self-sufficient country regarding the steel industry. It was considered as an advantage to have a domestic

supplier industry to the rapidly advancing Finnish engineering industry. Also the production of operating iron ore mines was desired to manufacture domestically.

Secondly, the capital-intensive character of the steel industry in a country poor in capital resources was a reason for the formation of the state-owned steel companies. Also the regional policy conducted by the government has affected the location decisions of steel plants in Finland.

The Finnish steel industry has suffered from the situation in the EC market area during years 1980-1985 since there the governments have heavily subsidised the European steel producers in order to sustain the competitiveness of the industry. This affected heavily the Finnish steel producers since the EC area was the most important export market in that time[39]. Finnish base metal industry as a whole has got little direct support from the government. The total sum of subsidy for the base metal industry is about FIM 30-40 million[40].

Today the Finnish steel producers as well as their European competitors can have only indirect subsidies by government in areas such as research and product development, environmental protection and in social costs resulted from the reductions of capacity. The investment subsidies or direct operational subsidies are not allowed anymore in the steel industry. The transportation subsidy that the steel producers in Finland get will be removed due to the EC rules.

The current negotiations of Finland's membership in the EC are considered to be important for the Finnish steel industry. It seems that the EC intends to keep strictly to protecting of its own steel industry. Although the Finnish steel industry has operated since 1974 (the CECA-agreement) according to common rules in the European steel industry the full membership in the internal steel market would be necessary to Finnish steel producers if the protectionism is raising[41]. The membership in the EC will open doors into European technological projects and that way the Finnish steel industry will get financial support for its R&D and markets for products developed in the projects.

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[39] Materiaalitalous 9/1987, 32-33

[40] Mäkinen 1992, 12

[41] Vuoriteollisuus 1992/1

The government has the most important role in stimulating improvements in science and technology. In order to sustain the advantages obtained from modern steel technology and to be able to have access to skilled engineer resources the Finnish steel industry hopes that the government is also ready to encourage the investments made in education and research. The co-operation between the government's technical research centre and the steel industry, and between the Finnish universities of technology is necessary in order to direct the research funds properly in projects which are important to upgrading or deepening the competitive advantage of the Finnish steel industry.

The government's stand on Finnish energy policy is of great importance to the development of the steel industry. Especially the energy policy affects the steel companies long-term investments in the home base. To the steel companies, which use scrap or ferrochorome as a raw material in production, the cost of energy and its sufficient supply are basic factors that direct the investment decisions. The government should take actions to introduce an energy policy that supports the competitiveness of the Finnish steel companies.

3.3.6. Chance

A great chance event for the development of the Finnish steel industry was the World War II. The production capacity of the industry was raised during the war in order to meet the growing demand of the war industry. Also the war reparations and the reconstruction of Finnish economy created opportunities to diversify and to increase the steel production.

Also the advent of new steel technologies (continuous casting and BOP process) in the beginning of 1960s created the potential that the Finnish steel firms could nullify the advantages of previously established large competitors to some extent. The new modern steel technology provided an opportunity for Finnish steel firms to gain international position.

4. Case Companies of Finnish Steel Industry

4.1. Imatra Steel

The data of this case is based on the interview with Sven Bertlin, President of Imatra Steel. Other sources are mentioned in the text.

4.1.1. Historical Development and the Market Position

In year 1915 two graduate engineers, namely Berndt Grönblom and Gustaf Aminoff founded a company called Elektrometallurgiska Aktiebolaget. The company had two little smelting plants in Vuoksenniska and in Nokia. The main products were ferrosilicon and synthetic pig iron. Their main idea was to develop large-scale iron processing, based on supplies of raw material in the home base. They were also interested in introducing the new electro-metallurgical technology in steel making but in the 1920s Finland did not have enough hydropower resources. Finland's struggle for independence during the years 1917-1918 interrupted the production of smelting plants and Berndt Grönblom was invited in special tasks by government during that time.[42]

Grönblom did not forget his vision of Finnish large-scale steel production. In the late 1920s Grönblom established a mechanical pulpwood factory (Osakeyhtiö Vuoksenniska Aktiebolaget 1926-1939) and extended the production of the smelting plant in Vuoksenniska. The new power station that was founded in Imatra by Valtion Koskivoimatoimisto in 1929 made the extensions possible. The production of the smelting plant was diversified to produce alloys for steel making, such as ferrowolfram, ferromolybdenum and ferrochrome. In the 1930s the company was successfully among the important European suppliers of these alloys. In year 1933 Elektrometallurgiska Aktiebolaget and Osakeyhtiö Vuoksenniska Aktiebolaget were merged and the new company was called Oy Vuoksenniska Ab.

An unexpected and surprising opportunity for Vuoksenniska was offered by Outokumpu's copper smelter in Imatra. The copper smelter produced burnt leavings which contained 60% iron. Vuoksenniska started to examine the opportunities to use the cinders of pyrite

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[42] Laakasuo 1985, 11-13

concentrates as raw material in iron production. The result of the research was good and the modern iron and steel production, based on domestic raw material, started during years 1935-1937 in Imatra.

The first Finnish large-scale iron and steel works applied electro-metallurgical production methods. The electrical furnace used in the iron production was a Norwegian type of Tysland-Hole furnace and it was the largest electrical furnace of its kind in the world[43]. Norwegian and Swedish experts assisted with the start-up phase and the works acquired an efficient operating rate from the beginning.

Interwar period 1939-1944 interrupted the extension of the Imatra iron and steel works. The production of the works was used totally to satisfy the needs of domestic war industry. The reconstruction of Finnish economy and the war reparations put big requirements on Vuoksenniska Oy. In 1943 Vuoksenniska Oy established an other ironworks in Turku (Turun Rautatehdas 1943-1979) in order to meet the growing domestic demand of pig iron. Vuoksenniska Oy also started to produce special steel niches like steel for tools and structures and stainless steel after the year 1949.

During the years 1950-1960 the company concentrated on producing ordinary steels but the share of production of special steels rose all the time. In the beginning of the 1960s a large investment program was implemented in Imatra ironworks. The aim was to concentrate in the long run on special steels for car and engineering industry and to rise the plant's production efficiency. The exports of these special steels were also started successfully to Scandinavia and to West-Germany during the 1960s. During the years 1960-1961 Vuoksenniska Oy together with the Swedish company, Stora Kopparbergs AB, established a new blast furnace plant in Hankoniemi, Oy Koverhar Ab.

The year 1965 was an epoch-making year to the development of the company. Vuoksenniska Oy was among the first steel making companies in the world that introduced the continuous casting method in steel processing. At the same year the company established a research laboratory and invested more and more in R&D, quality control and in marketing.

Vuoksenniska Oy has been a family-owned company ever since its establishment until in 1967 the Grönblom family was forced to sell the company for financial reasons to the

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[43] Raumolin 1988, 15

holding company of Pohjoismainen Yhdyspankki (PYP). In 1971 Oy Vuoksenniska Ab and Ky Åminnefors,Oy Fiskars Ab & Co Kb were merged and the new company got the name Ovako Oy. In 1972 Ovako Oy was owned by Pohjoismainen Yhdyspankki, Oy Fiskars Ab, Oy Wärtsilä Ab, Oy Strömberg Ab and by Lohjan Kalkkitehdas Oy. In 1979 the owner companies of Ovako carried out a significant structural rationalisation in Finnish private-owned steel industry. Ovako Oy Ab concentrated on the production of long steel products. The organisation structure of Ovako Oy Ab was changed to a profit centre based system, which was formed of three divisions: base steel division, steel wire division and steel products division.[44]

With this reorganisation the production capacity of ordinary steel was adjusted to meet the domestic demand. The production was concentrated in Koverhar steel works and in rolling mills of Dalsbruk and Åminnefors. The production of demanding steel grades was developed according to the needs of own rolling mills and further processing units. Imatra steel works concentrated on producing long special steels and it became an export-oriented steelworks.

In order to be competitive the company started a strong rationalisation programme during 1980-1983. It invested in process control and automation in order to raise the productivity and promoted research and development. One result of Ovako's own R&D was the introduction of M-steels (M refers to machinability) in 1981. These steels were aimed to create real savings to the user. Besides excellent machinability and good mechanical properties of M-steels, these steels allow increased cutting speed in machine-tooling without shortening of tool life. Ovako was the first to put M-steels into large-scale production in Europe and gained international recognition. It put special emphasis on marketing too and was also able to sell new process control technology abroad.

By 1985 the synergetic benefits of the restructuring of the Finnish private steel industry were exploited and Ovako was facing new challenges. The production scale of long special steel products was small regarded internationally. Also the production processes of Imatra steelworks needed upgrading. At the same time the Swedish special steel producer SKF Steel was facing structural changes. In 1986 a Nordic rationalisation of steel industries took place. Ovako and SKF Steel were merged into a new company Ovako Steel Ab. SKF Ab owned 50% of the new company whereas Oy Wärtsilä Ab had 25% of shares, Oy Fiskars Ab 20% and Union Bank of Finland 5%. The joining of forces of these companies was seen to

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[44] Company's annual reports 1970-1979

give better opportunities to compete in the world's tough steel markets. It also provided bigger investments in R&D and opened new market areas to products of Imatra steelworks[45].

In 1987 Ovako Steel gave up its production of ordinary steels and established together with Rautaruukki Oy a company called Dalsbruk Oy Ab, which continued the production of long ordinary steels. Imatra steelworks specialised to produce engineering steels. At the end of the 1980s Ovako Steel integrated forwards into the continental market through acquisitions.

In 1991 the Finnish-Swedish steel group was divided into two parts. The Finnish conglomerate Metra Oy Ab bought the Finnish part of the Ovako Steel Ab. The other part of the group stayed in ownership of SKF Ab. The new division was named as Imatra Steel and it became a wholly owned subsidiary of Metra. The biggest unit of Imatra Steel is the Imatra steelworks with its further processing plants: Billnäs's spring plant, Jokioinen's and Orivesi's nail and steelwire plants, and Loimaa's chain plant. It also has two processing plants in Sweden: Ovako Kilsta AB and Ovako Tooling AB in Karlskog. Due to downtrend in steel market it was considered to be important that Imatra Steel concentrates on its niche i.e. to produce demanding special steels to the car and engineering industry. The production is based on the high technological level of Imatra steelworks. The metal industry's traditions and international networks of Metra will support the development of Imatra Steel in the future.

In March 1993 Imatra Steel sold the plants of Jokioinen, Orivesi and Loimaa on MBO basis. In this way Imatra Steel was able to maintain the logical production chain from Imatra steelworks to further processing plants (Billnäs, Kilsta) of which 2/3 supplies the car industry now. The table 4.1. illustrates the production units of Imatra Steel.

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[45] Matti Sundberg 1987, 16

Table 4.1. The Production Units of Imatra Steel

Imatra Steelworks	Billnäs	Kilsta	Kilsta Tooling
Products: special steels for car and engineering industry	Products: leaf and parabolic springs for commercial vehicles	Products: crank axles, spindles for trucks and passenger cars	Products: forging tools
Export: 70% of production. Main export areas: Scandinavia, Germany , Great Britain, France	Export: 75 % of production goes mainly to Swedish truck industry	Export: 40 % of production. Main export areas: Germany, Great Britain	Supplier of Kilsta forgery
Turnover: FIM 350 million	Turnover: FIM 55 million	Turnover: FIM 175 million	Turnover: FIM 15 million
Employees: 700	Employees: 115	Employees: 295	Employees: 45

Markets and Rivalry

The share of home market of Imatra Steel's production is 16%. The rest is exported. The main export areas are Scandinavia, Germany, France and Great Britain. The company's market share in special engineering steels in Europe is ca. 5%.

The steel crisis in Europe has affected on Imatra Steel. The production of cars has decreased by 20% in Europe and this has cut down steel deliveries into the industry. The price level has also dropped. Imatra Steel is able to use only 70% of its capacity. The company has adjusted its operation according to market situation.

Due to the chosen strategy to concentrate on special steel niche and to compete globally company's rivals are found abroad: Ovako, Inexa, Fundia (Scandinavia), Krupp-Hoesch, Thyssen, Kloeckner, Saarstahl (Germany), United Engineering Steels UES (England), Asko metals (France), Falck Ilva (Italy), Sidenor (Spain).

Due to market situation the German rivals have experienced large losses which have accounted for 5-50% of turnover. They have introduced large capacity cut downs. The English and French counterparts have succeeded quite well because of restructuring of steel industry in 1970s. Imatra Steel has survived well in competition although it has made loss because of large capital costs and low capacity utilisation. Foreign rivals have larger operative units but Imatra Steel's counter forces in competition are flexibility and compact production. Rivals have also invested more in R&D and marketing due to their strong financial background, but there is now evidence that the investments have not been focused in proper way to benefit the industry.

4.1.2. Analysis of Competitive Advantage of Company

Company Strategy

At the core of strategy of Imatra Steel is to produce special steels that offer cost savings to users more than its competitors are able to. The target customer segments are car and engineering industry. The chosen niche requires globalization, selling world-wide. Imatra Steel has achieved also brand identification for its steels, which strengthens the strategy, not only through its own marketing efforts but also through international scientific research units.

Distribution is carried out in "business to business" basis to the big customers of car and engineering industry. The company uses domestic and Swedish steel wholesalers too and has own sales subsidiaries in England, Germany, and in France. Imatra Steel has also a special steel depot in Turenki that serves domestic steel users and ensures the deliveries. Orders and deliveries of steels are based on computer systems that offer accuracy and promptness to the customers. One essential part of the overall strategy is the location of Imatra steelworks in eastern part of Finland near raw material sources, which generates competitive advantage in logistics and transportation costs to the company.

Investment strategy is aimed at to support the overall strategy of the company. The production of Imatra steelworks is based on the high level of technology. During the years 1987-1990 the company invested circa FIM 600 million in steelworks in order to upgrade the production processes and equipment and to gain cost efficiency in production. In the future the investments are concentrated to open bottlenecks in production and to decrease dust emissions of the steel smelter according to environmental standards. Due to large

investments Imatra steelworks is one of the most modern special steels producers in Europe now. The modern production plant and the flexibility of production strengthen its position in competition.

R&D is concentrated on product development and market research and it is done mostly in co-operation with customers, which strengthens the company's strategy. The integration of Imatra Steel into forging sector supports R&D strategy by supplying a testing site for steels of Imatra steelworks and an inside look for customer needs. Imatra Steel has also strong connections with the universities of technology in Lappeenranta and Helsinki and with the Technical research centre of Finland (VTT), which benefits own R&D of the company. The company continues also research co-operation with the university of Hannover in Germany in M-steels.

Core Competence Areas of the Company

Factor Conditions

The basic factors which create competitiveness for the company are energy and scrap. They account for 50% of companie's total costs. The special steel production is totally based on iron and steel scrap in Imatra steelworks. Imatra Steel buys one fifth of the scrap purchases from the domestic supplier Osuuskunta Teollisuuden Romu, in which it is a shareholder. The availability of domestic scrap gives considerable savings in delivery costs to the company. In addition scrap is imported from Russia by railway (ca.100000 tonnes). This creates also logistical savings, since the location of Imatra steelworks is near the Russian border. By using scrap as a raw material the company has adopted the principle of sustainable development, which raises the image of the company in environmental aspects.

The production chain of Imatra steelworks is highly energy intensive. The supply of energy at a competitive price in Finland has generated competitive advantage to the company compared to its foreign competitors.

Technology

Imatra steelworks is one of the most modern steelworks in the Europe now due to heavy investments in upgrading of processes and equipment at the end of 1980s. The technological capability is a factor of which the company derives benefits in competition. From the

beginning of the company history technology has played major role in competitiveness of the company. The chosen technology, electrometallurgy and iron and steel scrap as a raw material, generates cost advantages to the company compared to the iron ore based production of steel. Since 1990 all steel is continuously casted in the Imatra steelworks, which also cuts costs of production.

The new special steel grades introduced by Imatra Steel have demanded many changes in production processes. In order to meet the requirements the company has invested strongly in own R&D. A good example of R&D work is M-steels of Imatra Steel. The basic knowledge to produce these kinds of steels is known by every competitor but no one else has succeeded to produce M-steels in large-scale but Imatra Steel. This is because of Imatra Steel possesses a large amount of cumulated in-house know-how in steel processing, especially in metallurgy, which is on the other hand linked with the high level of education in metallurgy in the Finnish universities of technology.

An other thing which supports Imatra Steel's R&D is its own steel-forging industry. The own forging company, Kilsta, gives a testing site for the results of R&D work. The joint problem solving and co-operation in R&D is aimed to lead to faster and more efficient solutions, which benefit also the customers of Kilsta. Today the R&D is concentrated on tempering treatments of steels in order to save energy, to decrease investment costs and to speed up the handling of materials in the forgery. This requires also introducing of new steel grades in the steelworks.

Co-operation with Customers

The most sophisticated buyer groups of Imatra Steel is the forging companies and working shops of car industry: Volvo, Scania (Scandinavia)/ Ford, Mercedes, MAN (Germany)/ Peugeot, Riv (France)/ Perkings, Rover, Jaguar (England). When the company is accepted among the car industry as a competent supplier this ensures that it will manage with its other buyer group, engineering industry. Demand conditions in buyer groups have guided the company to adopt user-oriented manufacturing strategy. Direct and open relationships with customers are highly emphasised in order to sustain competitive advantage.

Differentiating in a steel market requires unique advantages created to the customers. These can be cost savings like reduction of customer's stock level and shortening of production lead time in workshops or better products to the customers. However, the aim of Imatra

Steel is to take part in the product development of the customer already at an early stage, which gives better opportunities to the company to affect the advantages of customer more effectively. This requires that the customer trusts the supplier and knows the capabilities of the supplier. By investing in R&D co-operation and taking notice of problems of customers in steel production Imatra Steel has created established user-producer relationships which give competitiveness in tough steel market.

4.2. Rautaruukki, Steel Division

The data of this case is based on the interviews with Pekka Vaarno, Director of Steel Division, Kyösti Karjalahti, Assistant Director, Strategic Planning, Peter Sandvik, Director of R&D, Jukka Väyrynen, Manager of R&D, Olavi Kangas, Manager of Marketing Services Department, and with Pentti Hujanen and Kalevi Sohlo, both Managers of Customer Service. Other sources are mentioned in the text.

4.2.1. Historical Development and the Market Position

During the 1950s the Finnish government took the initiative in rising the stage of self-sufficiency in Finnish steel industry. At that time the production of steel plates was lacking totally in Finland and that was a serious shortage considering the domestic ship building industry.

The Finnish government owned a mining company called Otanmäki Oy that was established in 1950 to exploit the iron ore deposit in Otanmäki area. Based on these iron ore resources the government's idea was to refine iron into steel and further into steel plates. The plan came true in 1960 when Rautaruukki Oy was established[46]. First the company built a smelting plant in Raahe (the production started in 1964) which was based on the Soviet steel technology. The decision to locate the plant in Raahe was made because it sited near the harbour and there was enough working force available in the region. Also railway connection to plant was built by government (The iron ore concentrate was brought in the plant by trains). The capacity of the smelting plant to produce pig iron was estimated to be

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[46] Luukko 1990, 9 : The main shareholder was government and the other shareholders were state-owned companies Valmet, Outokumpu, Otanmäki and four big private-owned metalcompanies Fiskars, Lokomo, Rauma-Repola and Wärtsilä.

450 000 tonnes but already during the first years the capacity rose into 658 000 tonnes. Only 10-15% of the production could be sold to domestic markets so the company had to start exporting from the beginning. At that time the share of Rautaruukki's pig iron of the world trade was 10%. To market this amount of steel to the world's steel market was difficult in itself so Rautaruukki made an marketing agreement with American Lissauer company that sold pig iron to Japan[47].

The management of the company emphasised the role of R&D in order to be competitive right from the beginning. In the 1965 the company established its own R&D unit. A lot of efforts were allocated in developing of quality of steel products and a special interest was in welding technology and in corrosion resistance of steel grades.

Right after the establishment of Raahe smelting plant Rautaruukki Oy started the construction of steel smelting plant and rolling mill in Raahe. This integrated steel plant, Raahe Steel Works, started the production of steel plates in 1967. At that time steel was still produced in the world with processes dating back to the 19th century. Rautaruukki's radical decision to introduce the modern process route - blast furnace, oxygen converter, continuous casting - at the Raahe Steel Works gave the company competitive advantage over the older West-European steel industry till the early 1980s[48]. Rautaruukki was the first producer of steel plates in the world whose production was totally based on continuous casting.

In 1972 Rautaruukki raised the processing value of ordinary steel plates by establishing a cold rolling mill in Hämeenlinna. The demand for cold rolled steel plates was rising in Finland in that time. Likewise, the company integrated into downstream industry, steel pipe manufacturing, through acquisitions in the early 1970s. It acquired two domestic pipe manufacturers, Paltek Oy and Etna-Rör Ab[49]. During 1970s Rautaruukki doubled the production capacity. In 1966 Rautaruukki exported 20% of its production, but ten years later its exports accounted for 60% due to increased capacity in production.

In the 1980s Rautaruukki gave up the mining business and in order to find new working places for the miners it diversified into the special wagon industry. This new industry sector

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[47] Luukko 1990, 99

[48] Vuoriteollisuus 1985,9

[49] Luukko 1990, 157-160

benefited from the experience and know-how of Rautaruukki's steel industry. Rautaruukki strengthened also its market position in downstream industries in Scandinavia through acquisitions and established new sales companies. It got involved in steel wholesale trade in 1989 too.

The diversified production structure and the market changes set new challenges to Rautaruukki's management in the mid 1980s. The old operations model of the company was production oriented and the way of management was too concentrated and bureaucratic. In order to meet new challenges Rautaruukki started strategic planning in 1985 and the organisation structure was changed to a profit centre based system in 1987.

The strategic definitions guided the company towards customers and cost efficiency. The key sources of competitiveness were considered to be found in the ability to be flexible, to be able to offer high quality and service and to be a technologically advanced company.

Markets and Rivalry

The homebase and the neighbouring countries are the most important market areas for Rautaruukki Steel Division. 47% of deliveries of hot rolled steel plates goes to own processing plants. The direct export to EC area account for 24%. The share of domestic sales is 16%. The strong position on these markets is based on the extensive product range, high quality, and on individual customer oriented service. The customers get tailored products with short delivery time. Exports are focused on the most competitive product and market segments. The aim is to retain Rautaruukki's position in Central Europe, England and in USA. The growing export areas in Europe are Spain and Portugal and Rautaruukki is also looking for new markets for steel plates in the Middle East and Southeast Asia.

The biggest competitors of Rautaruukki are found from Germany (Thyssen Stahl), France (Usinor Sacilor) and from the Netherlands (Hoogovens). The benchmarking of competitors are continuous in Rautaruukki. The rivals have economies of scale in production and their capital costs are smaller than Rautaruukki's. Smaller batch sizes in steel production (Rautaruukki's batch size 100 tonnes, competitors' 200-300 tonnes) give advantage to react quickly to customer needs and enable quick deliveries. Labour costs are at the same level with the competitors'.

Rivalry has been affected since the competitors have had to reformulate their strategies in order to match the current market changes. Thyssen, Usinor Sacilor and Ilva have announced reductions of their steel production. The steel import duties imposed by USA have affected European steel producers too. Rautaruukki among other companies have been charged with dumping steel prices in USA market. Many companies have made decision to halt exports to USA. This means that these quantities must be sold elsewhere and Asia is the new market for many European steel producers.

4.2.1. Analysis of Competitive Advantage of Company

Company Strategy

The company's strategy is to offer differentiated steel products cost effectively to selective buyer groups. The growth of company is sought in downstream industries, in which economies of scale can be reaped. Also strategic alliances are possible in future in order to strengthen the international position of the company.

Rautaruukki has integrated strongly into the downstream industries. By integrating vertically Rautaruukki has been able to gain growth potential and increase the value added of production. This has also enabled the company to move near customers. 47% of steel deliveries are sold for own processing plants. It uses world's market prices in internal selling. Rautaruukki has focused on the development of its supply chain by improving every process phase to operate cost efficiently and without faults in production.

Rautaruukki has a strong position on Scandinavian markets in steel pipes and profiles, as well as thin sheet products for construction. The company is strongly related to construction industry and is a shareholder in some construction companies. It is also the third largest manufacturer of precision tubes and hollow sections in Europe[50]. The company has integrated to the production of transportation equipment and services, too. Rautaruukki develops actively new business segments in engineering and technology, which support the core business, but new technology products can find markets in other industries too.

The chosen strategy of Rautaruukki has influenced the production of steel so that it is now based on customer needs. The Raahe steelworks are able to produce even 700 customer

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[50] Rautaruukki News 1992

specific product applications. During years 1985-1989 Rautaruukki invested FIM 2,3 million in Raahe steelworks in order to meet sophisticated buyer needs[51]. Due to these investments the flexibility of production increased, the time of delivery decreased from 10 weeks to 3 weeks and the reliability of deliveries increased. Renewal of steel products is essential in tough market situation. In 1992 15% of all deliveries of Rautaruukki were new steel grades/-dimensions/-product types, which have been in production under five years. In order to improve co-operation with customers Rautaruukki has adopted the EDIFACT system in 1990. This increases accuracy of information flow and gives cost savings to the company This is considered to be a strategic competitive advantage to the company.

After many years of intensive investments Rautaruukki has sharply reduced its investments. From the 1991 level of FIM 1200 million investments drop to FIM 675 million in 1992. Only current and extremely important investments will be implemented. The aim is to make the existing units more cost effective.[52]

R&D investments have been sustained at a high level. Rautaruukki uses about FIM 80 million in R&D work annually. The focus is on increasing the productivity and cost efficiency of processes and production methods and on improving the quality and delivery time. Rautaruukki will obtain ISO 9001 certification to all its units. The company has also invested strongly in training, marketing and in the development of information systems.

Core Competence Areas of the Company

Factor Conditions

Rautaruukki imports iron concentrates from Sweden (Malmberget) and Russia (Olenogorsk). Raw material inventories supply two weeks' demand of steelworks. Raw materials are mainly delivered by sea into Raahe harbour. JIT-Trans division of Rautaruukki takes care of bulk transports. This traffic is handled with the pusher barge fleet in the Baltic Sea (See figure 4.1.). The pusher barges have proved their economy over short transportation distances and with large transportation volumes[53]. The raw material imports from Russia are delivered by railway. Export transportations are handled by sea too and

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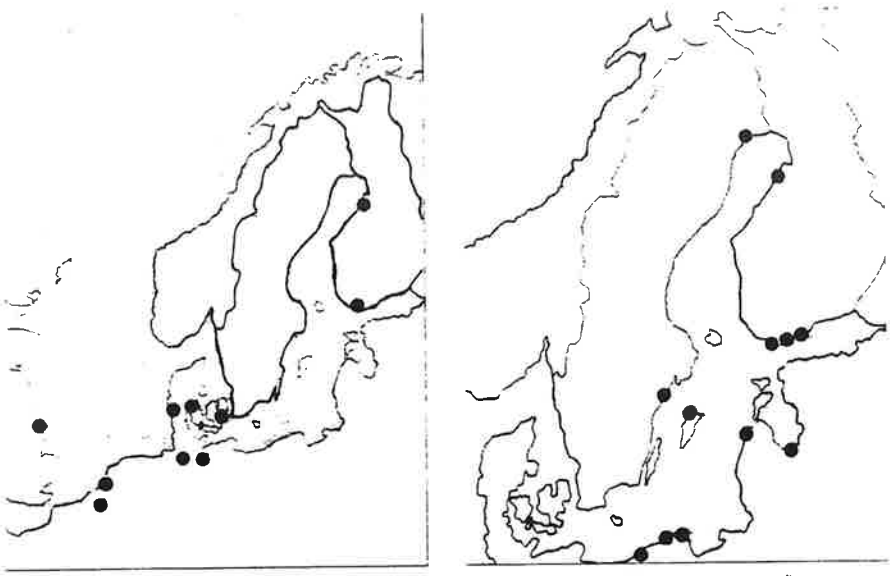
[51] Rautaruukki Oy Teräsryhmä 1990

[52] Rautaruukki News 1992

[53] Rautaruukki News 1992

Rautaruukki co-operates with Outokumpu and Dalsbruk in these transports. Thus, the Raahe steelworks is well situated in west coast of Finland considering its raw material sources and export markets. The good functional and practical harbour creates a competitive advantage in logistics.

Figure 4.1. Regular Harbours of the Pusher Barge Fleet of Rautaruukki



Export destination harbours in northern Europe. Regular harbours of the pusher barge fleet.

Source: Rautaruukki

A large investment in a basic factor was the construction of own coking plant during 1987-1992. The coking plant is an integral part in iron production and its by-product, cokegas, substitutes heavy fuel oil demand in steel works. Another by-product, benzene, is sold to chemical industry in central Europe. The plant supplies the whole metallurgical coke needed in Raahe steelworks[54]. The company is able to sell coke for other Finnish steel producers (Koverhar steelworks, Tornio stainless steel works) too. With its own coke the profitability of the blast furnaces of Raahe steelworks is improved and the good quality of hot steel metal is ensured[55].

[54] Annual Report 1991

[55] Rautaruukki News 1993

Technology

Rautaruukki uses modern technology in its production processes. R&D unit in Raahe steelworks employs fifty engineers. Half of them works in product development and the rest in process development. Considering the size of the company Rautaruukki's R&D expenditures are above average in steel industry. Rautaruukki works closely with several Finnish universities of technology and the Technical Research Centre of Finland. The company is a strong supporter of university research. It has also international linkages. The co-operation with Swedish Jernkontoret is well-established and it opens connections to Nordic universities. An other international linkage is that the chairman of the International Iron and Steel Institute's Committee on Technology is Aulis Saarinen, who is a member of Rautaruukki's Board of Directors[56].

Rautaruukki Engineering and New Technology divisions support the development of the core business, steel production. These divisions develop and market e.g. process automation technology, equipment and material technology and pipe machines (MAS Seuthe GmbH in Germany produces these machines).

Generally the R&D unit in Raahe focuses on sophisticated customer based projects, which create new business opportunities for Rautaruukki. One example of demanding customer needs were the bridge and icebreaker projects. In order to meet these demands Rautaruukki became a pioneer in developing thermomechanical rolling capacity (ACC, accelerated cooling unit) and introducing high performance steel TM (improved weldability at a given strength level and better surface quality with little scale). The first applications of TM steels were the support structures for Finland's largest bridge in Heinola and shipbuilding steels for Finnyards's multipurpose icebreaker[57].

User-Producer Relationships

Rautaruukki has selected the lead-users or key accountants of its steels in order to gain better information of needs of customers. The first focus areas are steel service centres, off-shore industry, pipe and profile manufacturers and manufacturers of moving machines

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[56] Steel News 1991

[57] Rautaruukki Steel News 1, 1993

(forest machines, lifting machines)[58]. Close and well-established user-producer relationships give an opportunity to find the best suitable steel products for customer's purposes.

In steel service centres Rautaruukki has started co-operation with important steel wholesalers in Italy and France and the focus area is on development of steel strands. In off-shore industry Rautaruukki has long traditions as a supplier of shipbuilding steels. The company has good relationships both with Finnish and foreign producers of off-shore industry. Especially important information is gained from the company's own downstream industries, from Thin Sheet Division and from Tubular Products and Sections Division.

The development of products according to customer's needs demands also improved co-operation within the company between different units in the process chain. Much of emphasis has been placed on the development of co-operation between the company's sales, R&D and production units. The information flows between these units must be open in order to be able to quickly respond to changing market situations.

4.3. Outokumpu Steel

The data of this case is based on the interview with Antti Närhi, the General Manager of Outokumpu Steel division. The other sources are mentioned in the text.

4.3.1. Historical Development and the Market Position

Finland became an important producer of stainless steels when Outokumpu Oy started to produce coils and sheets of stainless steel in 1976 in Tornio. It was easy for Outokumpu to move into stainless steel production. The company possessed the key raw materials for stainless steel: nickel and chromium (5 % of the world's accessible chromium). Raw materials accounted for a third of the cost of steel sheet, and 90% of the raw material cost in stainless production went for the two metals[59].

The time appeared right for the development of a new production capability. Firstly, the company's raw material base was strong. Secondly, the market picture was healthy for

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[58] Titaani 4, 1993

[59] Kuisma 1989, 184

stainless steel. Finnish imports of stainless steel was increasing at 12.5 % yearly in the 1960s, and the domestic consumption was over 20 000 tonnes a year. Thirdly, there were new technologies available to obtain in steel manufacturing in the beginning of 1970s. The advanced steel-making technology (continuous casting, AOD-refining) introduced in the new Tornio plant gave it a competitive advantage in the world market, where oversupply was threatening. Also the mine-to-mill control of the chromium production chain gave unique advantage to the company in a way other producers could only hope to imitate.

Although the stainless steel business was unfamiliar to Outokumpu its strong technological background in non-ferrous metals gave optimism to carry out the project successfully. There was also experienced labour force available which in their part contributed to the success of the project. Also the company invested much in further education of its staff.

After the successful start-up phase the development of Tornio plant's production was rapid. The yearly production of the Tornio rolling mill grew to over 60 000 tonnes in 1979, and 80 000 tonnes a year later. The capacity growth was achieved by increasing the efficiency of operating machines. The success of the Finnish stainless steel both in home and foreign market encouraged the company's management to set a long-term goal of doubling the capacity to 160 000 tonnes during the 1980s.

The investments were made gradually in several different stages in order to expand the capacity as table 4.2. shows. In that way the company could better follow the development of technology in the world and was able to buy up-to-date technology in every investment stage to the plant [60].

Besides the capacity investments the company wanted to expand its production to finished stainless steel products. Especially the company showed interest in the Finnish tube industry. The tube industry's companies were major customers of the Tornio plant. The intense competition among the tube industry's companies gave them much bargaining power in stainless steel industry by forcing down steel prices. In 1980 Outokumpu acquired its biggest customer and one of the Finland's largest producers of finished stainless steel products (equipment and tubes for process industries), Oy JA-RO Ab. After this acquisition the company controlled the entire production chain from chromium ore mining to finishing of its

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[60] Talouselämä 1980/33, 43

high-quality stainless steel products. The stainless steel products of Outokumpu captured quickly a 70 % share of the domestic market[61].

Table 4.2. The History of Kemi Mine and Tornio Works of the Outokumpu Group in 1959-1991.

1959 The discovery of an extensive chromium deposit at Kemi
1967 The Kemi mine started its production
1968 The establishment of ferrochrome production plant in Tornio
1973 The Outokumpu Supervisory Board's decision to move into stainless steel production.
1976 The stainless steel mill at Tornio started production.
1980 The renovation of Kemi mine's concentration plant.
1983 The second annealing and pickling line at the cold rolling mill was started.
1984 The start up of the pebble mill in Kemi mine.
1985 The second production line of the Ferrochrome plant was started.
1988 The hot rolling mill started operation.
1989 The new sintering mill of the Ferrochrome plant was started.
1989 The modernisation of the steel smelting plant.
1990 The second Sendzimir-roller started.
1991 The third annealing and pickling line started.

Outokumpu also invested in R&D of stainless steels. In 1983 the company founded a new metal technology laboratory in Tornio in order to improve the customer service and to upgrade the quality of stainless steel and also to intensify the product development.

When the production capacity expanded the share of exports was emphasised. In the beginning of the 1980s over 60% of Outokumpu's stainless steel products were exported. The main market areas were Scandinavia and Western Europe. An advantage to the exports of stainless steel products was the availability of Outokumpu Group's own marketing companies through which the products were distributed. Although the world's overall steel industry was suffering from recession in the mid 1980s, Outokumpu was able to capture new market shares.

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[61] Kuisma 1985, 395

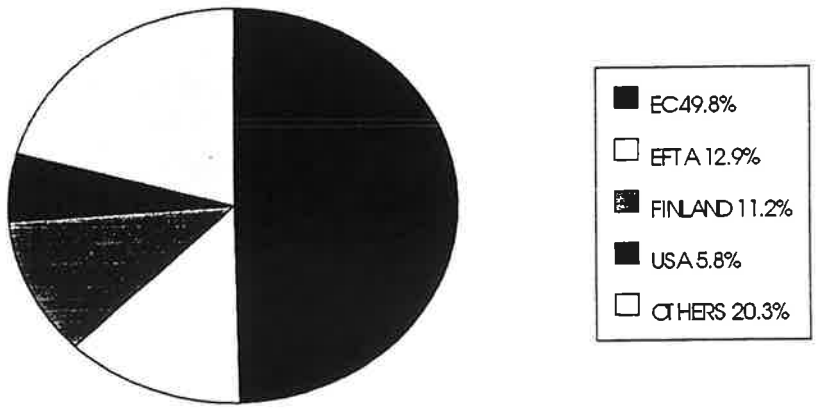
Today Outokumpu Steel consists of three units (Outokumpu Chrome, Outokumpu Polarit, JA-RO), which function almost as independent companies. In 1992 the steel division accounted for 20% of the Outokumpu Group's turnover and it employed over 2000 employees.

Markets and Rivalry

In 1992 the world stainless steel production totalled 12.76 million tonnes. Outokumpu Steel possesses 3% of the world market share with its production capacity of 400000 tonnes annually. It is estimated that the consumption of stainless steel will increase 3% annually in the world. Especially the consumption is increasing in Asia.

Outokumpu Steel exports over 80% of its production. The main market areas are the EC and EFTA countries (See figure 4.2.). Outokumpu Steel's important customer groups are food, chemical and paper industries. Also the car industry is becoming a potential user because of usage of stainless steel in car exhaust systems.

Figure 4.2. Sales by Market Area of Outokumpu Steel in 1992



There is overcapacity in stainless steel in the world market. The overall economic recession of industrialised countries, which has decreased the investment level, has squeezed the market situation. Also the increasing raw material (ferrochrome) flows of stainless steel from Russia and China have decreased the price level. The western producers have sought new

market areas from Asia, but the competition in that area is also tough because of recently built capacity by the Japanese, Koreans and Taiwanese producers of stainless steel.

The main competitors of Outokumpu Steel are found from big western Groups of steel producers such as Avesta Sheffield (Sweden), Thyssen, Krupp (Germany), Ilva (Italy), ALZ (Belgium), Usinor (France) and Ascernox (Spain). Competitors have big home markets as their advantage and they are able to get more financial support from their parent companies into investments and R&D compared to Outokumpu Steel. Because nearly 50% of Outokumpu Steel's sales goes to EC market area the company competes within its competitors home markets. Due to the long distance from Finland to main market area the company has improved the market presence by establishing a further processing centre in Holland. This improves market position by offering quick deliveries and improved customer service.

4.3.2. Analysis of Competitive Advantage of Company

Company Strategy

Outokumpu Steel's overall strategy is to produce high quality stainless steel products to global markets cost efficiently and to use customer-oriented marketing in order to sustain market positions. The value added of production is sought in downstream industries.

Outokumpu sells its stainless steel under the "Polarit" trademark in more than 55 countries[62]. In 1992 the five marketing companies operating in Japan, USA, Norway, Denmark and in Germany were connected under the Steel division, which supports and improves the market presence of Outokumpu Steel.

During years 1989-1991 the company invested in steel production FIM 900 million. Due to these investments Outokumpu Polarit is able to produce 250 000 tonnes of cold-rolled stainless steel coils and sheet annually and hot-rolled coils 100 000 tonnes. Today Tornio steelworks is a modern and efficient production plant with high automation level of processes. Besides capacity expansions investments have been made in environment protection and improving working conditions. In 1991 the environmental investments accounted for about FIM 80 million.

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[62] Inside Out 3/1992

R&D work is focused on the development of market based products and production processes. The improvements in efficiency of production chain and in environment protection are under continuous research. The developing of quality assurance system is also essential, because ISO certification is compulsory in the future in the EC and American markets. Polarit and JA-RO have already gained registration of ISO. Total Quality Management (TQM) methods are also under developing phase.

Fifty persons of Outokumpu Steel's personnel work in R&D and about 1% of division's turnover (FIM 30 million) is used in R&D. Tornio steelworks has its own well-equipped laboratories and addition to that Outokumpu Steel uses Outokumpu Research Centre. The connections with Finnish and other Scandinavian research centres and universities are good and well-established.

Core Competence Areas of the Company

Factor Conditions

The basic factors of production support the stainless steel production. Stainless steel production is a growing industry sector within the steel industry in the future. Chrome ore resources of Kemi mine are sufficient and will last for 150 years to come[63]. The nickel production of Outokumpu Group gives advantage to the steel division although it uses also global sourcing of nickel. The integrated production chain from chrome mine to stainless steel gives competitive advantage for Outokumpu Steel.

The production of ferrochrome is very energy intensive. Due to own R&D work the process has been able to make very cost-efficiency. This is important considering the whole stainless steel production. The supply of energy at a competitive price in Finland will in future become an issue.

Outokumpu Steel possesses specialised factors in human resources and in metallurgical know-how too. Upgrading of these factors occurs through investments in training and in R&D.

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[63] Annual Report 1991

Technology

The chosen technology (AOD process) twenty years ago has proved to be right and no major breakthroughs in stainless steel refining processes are expected in near future. Upgrading of processes and equipment is continuous in Outokumpu Steel. The objectives have been among other things to decrease energy consumption, to improve the exploitation of chrome ore and environment protection.

Nowadays all stainless steel producers use continuous casting in production. However by the second half of the decade competing technology with continuous casting will be thin slab casting, which has been used in trial quantities of stainless steel casting in the USA[64]. This new technology will introduce further cost reductions for stainless steel producers. Outokumpu Steel follows the development of this technology and searches for the possibilities to introduce it in its production.

4.4. Fundia, Dalsbruk Ltd

The data of this case is based on the interview with Klas-Göran Eriksson, General Manager of Dalsbruk Oy Ab and Executive Vice President of Wire rod group of Fundia, and with Henry Engblom, Director of Reinforcing Division. The other references are mentioned in the text.

4.4.1. Historical Development and the Market Position

Large reorganisations of Scandinavian's steel industry in long steel products was carried out in the late 1980s. The consequence was that the practically only producers of long steel products were Dalsbruk in Finland, Fundia in Sweden and Norsk Jernverk in Norway. The reorganisation was itself successful but not sufficient, because production capacity remained high compared to the Scandinavian consumption. In order to response to the market situation these three Nordic steel companies were united. In 1991 Rautaruukki (the owner of Dalsbruk) and Norsk Jern Holding acquired the Swedish Fundia AB, and in 1992 Fundia acquired Dalsbruk Oy Ab and Norsk Jernverk AS. The new Nordic steel Group got the name Fundia.

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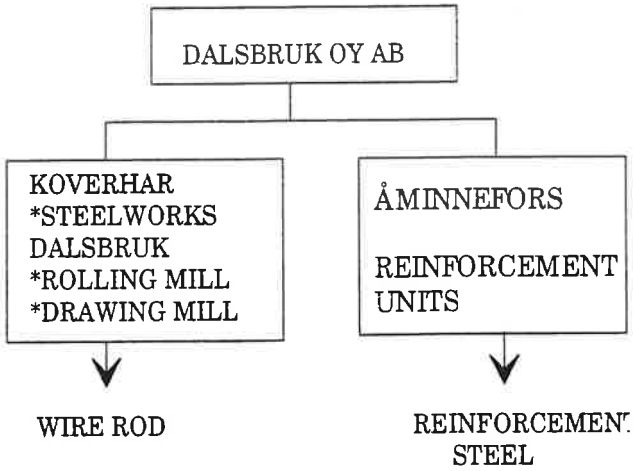
[64] MBM August 1993

The Finnish part of Fundia Group, Dalsbruk, is the only producer of reinforcing steel and wire rods in Finland. The company has an integrated production chain from iron ore production to end products. The figure 4.3. illustrates the production units of Dalsbruk.

Figure 4.3. The Production Units of Dalsbruk



Koverhar steelworks, the rolling mill and drawing mill of Dalsbruk form the base for the production of wire rod. The roots of Koverhar steelworks are found from 1960 when the production of pig iron started and the steel plant came on stream in 1971 under the ownership of Ovako Oy. Today Koverhar's main product is continuously cast billets. The production capacity of the steelworks is about 500 000 tonnes annually. The production is based on iron ore. The plant uses 700 000 tonnes of iron ore per year, which comes from Sweden (LKAB) and from Russia (Murmansk) by sea or railway deliveries. The steel production process at Koverhar is self-sufficient in energy. Cinder, which is a by-product of the steel process is sold mainly to road-building industry. The location of steelworks is ideal, because it is situated near railway and it has an own harbour. The harbour is open all year long and about 200 ships visit the harbour annually. One third of the billets are exported through the plant's harbour and the rest goes by road (30 truckloads per day) to the rolling mill of Dalsbruk.

The rolling mill of Dalsbruk has long traditions. The first rolling mill at that site was established already in 1860 and in 1894 the first Finnish wire rod rolling mill was founded in Dalsbruk. Today Dalsbruk rolling mill produces all of the Fundia Group's wire rods. Its capacity is nearly 300 000 tonnes but it is not sufficient, because the consumption of wire rod is about 500 000 tonnes. The Fundia Group has decided to start wire rod production

also in Mo i Rana in Norway by 1995. The ore-based production of wire rod is highly appreciated among customers because of its purity. That is why Dalsbruk is known from its high-quality welding wires. Dalsbruk has also a drawing mill, which has invested in the production of zinc-coated wire, PC strands, and welding wires. The aim of the both mills is to operate cost-efficiently. The competitive advantage of Dalsbruk mills is the own harbour. The majority of shipments abroad go through the Dalsbruk harbour.

Reinforcement bars are produced in Åminnefors. This plant was established already in 1875 in Pohja. The raw-material is delivered from Mo i Rana steelworks, Norway and from Koverhar steelworks. Today Åminnefors' capacity is 180 000 tonnes, but it is only able to operate at a 40% used capacity rate because of market situation. From Åminnefors the reinforcement bars are delivered to own downstream industries, which produce reinforcement nets, nails and moduls, or to construction industry.

Markets and Rivalry

Fundia Group is a market leader in reinforcement steel in Scandinavia. Deliveries are carried out through own further processing units and through steel wholesalers. Fundia has also own sales subsidiaries in Scandinavia and in Germany, Holland, England, and in France. The demand of reinforcement steels has decreased because of downturn of construction industry. The overcapacity in European market has also affected the prices, which have decreased by 25-30%. Only the offshore-industry in Norway has increased the demand.

In wire rods Fundia is also a market leader with its 45% market share in Scandinavia. Over 40% of its products are exported outside of Scandinavia mainly to Europe. The demand of specialised wire products is increasing and Fundia has been able to meet that market challenge by investing in R&D of sophisticated wire products.

The main competitors are found from Europe and are as follows: Hoogoven (Holland), Ilva (Italy), Thyssen, Saarstahl (Germany), Arbed (Belgium), Scanthorpe (England) and Ensidesa (Spain). The European production of wire is about 12 million tonnes of which 1.2 million tonnes is ore-based. The rest is scrap-based from mini-mills. In rivalry against big producers Dalsbruk has cost advantage in production due to continuous upgrading of processes with a help of own R&D unit and due to automation. Dalsbruk has a full sortiment of products, which gives advantage for the company. The location of production plants near the sea with three harbours gives logistic advantage considering raw material and export deliveries.

4.4.2. Analysis of Competitive Advantage of Company

Company Strategy

The competitive strategy of the company focuses on cost reductions in production and emphasises the role of market presence. Dalsbruk has an integrated production chain under control and by rebuilding every process phase the company can introduce large cost reductions. This demands a commitment from employees too.

The market situation in steel wires requires high quality products and customer needs must be taken account at an early state of the production. Dalsbruk's strategy is to co-operate with customers and share the accumulated know-how of steel production with customers in order to introduce better products. Also market presence in main market areas is essential in order to ensure accurate deliveries and service. To strengthen marketing strategy Dalsbruk has established a sales subsidiary in growing German market in 1992. Due to requirements of construction industry to keep total costs of construction down and to improve the working conditions new possibilities have occurred in reinforcement steels too. The steel bars are cut and bent according to customer's need or build as a moduls, which are ready to put in place in constructions. In reinforcement steels the company is willing to seek market opportunities in Baltic countries.

The investment in new casting machine in Koverhar steelworks in 1991 has enabled the company to increase the weight of spools into 1.4 tonnes. The bigger spools reduce set up times and give cost advantage in customers' manufacturing plants. The new casting machine paves the way for product development and for production of new sizes of billets.

Dalsbruk uses 1% of its turnover in R&D annually. The focus has been on new sophisticated products and on the development of own technology into the new Koverhar's casting machine. Also quality assurance in production is under continuous development. Dalsbruk's rolling mill has already got ISO quality assurance. The company has own laboratory where product's quality and applicability is tested to ensure customer satisfaction. The company possesses also cumulated know-how in steel metallurgy which gives advantage in development of processes and it co-operates with universities and research centres in other Nordic countries too.

Core Competence Areas of the Company

Factor Conditions

The location of Dalsbruk's production plants and the three harbours, which it possesses give competitive advantage for the company. The company collaborates with Rautaruukki Oy in deliveries.

Dalsbruk has also cumulated know-how in metallurgy because of its long traditions in steel making. Nowadays there are still working personnel, who started in 1970 in Koverhar's steelworks. The company has started a project, which gathers the knowledge of old employees in the use of the company and offers physically less stressing working opportunities to them in order to lengthen their active working life.

Technology

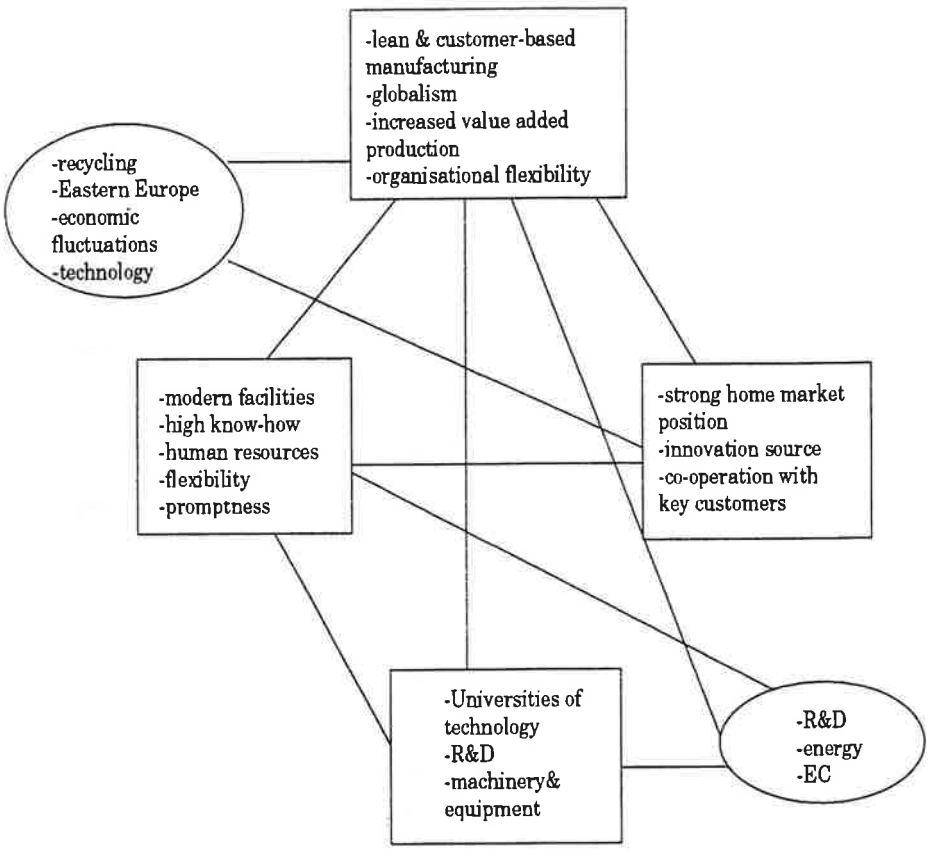
Technology used by Dalsbruk is modern. Although machines are mainly outsourced from abroad the own R&D unit develops the process technology suitable to the company needs. E.g. the computerised blast furnace process control system, which ensures the stabile and economic operation of the blast furnace has been developed by Dalsbruk R&D unit and the system has been sold abroad too.

5. Conclusion and Recommendations

5.1. The Diamond Model in the Finnish Steel Industry

The figure 5.1 illustrates the factors, which improve the competitive advantage of Finnish steel industry and the important interactions between factors.

Figure 5.1. Determinants Improving the Competitive Advantage of Steel Industry



The most important determinant of Finnish steel industry diamond is demand conditions, because it has strong connections to factor conditions and to strategy, structure, and rivalry. Although Finnish steel industry has sophisticated buyers in domestic market the foreign demand conditions are also necessary to the industry in order to sustain competitiveness in the long run. Demand conditions are essential source of innovation too.

Strategy, structure and rivalry is also important determinant, because it interacts with factor and demand conditions, and related industries. The strategies of steel firms are aimed to link demand and factor conditions in order to produce high quality customer-based products. Demand conditions emphasise investments in higher value-added production in the Finnish steel industry. The missing domestic rivalry has been offset by openness to international competition. The global strategies employed in the industry have made it possible to the firms to command the attention of foreign buyers.

Factor conditions are both advanced and specialised in the steel industry. Although the disadvantage in raw material resources exists the steel industry has created other factors, which enable the firms to produce steel in a competitive way. A significant direct investments in factor creation by firms are characteristic of the Finnish steel industry. Factor conditions are affected by government, related industries, and by demand conditions through firm strategy decisions.

Related and supporting industries interchange directly with factor conditions and strategy, structure, and rivalry. Also government has connections to related industries through investments in the universities of technology and research centres.

The role of government is moving from direct to indirect in the steel industry diamond. The government can better improve the competitive advantage of Finnish steel industry by influencing partially to the context and institutional structure surrounding firms. The government's proper role is to create specialised factors by investing in research and development, infrastructure and in education with a close connection to the steel industry. Government actions towards energy and trade policy must benefit the steel industry in order to keep the homebase of industry in Finland.

Chance events affect the diamond strongly through demand conditions, but also through strategy, structure, and rivalry. The discontinuities that chance events create can improve or nullify the advantages of Finnish steel industry. It is important for steel firms to seek actively the signals of change and act on them as early as possible.

The competitive advantage of Finnish steel industry results from many interactions between the determinants of the diamond. The diamond guides the steel industry to the direction of customer-based production with differentiated high quality products. Actions of the steel industry to improve this development create sustainable competitive advantage.

5.2. Recommendations for the Steel Industry

Develop logistics

The Finnish steel producers locate quite far away from their main markets in Europe, so the chosen distribution channels and logistics get a big role in competition. The steel firms should continue to strengthen their ability of logistics and take the whole distribution channel under control.

Build direct customer relationships

The steel firms should continue to develop direct relationships with steel users and develop loyalty among customers through value added services.

Streamline the image of steel industry

Much of emphasis should be laid on improving the image of steel industry. This is important in order to secure the flow of capital and skillfull human resources into industry and in order to market steel products for sophisticated buyers.

Emphasise concern for environment

The steel industry should continue to develop ecologically beneficial production processes and equipment. The environmental protection will increase in the future and by adopting now the ideology of sustainable development of the world the Finnish steel producers could gain first mover advantages.

5.3. Conclusion

The most important determinants of the steel industry's diamond are demand conditions and firm strategy, structure, and rivalry. These factors drive the Finnish steel industry towards customer based and cost effective manufacturing.

Factor conditions are affected by demand factors and firm strategy decisions. In order to meet the demand conditions factor conditions must be specialised. This has forced the steel firms to invest in R&D and training of personnel. The cumulative knowledge of steel making through decades benefits the industry too. The modern technology chosen by steel producers and the commitment to continuously upgrade processes have enabled the Finnish firms to compete successfully with the large European integrated steel producers. Flexibility of

production is the key word in the steel industry today. Finnish producers whose production units are smaller than competitors are able to introduce the economies of scope. Also in deliveries competitiveness has occurred through improvements in logistics. To sustain competitiveness the core competencies of the firms must be traced in order to be able to allocate the resources in a right way.

Demand conditions are the most dynamic factor of the diamond from which competitive advantage can be found. Sophisticated buyer needs both in home base and abroad shape the Finnish steel industry. Demand conditions are important source of innovation too. The steel producers have named key accountants whose needs and problems are taken account at an early stage of R&D work. The aim is to get direct information of customer satisfaction, which is important to the firm's R&D. The key customers are even integrated into firms' value chain in order to get the product innovations quickly to market.

A strong supporting industry for the steel producers is energy industry. Especially for Imatra Steel and Outokumpu Steel the sufficient supply of energy at a competitive price is essential since they use scrap and ferrochrome in their steel production. The supply of energy guides the firms' investment decisions in the future too. Finland as an investment base is not attractive anymore, if sufficient energy supply is not available. The government's role in this issue is essential. The parliament's negative stand on the fifth nuclear power station did not take account the whole base metal industry's development needs in the long run.

The universities of technology and research institutes are related into the Finnish steel industry. The steel companies together with these institutes co-operate in joint projects in order to develop the know how base of steel making. These development projects are also important source of competent employees in to the steel industry since many students are involved in these projects.

Two state-owned companies (Outokumpu, Rautaruukki) and two private-owned companies (Fundia. Imatra Steel) operate in the Finnish steel industry. The division labour in the steel industry has decreased domestic rivalry between these companies. The competition felt by domestic producers comes from foreign imports of steels. Rivalry is also tough in the export markets of Finnish steel producers. In the main market area, in Europe, Finnish producers face large integral steel producers which can enjoy economies of scale in steel production. Since Finnish steel producers are not able to compete with economies of scale the firms' strategic decisions have been aimed to introduce economies of scope. They have started the

restructuring of organisations and production processes and the development continuous through the 1990s. The companies have improved communication between different levels and departments of a company in order to be flexible and to ensure the direct flow of information. It has also required development of information systems in order to react quickly into changing market situations. The production processes are aimed to increase the value added through firm's value chain in order to meet the customer needs. The importance of quality introduced in the processes is also emphasised. The quality concept must be introduced through the organisation levels, from top management to job shop levels, in order to gain competitiveness of that. Each employee must be aware of the need to serve the customer, whether it is the end user or an internal customer of steel.

The foreign competition together with demand conditions have guided the Finnish steel producers to introduce both low cost and differentiation in their strategic decisions. The European steel industry's life-cycle is in a shaking stage. Only those steel producers whose cost structure is good will survive in the industry. The profits of operations can be gained by introducing customised products made to order. The strategic aim of Finnish steel producers has also been to introduce value added of production by integrating into down stream industries (steel service centres, construction industry, pipe industry etc.). This has enabled to be closer to customers and ensured free flow of information too.

The government's role in shaping steel industry's competitiveness must be indirect. The proper role is to create specialised factors by investing in research and development, infrastructure and in education with a close connection to the steel industry. Especially funds must be directed to the basic research. The co-operation between the government and the steel industry is essential in order to guide the resources into correct areas. The government has also a role in affecting both the supply and cost of capital as well as the markets through which it is allocated. The high real interest rates in the end of 1980s increased the financing costs of Finnish steel firms compared to their competitors. The government should take actions that interest rates do not create disadvantage to the industry in the future and it should also emphasised the role of venture capital in financing the industry. The government should strengthen the position of base industries, steel industry's among others, in the Finnish economy. The government should draw up a long-term industrial policy that encourages investments in homebase and which promote the role of Finnish base industries based on knowledge resources at a high level in the international division of labour. By improving the image of base industries the flow of venture capital in to the industries could be guaranteed.

The World War II was a strong chance event for the Finnish steel industry. It gave an impetus to increase production capacity in order to meet growing domestic needs and to move into speciality steels. In the 1960s when the Finnish steel industry was expanding strongly new steel making technology was available (BOP, continuous casting) and the Finnish producers were among the first to introduce this technology in their plants. These technological improvements gave competitiveness for the producers in international competition.

Today there exists already some new chance events which may create competitiveness for the steel producers but they are not fully discovered yet. The Baltic Sea area and the former Soviet areas are a great opportunity for Finnish steel producers. If the development of these areas continuous favourably investments in infrastructure and construction will occur and this opens new markets for Finnish steel products. Finnish steel producers must actively seek business opportunities from these areas since logistically we are near these markets. An other asset in international competition in the future will be the commitment to the principles of sustainable development. Effective use of materials in order to decrease the environmental load and the introduction of less capital intensive technology (minimills, thin slab casting) in steel making are along with the principles of sustainable development. The Finnish steel industry is committed to use scrap as a raw material in steel making. They also recycle the by-products of steel processes such as the slag aggregate, which can be utilised in road construction, soil conditioning, and the building materials industry and waste heat from the processes, which is used in the plant itself or for district heating. Recycling will be a marketing asset in the future and Finnish steel producers must emphasised that in their strategies.

5.4. Connections Between the Theory and Empirical Findings

As the theory stated the firms and industries with high raw material content will be relatively more affected by changes in macroeconomic variables, such as exchange rates and energy prices. The steel industry could be considered to be a macro-sensitive industry. The steel firms with an export orientation and domestically based production are vulnerable to fluctuating exchange rates. However, the Finnish steel firms have developed strengths which offset and cushion the effects of macroeconomic changes. Innovation and technological development are used to overcome disadvantages and create strengths which are firm specific and not easily imitated by foreign competitors.

Demand conditions have affected strongly in the Finnish steel industry. Since many buyers of steel have introduced JIT production philosophy in their processes this increases requirements for the steel producers to deliver promptly and to order. The steel producers ability to be flexible and to react quickly to the market changes are also qualities, which have particular importance for the buyers of steel products. These changes have affected the Finnish steel producers to adapt the user-oriented steel manufacturing. Buyers and producers of steel operate closely together in order to improve existing steel grades or to invent new customer-oriented applications.

The empirical findings strengthened the assumption that in order to survive in tough steel competition the firms must introduce both low cost and differentiation strategies at the same time. The firm, whose cost structure is good and which can offer customised products, will survive in the industry in the long run. Firms must trace also their core competencies in order to better allocate their resources and in order to sustain competitiveness in the future.

References

Advanced Mining Technology From Finland (1990), *The Finnminers Group.* The Finnish Foreign Trade Association. Helsinki 1990.

AIECE Raw material group, handout September 1993.

Association of Finnish steel and metal producers (1985), *Steels from Finland.*

ETLATIETO Oy (1992), *Suomen ulkomaankauppa-aineisto.* Seminar paper.

Finnish Trade Review 3/1989, *The Finnminers Group - strength in diversity.*

Haavisto, Helge (1985), *Teknologia vuoriteollisuutemme perustana.* Vuoriteollisuus 1/1985, 10.

Historiallinen arkisto 55, (1955), toim. Suomen Historiallinen Seura. Helsinki: Suomalaisen Kirjallisuuden Seuran Kirjapaino Oy.

Holappa, Lauri (1989), *Jatkuvavalun teknologiaohjelma.* Vuoriteollisuus 1/1989.

Honkasalo, Jorma (1982), *Suomen vuoriteollisuuden nousu ja merkitys 1900-luvulla.* Vuoriteollisuus 1982 40:1, 9-12.

Imatra Steel tiedotuslehti 18.12.1991.

Inside Out, The International Employee Magazine of the Outokumpu Group 2/1992, *Quality is a must for Outokumpu Polarit.*

Inside Out, The International Employee Magazine of the Outokumpu Group 3/1992, *Stainless steals the show.*

Kauppalehti 24.3.1993, *Maailman terästeollisuus painii kustannuskriisissä.*

Kilpinen, Matti (1991), *Kaivosteollisuutemme kansainvälistyminen ja tekninen kehitys.* Vuoriteollisuus 1/1991.

Kinnunen, Helvi (1990), *Suomen suorat sijoitukset ulkomaille ja tuotantotoiminnan kansainvälistyminen 1980-luvulla.* Suomen itsenäisyyden juhlavuoden 1967 rahasto. Helsinki 1990.

Kinnunen, Helvi (1991), *Suomalaisten yritysten kansainvälistyminen: ulkomaantoiminnan kannattavuus ja vaikutus kotimaantalouteen.* Suomen Pankin julkaisuja A:80. Helsinki.

Kuisma, Markku (1985), *Outokumpu 1910-1985.* Forssa: Forssan Kirjapaino Oy

Kuisma, Markku (1989), *History of Outokumpu.* Jyväskylä: Gummerus Kirjapaino Oy

Laine, Eevert (1948), *Suomen vuoritoimi 1809-1884; Ruukit.* Historiallisia tutkimuksia 31;2. Julkaissut Suomen Historiallinen seura.Helsinki: Suomalaisen Kirjallisuuden Seuran Kirjapaino Oy.

Laine, Eevert (1950), *Suomen Vuoritoimi 1809-1884; Yleisesitys.* Historiallisia tutkimuksia 31;1. Julkaissut Suomen Historiallinen Seura. Helsinki: Keskuskirjapaino.

Laine, Eevert (1952), *Suomen vuoritoimi 1809-1884; Harkkohytit, kaivokset, konepajat.* Historiallisia tutkimuksia 31;3. Julkaissut Suomen Historiallinen Seura. Forssa: Forssan Kirjapaino Oy.

Laukkanen, Pekka (1989), *Teräs pesee kasvojaan.* Ovako Steel henkilöstölehti 4/1989.

Linna, Juhani (1987), *EEC:n teräsmarkkinat ja Suomi.* Materiaalitalous 9/1987.

Lukkari, Esko (1992), *Rautaruukki has the correct size of production units.* Rautaruukki News vol 1 1992.

Luostarinen, Reijo (1979), *Internationalization of the Firm.* Acta Academiae Oeconomicae Helsingiensis.

Luostarinen, Reijo and Welch, Lawrence (1990), *International Business Operations.* Helsinki: Kyriiri Oy.

Luukko, Unto (1990), *Rautaruukki 1960-1990.* Kirjapaino Osakeyhtiö Kaleva. Oulu 1990.

Luukkonen, Keijo (1977), *Oy Romurauta Ab historiikki 1937-1977.* Helsinki 1977.

Malmberg, Harri (1982), *Outokumpu Oy:n ja metalliteollisuutemme viisi vuosikymmentä.* Outokummun Sanomat 2/1982.

Matikainen, Raimo and Pukkila, Jukka (1990), *Mining in Finland.* Helsinki: Reprotalo Oy

Matikainen, Raimo (1991), *Vuoriteollisuuden osaaminen myyntituotteena - Jatkuuko menestys?.* Vuoriteollisuus 1/1991.

Metal Bulletin Monthly (1993), *Thin slab casting gathers pace.* MBM August 1993.

Metalliteollisuuden Keskusliitto MET, *Metalliteollisuus 1992.*

Myllyntaus, Timo, Michelsen, K-E, Herranen, Timo (1986), *Teknologinen muutos Suomen teollisuudessa 1885-1920.* Societas Scientiarum Fennica. Helsinki 1986.

Myllyntaus, Timo (1989), *Finnish Industry in Transition 1885-1920.* Tekniikan museon julkaisuja IV. Tammisaari 1989.

Mäkinen, Markku (1992), *Euroopan yhdentymisen merkitys Suomen perusmetalliteollisuudelle.* Vuoriteollisuus 1992/1, p.12-14.

OECD, (1993), *The steel market in 1992 and the outlook for 1993.* Paris 1993.

Okko, Paavo (1985), *Metalliteollisuus ja sen sopeutumishaaste: The Finnish metal and engineering industries in transition.* ETLA sarja B 41.Helsinki 1985.

Ourila, Anne (1991), *Rautaruukki's new business activity gains momentum.* Steel News 2/1991.

Outokumpu vuosikertomukset 1980-1991

Outokumpu harkitsee vielä Tornion tehtaan laajennusta. Kauppalehti 2.3.1993

Ovako vuosikertomukset 1974-1989

Penson, Stuart (1993), *Thin slab casting gathers pace.* MBM August 1993 volume No 272.

Pihkala, Erkki (1970), *Suomen Venäjän Kauppa Vuosina 1860-1917. Helsinki 1970.*

Porter, Michael (1980), *Competitive Strategy: Techniques for Analysing Industries and Competitors.* The Free Press-New York.

Porter, Michael (1985), *Competitive Advantage: Creating and Sustaining Superior Performance.* The Free Press-New York.

Porter, Michael (1990), *Competitive Advantage of Nations.* Billing & Sons Ltd, Worcester, Great Britain.

Prahalad C.K. and Hamel Gary (1990), *The Core Competence of the Corporation.* Harvard Business Review, May-June 1990.

Radetzki, Marian (1988), *The Role of State Owned Enterprises in the International Metal Mining Industry.* Seminar Paper No. 407. Institute for International Economic Studies,Stockholm, Sweden.

Raumolin, Jussi (1986a), *Kaivos- ja metallituotteiden maailmantalous.* ETLA Discussion papers No 211.

Raumolin, Jussi (1986b), *The Role of Education in the Development of the Mining Sector in Finland.* ETLA Discussion papers No 219.

Raumolin, Jussi (1988a), *Restructuring and Internationalization of the Forest, Mining and Related Engineering Industries In Finland.* ETLA Discussion papers No 267. Helsinki

Raumolin, Jussi (1988b), *Problems Related to the Transfer of Technology in the Mining Sector with Special Reference to Finland.* ETLA Discussion papers No 269.

Raumolin, Jussi (1990), *The Transfer and Creation of Technology in the World Economy with Special Reference to the Mining and Forest Sectors.* ETLA Discussion papers No 313.

Rautaruukki Steel News No. 1, 1993

Rautaruukki vuosikertomukset 1970-1991

Ray, George F. (1988a),*The diffusion of technology in Finland.* ETLA Discussion papers No 258.

Ray, George F. (1988b) *The Finnish economy in the long cycles*, Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, 1988. Discussion papers No 278.

Rouvinen, Petri (1993), *Data-guide to OECD exports.* ETLA, 1993. Discussion papers No 426. Helsinki.

Siltari, Olavi (1991), *Ruostumattoman teräksen valmistus Suomessa.* Vuoriteollisuus 1/1991.

Smolsky, Sirpa (1990), *Pärjäämme kyllä kun kilpaillaan reilusti.* Steel News 3/1990.

Smolsky, Sirpa (1991), *The steel and non-ferrous metals industry.* Kemia-Kemi vol.18 (1991).

Sundberg, Matti (1987), *Ovako Steel - Pohjoismainen yhtiö.* Vuoriteollisuus 1/1987.

Sölvell, Örjan, Zander, Ivo, Porter Michael (1991), *Advantage Sweden.* Norstedts Juridik-förlag, Stockholm, Sweden.

Talouselämä 33/1980, *Kupariyhtiö terästyy.* s. 40-45

Tilastokeskus (1988), *Standard Industrial Classification (SIC).* Valtion painatuskeskus, Helsinki.

Titaani 4, 1993

van der Linde Claas (1991), The *Competitive Advantage of Germany*. H.Tschudy & Co. AG, St.Gallen, Germany.

Voutilainen, Pertti (1984), *Vuoriteollisuuden tulevaisuus Suomessa*. Vuoriteollisuus 1/1984.

Vuoriteollisuus 2000 - Kaivosteollisuus (1993), *Teknologiaohjelma*. Sarja A N:o 101, 1993. Vuorimiesyhdistys.

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Jukka Väyrynen, Manager of R&D Department, Raahe
Kyösti Karjalahti, Assistant Director,Strategic Planning, Rautaruukki Ltd, Oulu

5.11.1993 Klas-Göran Eriksson, Vice President, Fundia, Tammisaari
Henry Engblom, Director of Fundia Reinforcing, Tammisaari
Ulla Lindström-Dahl, Personnel Manager, Fundia Koverhar

15.11.1993 Antti Närhi, Managing Director of Outokumpu Steel Division, Helsinki

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