LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Industrial Engineering and Management

MARKET POTENTIAL FOR FREE-CUTTING STEELS IN EUROPE

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ABSTRACT

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Keywords:	Market potential, steel industry, free-cutting steels, competitor analysis
Hakusanat:	Markkinapotentiaali, ter steollisuus, automaattiter kset, kilpailija-analyysi

The aim of the master thesis was to survey the market situation of free-cutting steels in Europe to define Imatra Steel's opportunities to compete on those markets. The key objective was to evaluate the total potential in Germany, Sweden, England and Finland. In addition to total potential it was important to find out the free-cutting steel grades and diameter range used, price situation, and technical details concerning the machinability. Also an important issue in this work was to find out the opinions and attitudes concerning the possible prohibition of lead in steel in the future. To get a better view about the European free-cutting steel markets the competition situation was also analysed.

The theoretical basis of the work consists of special characteristics of industrial marketing research, concepts concerning the market potential definition, and theory about competitor analysis. Empirical research was conducted by interviews and questionnaires. As interviewees were dealers and end-users. Competition analysis is mainly based on secondary data like Internet-sites and data collected by sales offices.

The total market potential for free-cutting steels in Europe is estimated to be one million tons and it is mainly centred to the market areas that were under the research. The greatest volumes are concentrated on small dimensions, ∅ 12 - 50 mm. The markets are mainly managed by a few big suppliers. Imatra Steel as quite a small producer is not able to compete with its volume and product mix with those bigger players in the market. The possible strategy for Imatra Steel would be to try to find a market niche in which its products and know-how provide the customer with greater advantage than competitors.

TIIVISTELM

Tekij :	Heli Hannele Ala-Poikela
Diplomity n nimi:	Automaattiter sten markkinapotentiaali Euroopassa
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Hakusanat:	Markkinapotentiaali, ter steollisuus, automaattiter kset, kilpailija-analyysi
Keywords:	Market potential, steel industry, free-cutting steels, competitor analysis

Ty n tavoitteena oli selvitt   tilannetta Euroopan automaattiter smarkkinoilla ja sen perusteella arvioida Imatra Steelin mahdollisuuksia kilpailla kyseess   olevilla markkinoilla. T rkein tavoite oli kokonaismarkkinapotentiaalin arvioiminen Saksan, Ruotsin, Englannin ja Suomen markkinoilla. Lis ksi selvitettiin k ytetyt automaattiter slajit ja mitta-alue, hintataso sek   koneistukseen liittyvi   teknisi   yksityiskohtia. Tavoitteena oli my s kartoittaa asenteita ja mielipiteit   mahdollisesta lyijyn k yt n kielt misest   ter ksen seosaineena tulevaisuudessa. Paremman kokonaiskuvan saamiseksi analysoitiin my s kilpailutilannetta Euroopassa.

Ty n teoriakehyksess   tutkittiin teollisuustuotteiden markkinatutkimuksen suorittamisen erityispiirteit , markkinapotentiaalin m   ritt miseen liittyvi   k sitteit   ja kilpailija-analyysin suorittamista. Empiirinen tutkimus suoritettiin p   asiassa asiantuntijoiden haastattelujen ja kyselyjen avulla. Haastateltavina oli tukkureita ja loppuk ytt ji . Kilpailutilanteen kartoittaminen perustuu l hinn   sekund   riseen tietoon, Internet-sivuihin ja myyntikonttoreiden aikaisemmin ker   m   n tietoon.

Automaattiter sten kokonaispotentiaaliksi Euroopassa arvioitiin miljoona tonnia ja suurin osa kaupasta k yd   n tutkituilla markkina-alueilla. Suurimmat volyymit sijoittuvat pienemmille mitta-alueille, ∅ 12 - 50 mm. Markkinoita hallitsee muutama suuri ter ksen valmistaja. Imatra Steel kohtuullisen pienen   toimittajana ei pysty kilpailemaan volyymilla ja tuotevalikoimallaan suurten ter sj ttien kanssa. Imatra Steelin mahdollinen strategiavaihtoehto olisi yritt   l yt   ne kapeat segmentit ja markkinaraot, joilla sen tuotteet ja tietotaito tuovat asiakkaalle suurimman mahdollisen hy dyn verrattuna kilpailijoihin.

ACKNOWLEDGEMENTS

This master thesis has been made for Imatra Steel in Imatra. The aim of the thesis was to research the market situation in the free-cutting steel markets to provide an estimation about the market potential in Europe. Also an important aspect in this work was find out the opinions about the possible prohibition of lead in steel in the future.

I was working under the guidance of Export Manager Jari-Jukka Asikainen, to whom I would like to express my gratitude for advice and positive attitude towards my work. Very many people in Imatra Steel both in Imatra and in sales offices provided information and technical advice concerning the thesis and helped me collecting the data that this thesis is based on. I appreciate their kind co-operation. Especially I want to thank Seppo H rk nen and Jukka Kivel   for arranging the interviews that were very important for my work. My warmest thanks belong to the personnel of marketing department in Imatra for helping me to understand the world of steel industry.

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My warmest thanks are owned to Henri for supporting and encouraging me during the work. Also my family and all my friends deserve warm thanks.

Heli Ala-Poikela

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LIST OF ABBREVIATIONS

ACEA	Association des Constructeurs Europ en d'Automobiles
CNC	Computerised Numerically Controlled
GNP	Gross National Product
HSS	High Speed Steel
EU	European Union
ktn	kilotons
SIC	Standard Industrial Classification

Chemical symbols of materials

Bi	Bismuth
C	Carbon
Cr	Chrome
Mn	Manganese
Mo	Molybdenum
Ni	Nickel
P	Phosphorus
Pb	Lead
S	Sulphur
Si	Silicon
Te	Tellurium
TiN	Titanium nitride
TiN-$Al_2 0_3$-TiC	Titanium nitride aluminium oxide titanium carbide

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1 INTRODUCTION

1.1 Aim of the Master Thesis

This master thesis provides a perspective of understanding the issues that have to be taken into account in determining the extent of market potential and competition situation in the area of steel industry. The aim of the master thesis was to survey the market situation of free-cutting steels in Europe and to define Imatra Steel s opportunities to compete on those markets.

1.1.1 Problem Area

The competition in the steel industry is strong and the situation is even tightening in the future. To be able to compete in the business Imatra Steel has to be aware of customers needs and future trends in the market. Critical success factors are also the ability to innovate and the potential to invest in research and development of new products.

At the moment Imatra Steel is neither producing free-cutting steels and nor competing on those markets. Both leaded and non-leaded free-cutting steels are produced and used in Europe. The use of lead in steel production is forbidden in Scandinavia and the development also in other European countries is going towards prohibition. The most important technical requirement for free-cutting steel is good machinability. Imatra Steel has a strong know-how in producing steels with good machinability so it would have the ability to develop non-leaded free-cutting steels that could compete with those already existing in the market.

When considering investing in new product development the careful examination about the situation in the market and the probable direction of development in the future was needed.

1.1.2 Objectives

The objective of the master thesis was to estimate the market potential for free-cutting steels in Europe. The key objective was to try to evaluate the current and future volume of free-cutting steels. The volume was evaluated by different steel grades and by diameter range. The market areas taken into examination were Sweden, Germany, England and Finland.

To make it easier for Imatra Steel to get a realistic view about the European free-cutting steel markets, it was essential to map the competition situation. Also an important aspect in this work was the possible prohibition of lead in steel. It was important to find out what are the opinions and attitudes in the markets, and is there a need for new non-leaded alternatives.

The thesis should be able to provide a framework for strategic decision-making and planning concerning research and new product development activities in Imatra Steel.

1.1.3 Used Methods

The theoretical basis of the master thesis consists of special characteristics of industrial marketing research, concepts concerning market potential definition, and theory about competitor analysis. Theoretical framework was utilised in defining the information need arising from the problem area of the thesis.

As sources of information was used both primary and secondary data. Data needed in market potential evaluation was mostly gathered by interviewing professionals. Survey about the competition situation is mainly based on the secondary data. The type of the data collected enabled to conduct a qualitative market research about the free-cutting steel markets in Europe.

1.2 Imatra Steel Oy Ab

Imatra Steel is a supplier of low-alloy engineering steels and steel products for the European automotive and mechanical engineering industries. Imatra Steel is a subgroup of Metra Corporation. Metra s other subgroups are W rtsil NSD Corporation and Sanitec. Imatra Steel s operation is founded on full co-operation between its production units: Imatra Steel Works, Kilsta Forge and Billn s Spring Factory. (Imatra Steel Annual Report, 1998, p.3)

This work was done at the Imatra Steel Works and when talking about Imatra Steel the steel works only is referred to.

In 1998 Imatra Steel s consolidated net sales were FIM 789 million. The amount of deliveries was 249 kilotons and the number of personnel was 747. (Imatra Steel Annual Report, 1998, p.6) It is estimated that in 1999 the amount of deliveries will be approximately 230 kilotons and net sales FIM 675 million. The demand in the market is good, but the price level of 1999 is well below of that in 1998.

Imatra Steel is specialised in producing long steels and its products can be grouped according to steel grade, size range, form and the state of delivery. Production programme contains size ranges for round, square and flat bars. Products belong to the following steel groups:

- Through hardening steels with subgroups of
  - quenched and tempered steels
  - spring steels
  - boron steels
- Case hardening steels
- Structural steels
- Forging steels with subgroups of
  - precipitation hardenable ferrit-pearlitic steels
  - direct hardening steels

Production is totally based on scrap. (Production Programme, 1993, p.3)

Almost 80 of Imatra Steel s products are exported. The main export areas are Scandinavia, Great Britain, France and Germany. The company s market share in special steels in Europe is approximately 10 . The end-user for Imatra Steel s products is mainly car and truck industry. Another section is mechanical engineering industry. Sales by market segment are introduced in figure 1.

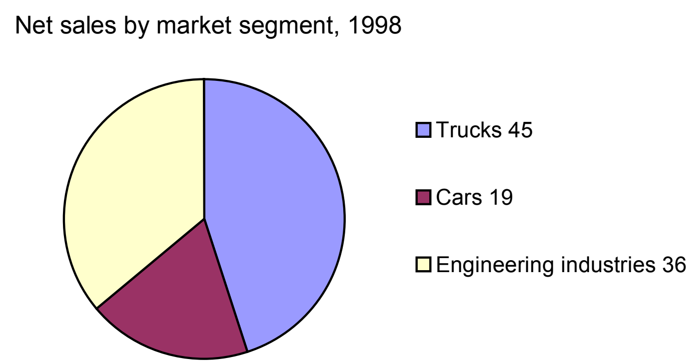

Figure 1. Imatra Steel s net sales by market segment in 1998.
(Imatra Steel Annual Report, 1998, p.3)

2 INDUSTRIAL MARKETING RESEARCH

According to Kotler (1997, p.114) marketing research is a systematic design, collection, analysis, and reporting of data and findings relevant to a specific marketing situation facing the company.

Marketing research and market research are often confused. Market research is actually one component of marketing research; it is research into a particular market. (Kotler, 1997, p.114) At one time market research and marketing research tended to be used to describe particular activities the former referring to enquiries into market size and related statistics, the latter covering a fuller area of enquiries involving, for example, behavioural factors, advertising strategy, and measurement of market demand. This pedantic distinction is nowadays discarded and the terms are used indiscriminately. (Chisnall, 1995, p.114)

Marketing research has a very practical purpose: to provide reliable knowledge about specific aspects of marketing. Its function is, anyhow, not just to provide information, but to interpret data as well. To be valuable, research into marketing should be objective.
(Chisnall, 1995, p.113)

Hutt (1992, p.144) defines business marketing research as the systematic gathering, recording, and analysing of information and opportunities relating to the marketing of industrial goods and services. It typically includes sales and market potential analysis, sales forecasting, market surveys, and experiments.

Marketing research is one component of the industrial marketing intelligence system. Marketing intelligence is a systematic process for generating the information needed to manage the business marketing strategy effectively. Marketing strategy decisions will be based on information about market potential, customer requirements, industry and market trends, present and future competitive behaviour, expected sales, market segment size and requirements, and sales and profit performance for customers, products, and territories. (Hutt, 1992, p.125) Marketing research is one instrument to provide the information needed for marketing strategy decisions.

This study is a marketing research about the market potential and competition situation in the free-cutting steel markets. The information is needed to help the decision-making about research and development activities in Imatra Steel.

2.1 The Marketing Research Process

Effective marketing research involves the five steps shown in figure 2.

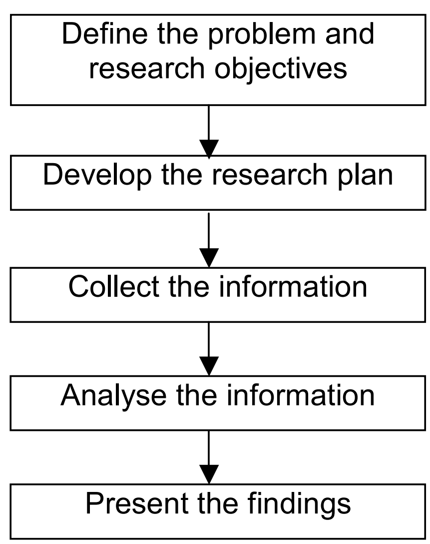

Figure 2. The Marketing Research Process. (Kotler, 1997, p.116)

Step 1: Define the problem and research objectives

The first step calls for the marketing manager and marketing researcher to define the problem very carefully and agree on the research objectives. (Kotler, 1997, p.116) This initial and crucial stage will decide the nature of the entire research. (Chisnall, 1995, p.120)

Step 2: Developing the research plan

The second stage of marketing research is to develop the most efficient plan for gathering the needed information. Designing the research plan calls for decisions on the data sources, research approaches, research instruments, sampling plan, and contact methods. The research plan can call for gathering primary data, secondary data, or both.
(Kotler, 1997, p.117)

Step 3: Collect the information

The data collection phase of marketing research is generally the most expensive and the most susceptible to errors. (Kotler, 1997, p.123) This step is usually occupying a considerable amount of time. The relative efficiencies of collecting data by alternative methods have to be checked. (Chisnall, 1995, p.123)

Step 4: Analyse the information

In this stage the pertinent findings have to be gathered from the collected data. (Kotler, 1997, p.124) Data are the raw material of the research programme. They have to be refined by means of tabulation, analysis, and interpretation. During these processes, significant relationships between variables may be discovered. These require objective discussions and evaluation related to the problems, which the survey has undertaken to study. (Chisnall, 1995, p.123)

Step 5: Present the findings

As the last step in marketing research, the researcher presents the relevant findings to the parties responsible for marketing decisions. (Kotler, 1997, p.124) This stage completes the research programme. To make the report informative enough, special attention should be paid for preparing the report. (Chisnall, 1995, p.124)

2.2 Data Sources and Research Methods

An important part of research activity is to decide on the research strategy and develop a research plan. Research strategy covers the selection of suitable methods of survey, the nature of the research instruments, and the types of data to be collected (quantitative, qualitative or, ideally, both). Data for marketing research can be obtained by several methods and from various sources. Two main sources are primary data and secondary data. (Chisnall, 1995, p.124-125)

Primary data

Primary data are data needed for a specific research project. This refers to data, which are unique in the sense that they must be specially generated because of the possible absence of secondary data. There are three main methods of collecting primary data: observation, experimentation and questionnaires. Questionnaires are the most widely used methods in industrial marketing surveys. They can be administrated by telephone or mail, or through personal interviewing. In addition to the three main methods there are also other possibilities: group discussions, focus groups, continuous research, and expert informants. These methods provide mainly qualitative information.
(Chisnall, 1995, p.137-146)

Secondary data

Secondary data are data that have been collected for another purpose and already exist somewhere. Researches are usually started by examining secondary data to find out whether the problems can be partly or wholly solved without collecting costly primary data. Secondary data provide a starting point for research and offer the advantages of lower costs and ready availability. (Kotler, 1997, p.117)
External secondary data are available from several sources: statistics and reports issued by governments, trade associations, and academic institutions. (Chisnall, 1995, p.126)

2.3 Problems of Fit and Accuracy

There are two problems that commonly arise when secondary data are used: they do not completely fit the problem; and there are problems with their accuracy. (Churchill, 1995, p.273)

Problems of fit

Since secondary data are gathered for other purposes, it will be rare when they fit the problem as defined perfectly. Reasons for this are:

1. Units of measurement. It is not uncommon that secondary data have different units than appropriate for the project.
2. Class definitions. Presented class boundaries are often different from those needed.
3. Secondary data often lack publication currency.

(Churchill, 1995, p.273)

Problems of accuracy

Possibility for errors is remarkable when collecting, analysing and presenting marketing information. When researcher collects the information, the individual s firsthand experience should allow the assessment of the accuracy of the information and its bounds of error. These bounds can be critical for marketing decisions that are based on the information. The following criteria help the researcher judge the accuracy of any secondary data:

1. The primary source of secondary data should be preferred. The primary source will be the only source that describes the process of collection and analysis, and thus is the source by which the judgement can be made. A primary source is often more accurate and complete than a secondary data.
2. A second criterion is the purpose of publication. There are sources of data that can be suspect. For example, sources published to promote sales, and to present the cause of a political party. Researcher can use the data collected or sponsored by an interest party, but it should be viewed most critically.
3. A general evidence of quality is the third criterion. One item of evidence in this case is the ability of supplying organisation to collect the data. Also the data collection methods should be examined to state that the data collection has been made professionally.

(Churchill, 1995, p. 275-277)

2.4 Differences between Industrial and Consumer Marketing Research

The environment of the industrial market and the nature of organisational buying create own characteristic features to industrial markets. Hutt (1992, p.144-146) has identified the differences between industrial marketing research and consumer marketing research. Some of the most relevant differences are:

1. Greater reliance on exploratory studies, secondary data and expert judgement data in industrial research.

2. Industrial marketing research places more emphasis on surveys as opposed to experimental and observational primary data methods.
3. Personal interviewing is stressed in industrial marketing research.
4. Industrial marketing research is concerned with the determination of market size and potential, as opposed to the consumer research concern for psychological market segmentation.
5. Industrial marketing researchers typically work with smaller samples (because of the smaller universe and concentration of buyers).
6. Surveys in industrial marketing frequently encounter different problems than do surveys in consumer research; as a consequence, the survey process is often quite different. These differences are compared in the table 1.

Table 1. Differences in survey research process in industrial and consumer marketing research. (Hutt 1992, p. 146)

Consumer	**Industrial**
Universe Population	
Large. Dependent on category under investigation but usually unlimited. Millions of consumers and households.	Small. Fairly limited in total population and even more so if within a defined industry or SIC category.
Respondent accessibility	
Fairly easy. Can interview at home, on the telephone or using mail techniques.	Difficult. Usually only during working hours at plant, office or on the road. Respondent is usually preoccupied with other priorities.

Respondent co-operation	
Over the years has become more and more difficult, yet millions of consumers have never been interviewed.	A major concern. Due to the small population, the industrial respondent is being over-researched. The purchaser and decision-makers in an industrial firm are the buyers of a variety of products and services from office supplies to heavy equipment.
Sample size	
Can usually be drawn as large as required for statistical confidence since the population is in the hundreds of millions.	Usually much smaller than consumer sample, yet the statistical confidence is equal due to the relationship of the sample to the total population.
Respondent definitions	
Usually fairly simple. Those aware of a category or brand, users of a category or brand, demographic criteria, etc. The ultimate purchaser is also a user for most consumer products and services.	Somewhat more difficult. The user and the purchasing decision-maker in most cases are not the same. Factory workers who use heavy equipment, secretaries who use typewriters, and so forth, are the users and best able to evaluate these products and services. However, they tend not to be the ultimate purchasers and, in many cases, do not have any influence on the decision making process.

Interviewers	
Can usually be easily trained. They are also consumers and tend to be somewhat familiar with the area under investigation for most categories.	Difficult to find good executive interviewers. At least a working knowledge of the product class or subject being surveyed is essential. Preferably more than just a working knowledge.
Study costs	
Key indicators of cost are sample size and incidence. Lower incidence usage categories or demographic or behavioural screening criteria can up costs considerably.	Relative to consumer research, the critical element resulting in significantly higher per-interview costs are: the lower incidence levels, the difficulties in locating the right respondent and securing co-operation for the interview itself.

Promoting consumer goods relies on conveying the image of a good whose value exceeds its cost. Industrial goods are very different. A distinguishing characteristic of these goods is that technical performance largely takes the place of consumer perception in determining market success. This distinction is very important in defining the strategy for business development with industrial products.
(Busch, Tinscher, 1998, p.48)

3 INTRODUCING STEEL INDUSTRY AND FREE-CUTTING STEEL MARKETS

3.1 Overview of the Steel Industry

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. In the old industrialised countries the steel industry is a mature industry segment; 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 the situation is the other way around. (Kaipainen, 1994, p.19) In 1998 the estimated steel consumption in the world was 692 million metric tons of steel products. In 2005 it is estimated to be 764 million metric tons.
(http: www.worldsteel.org trends indicators demand.html)

Over capacity is characteristic in today s steel industry. This has a negative effect on the prices of steel. Although the level of steel consumption at the moment is good, the prices still tend to decline. In the long run there has been a two percent decrease in prices per year.

There are also structural changes in the European steel industry. Large steel producers have merged to become still larger. There are several explanations for the mergers. Common motivation is synergy advantages. One reason for the mergers is the belief that the smaller amount of producers cuts down the over capacity, which has caused low prices and decrease in profitability. The most essential aspect is the direction of development occurring among customers. There have been mergers also in the car industry. Today, the car producers are global giants, who want to benefit from economies of scale and increase efficiency. Benefit or not, but it is sure that competition in the industry is getting harder and companies compete with global strategies. The cost advantage of big producers will be seen in even lower prices. Another trend seen in the car industry is that large car producers tend to exploit their buying volume by competing their suppliers globally and by demanding convergent offers, no matter where the plants exist and what the freight charges are. Latest development trend in the car industry is also the abandonment of own production. The car industry is assigning the responsibility about materials, planning, R D and production to the suppliers. By joining this with price competition the additional responsibility of suppliers to the car industry will be hard to handle. (Taavitsainen, 1999, p.3-4)

Due to restructuring of the steel industry, the number of employees at the operational level is decreasing. The steel industry needs more highly educated experts. The industry has become more customer oriented and the experts of steel industry take part in customer s product development already at an early stage. (Kaipainen, 1994, p.20)

The environmental questions have made their breakthrough also in the steel industry. Steel producers have noticed that the environmental issues have 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 steel products must be effectively recycled back to use of production. The steel industry is the worldwide leader in recycling, demonstrating clearly through the recycling of millions of tons of steel scrap each year that recycling is economically and environmentally feasible. Through the efficiency of the steel recycling infrastructure, the steel industry receives a steady scrap flow. (Crawford, 1999, p. 14) Research and development activity towards raw materials that stress the environment least is also an essential objective. The use of lead in steel is a current topic in discussion about raw materials.

There are also some substitutes for steel, such as aluminium, plastics and ceramics, but these substitutes do not constitute real threats to the steel industry, at least so far. The price trend of steel has been more advantageous compared to other construction materials.
(Kaipainen, 1994, p.22) Steel s status as the automobile industry s major materials supplier is not likely to change in the immediate future, but steel manufacturers would be foolish to take it for granted. Aluminium, for example, is a strong challenger to steel in the future. It is more expensive than steel, but continuing emphasis on vehicle weight reduction has spurred carmakers to increase their use of aluminium. And also the prospect of future tightening of corporate average fuel economy requirements is stimulating increased interest in the use of aluminium for applications where steel has been the traditional choice, such as auto body structures, doors, fenders, and hoods. (Sheridan, 1996, p.120)

The development of more ecological production methods of steel and the recyclability of steel in production are factors that give a strong position to steel as a construction material in the world in the future.

3.2 Free-cutting Steel Markets

Free-cutting steels have been developed to create steels with best possible machinability properties. To achieve steels with good machinability some soft alloying materials has been used. The most common soft alloying materials are sulphur and lead, the amount of which in free-cutting steels is 0,2 - 0,3 . Free-cutting steels are alloyed either only with sulphur or with both, sulphur and lead. The combination of sulphur and lead brings the best machinability properties in many cases. Tellurium is also one alloying material used in free-cutting steels, but it is used less.

Free-cutting steels are mostly used for small components in the automotive industry. Other target segments are components used in the hydraulics industry and electrical accessories in the electronics industry.

The most common free-cutting steel grades are 11SMn30 and 11SMnPb30. Those names adhere to the new standard, EN 10087:1998, and correspond to the old names of DIN-standard 9SMn28 and 9SMnPb28. The majority of free-cutting steels are supplied in drawn condition.

Table 2 illustrates the groups of free-cutting steels that are classified by European Standard EN 10087:1998. In the standard the technical delivery conditions for semi-finished products, hot-rolled bars, and rods manufactured from free-cutting steels are also given.

Although the addition of lead in free-cutting steels improves the machinability, there are environmental disadvantages of using lead in steel. Lead and all its compounds are toxic. More about lead is told in the chapter 3.4.

Table 2. Types of steel, chemical composition (applicable to cast analysis) (CEN, European Committee for Standardization, 1998, p.11)

Steel designation		Chemical composition (% by mass)					
name	number	C	Si max.	Mn	P max.	S	Pb
Steels not intended for heat treatment							
11SMn30	1.0715	≤ 0,14	0,05[2]	0,90 to 1,30	0,11	0,27 to 0,33	-
11SMnPb30	1.0718	≤ 0,14	0,05	0,90 to 1,30	0,11	0,27 to 0,33	0,20 to 0,35
11SMn37	1.0736	≤ 0,14	0,05[2]	1,00 to 1,50	0,11	0,34 to 0,40	-
11SMnPb37	1.0737	≤ 0,14	0,05	1,00 to 1,50	0,11	0,34 to 0,40	0,20 to 0,35
Case-hardening steels							
10S20	1.0721	0,07 to 0,13	0,40	0,70 to 1,10	0,06	0,15 to 0,25	-
10SPb20	1.0722	0,07 to 0,13	0,40	0,70 to 1,10	0,06	0,15 to 0,25	0,20 to 0,35
15SMn13	1.0725	0,12 to 0,18	0,40	0,90 to 1,30	0,06	0,08 to 0,18	-
Direct-hardening steels							
35S20	1.0726	0,32 to 0,39	0,40	0,70 to 1,10	0,06	0,15 to 0,25	-
35SPb20	1.0756	0,32 to 0,39	0,40	0,70 to 1,10	0,06	0,15 to 0,25	0,15 to 0,35
36SMn14	1.0764	0,32 to 0,39	0,40	1,30 to 1,70	0,06	0,10 to 0,18	-
36SMnPb14	1.0765	0,32 to 0,39	0,40	1,30 to 1,70	0,06	0,10 to 0,18	0,15 to 0,35
38SMn28	1.0760	0,35 to 0,40	0,40	1,20 to 1,50	0,06	0,24 to 0,33	-
38SMnPb28	1.0761	0,35 to 0,40	0,40	1,20 to 1,50	0,06	0,24 to 0,33	0,15 to 0,35
44SMn28	1.0762	0,40 to 0,48	0,40	1,30 to 1,70	0,06	0,24 to 0,33	-
44SMnPb28	1.0763	0,40 to 0,48	0,40	1,30 to 1,70	0,06	0,24 to 0,33	0,15 to 0,35
46S20	1.0727	0,42 to 0,50	0,40	0,70 to 1,10	0,06	0,15 to 0,25	-
46SPb20	1.0757	0,42 to 0,50	0,40	0,70 to 1,10	0,06	0,15 to 0,25	0,15 to 0,35

[1] Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. However, elements such as Te, Bi etc. may only be added by the manufacturer for improving the machinability, if this has been agreed at the time of enquiry and order.

[2] If, by metallurgical techniques, the formation of special oxides is guaranteed, a Si-content of 0,10% to 0,40% can be agreed.

Also in the free-cutting steel markets there is remarkable over capacity in Europe and heavy competition on prices. At the moment Imatra Steel is not producing and selling free-cutting steels. Imatra Steel has a strong know-how in producing calcium treated M-steels, which are also steels with good machinability, but they have also better mechanical properties than free-cutting steels. Chapter 3.3.3 tells more about M-steels.

Imatra Steel is able to roll steel bars starting from ∅ 25 mm. Free-cutting steels are often produced and used in quite small diameters. It is important to know, what are the most common diameters to find out if there is potential in Imatra Steel s diameters. With the current production capacity Imatra Steel could supply free-cutting steels at most 10 000 tons annually. The amount is quite small, so the objective of Imatra Steel would be to find a suitable niche in the limited market areas.

3.2.1 Producers in Europe

Producers of free-cutting steels in Europe are divided into two groups. Some are producing only non-leaded steels and some are producing both leaded and non-leaded steels.

Producers of both leaded and non-leaded free-cutting steels:

- British Steel, England
- Unimetal, France (belongs to ISPAT Group)
- Walzdraht Hochfeld, Germany (belongs to ISPAT Group)
- Saarstahl, Germany
- von Moos, Switzerland

Producers of only non-leaded free-cutting steels:

- Sidenor, Spain
- Lucchini-Group, Italy and France
- RIVA-Group, Italy
- Zelazarny Hradec, Czech Republic
- Trineck, Czech Republic
- OMEK, Russia

3.2.2 Customer Segments

The main customer segments in the free-cutting steel markets are the automotive industry and engineering workshops. The business is managed mostly through dealers, who have close relationship to sub-contractors for drawing, turning and peeling. Only the bigger players from the customer side are dealing directly with the steel mills. This is because the stockholders also perform a storage function and customers can buy steel in smaller quantities than directly from steel mills.

Steel products represent a significant element of the customers total costs. Thus the quality of steel products is important to the customers. Recently, especially the car industry has attached weight to the quality of steel used. This has led to the adoption of user-oriented manufacturing philosophy. Customers and steel producers operate closely together in order to improve existing steel grades or to invent new applications. In the case of free-cutting steels, special emphasis is assigned to machinability and how it could be improved.

3.3 Technical Characteristics of Free-cutting Steels

3.3.1 Target of Usage and Factors of Machinability

The most important technical requirement for free-cutting steels is good machinability. That is because the targets of usage are mainly products that require a lot of machining and are produced in large series. Typical end-use targets for free-cutting steels are smaller mass products for the car industry, as well as for general engineering. Those components are for example shafts, gears, sleeves, valves and nipples with low requirements of mechanical properties.

Machinability is an attribute that can not be evaluated with one numerical value. Machinability is good if the removal of the material in the machining does not require much capacity and causes minimum cutting forces. Good machinability includes also a long tool life. (Ihalainen, 1985, p.136)

The factors affecting the machinability are tool wear, uniformity of machinability, cutting forces, chip form, and the condition of the machined surface. Those factors are illustrated in figure 3.

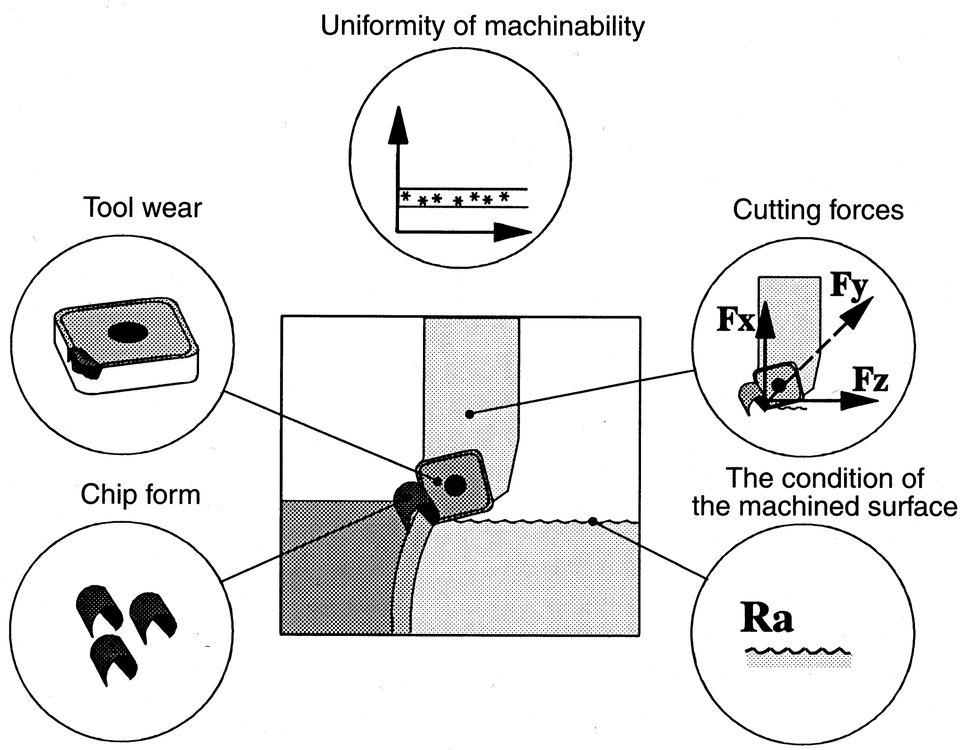

Figure 3. Factors of machinability. (Imatra Steel, 1995)

Factors of machinability are valued in diverse ways by different customers. However, the most important factor is often the tool wear, because it is directly related to the production time of the product and so affects the production costs.

Free-cutting steels offer a very good chip form and minimise the tool wear. Also cutting forces are low. This enables maximal amount of machined material.

3.3.2 Elements Affecting the Machinability

Tool material, working machine, cutting fluids, and work material are elements that have an influence on the values of the factors described in figure 3.

Tool material

The cutting tool material is one of the important elements of the machining system. Tool material and geometry must be carefully chosen in relation to the workpiece material to be machined, the kinematics and stability of the machine tool to be employed, the amount of material to be removed, and the required accuracy and finish. The most satisfactory tool will usually be the one corresponding to the minimum total cost of performing a required operation to the specified accuracy. One important element affecting the total cost is tool life that should be maximised to reduce costs. (Shaw, 1986, p.333-334)

Major tool material types used with free-cutting steels are high speed steel (HSS) and carbide. Carbide tools have good wear hardness, but high speed steel is tougher. There are also ceramic and cermet tools, but they are not that popular in machining free-cutting steels. HSS tools are mostly used in old, conventional working machines. Carbide tools are common in modern working machines like CNC-machines.

Working machine

The working machine has also an essential influence on machining. When machining with a conventional working machine the actual machining time is only 15-30 of the total production time because installation and faults require so much time. In that case the good machinability of a certain material does not have such a great effect on the total production time and costs. Computerised, numerically controlled (CNC) machines are not that vulnerable for faults and they also require less installation. By using modern CNC-machines the time used for actual machining process is longer and the good machinability of steel is more important because of the savings in costs. The customers using modern working machines gain more benefit from the good machinability of steel.

The definitions of conventional working machine and CNC-machine are not always very clear. The age of the machine is the most essential thing. Old machines are seldom controlled by computer and those can be regarded as conventional working machines. Modern CNC-machines are totally controlled by computer. However, there can be machines that are only partly controlled by computer. Multi-spindle automatic machines, which are mostly used in machining free-cutting steels, are often that kind of partly computerised machines.

Cutting fluid

There are three main functions of cutting fluids: lubrication, cooling and chip disposal. Lubrication is needed at relatively low cutting speeds and cooling at relatively high cutting speeds. Due to cutting fluids the tool maintains its hardness also at high cutting speeds. This is important when using HSS tools. When using carbide tools cutting fluid is not necessarily used. Requirement for a good cutting fluid is that it avoids corrosion and bacteria. (Ansaharju, 1997, p.26-27) There is a strong trend, mainly for environmental reasons, away from cutting fluids.

Work material

In this work only steels are concerned as a work material. Steel is basically an alloy of iron and up to about 1.5 $^{w}{}_{o}$ carbon. Alloy steels contain additions of one or more other elements to provide a variety of special properties. Manganese (Mn), chrome (Cr), molybdenum (Mo), nickel (Ni), and silicon (Si) are used to increase hardenability or to provide greater strength. Sulphur (S), phosphorus (P), lead (Pb), tellurium (Te) and bismuth (Bi) are used to improve machining properties. On the other hand nickel, manganese and chrome are weakening the machining properties. (Shaw, 1986, p.368-377)

The work material has a crucial role in the machining process. That is the reason why steel producers have to invest in developing materials that would have the best possible machining properties.

All these elements together are affecting the machinability. In order to gain a successful and cost effective machining process all the elements have to be optimised. This optimisation process is often implemented by the customer and steel producer together. Today a steel producer is not responsible only for the delivered material but also for being able to advise and support the customer in finding the applicable machining parameters suitable for the customer s machines and production process. Steel producers who have strong know-how also in machining have a competitive advantage in the market.

Decreasing production costs by decreasing the costs of machining is an important advantage for the customer. Imatra Steel has made machining experiments and calculations about the production costs of different components. The longer the machining time of a component the larger amount of its production costs come from machining. This calculation is seen in appendix I where the proportion of machining of production costs of different components is illustrated.

3.3.3 Free-cutting Steels Compared with Imatra Steel s M-steels

Imatra Steel has done a lot of work in developing a product range to correspond to customers requirements concerning machinability. Machinability of standard engineering steels has been one of the major research and development areas of Imatra Steel for over 20 years. This has been resulted in the development of M-steels, standard quenched and tempered and case hardening steels, which were introduced in the early 1980s. Imatra Steel s structural steel with M-treatment for improved machinability is called Imatra 520. A further development is HYDAX, steels for component production where a considerable amount of material is machined away or the machining is particularly demanding.

M-steels (M machinability) are steels treated with M-treatment. Most steels meeting national and international standards can be M-treated in addition to individual customer s specifications.
M-treatment comprises:

- special calcium treatment
- optimisation of the steel composition and of the possible heat treatment
- machinability testing

The M-steels exhibit excellent machinability without sacrificing other important properties such as hardenability, tensile strength, toughness and fatigue strength. The special treatment modifies the non-metallic inclusions in steel thus enchancing its machinability. Non-metallic inclusions in M-treated steel form a protective film on the tool surface.

The positive influence of calcium treatment has been known for a long time, but only in the past 20 years has it been researched more closely. The most essential benefit of calcium treated steels is reduced machining costs. In machining they are characterised by an increased tool life, lower cutting forces, a more favourable chip formation, smooth machined surfaces and a consistent machinability. These elements enable higher machining speeds and as a result in an increased machining throughput.

The greatest difference between free-cutting steels and M-steels is that M-steels have, in addition to good machinability, also better mechanical properties (see appendix II). Free-cutting steels are quite soft steels and their applications seldom require special mechanical properties. Despite the good machinability of M-steels, the machinability of free-cutting steels is even better, because of the use of lead in some grades, and also because of the inferior mechanical properties. That makes them also cheaper than M-steels. Free-cutting steels are not usually heat treated. There are differences also in applications. Free-cutting steels are commonly used in small components used in the car industry. M-steels, however, are used in applications where improved machinability is required, in through and case hardening steels, and structural steels.

One M-steel type, HYDAX, can be regarded as a half free-cutting steel. HYDAX is a structural steel combined with excellent machining properties. The sulphur content in HYDAX is higher (0,1) than in other M-steels. However, the mechanical properties do not essentially differ from other structural steels with normal sulphur contents, but the machinability is even better. HYDAX steels allow shorter machining times and give reduced tool wear. In addition they give a good surface finish. Such predictable machinability allows work to continue without troublesome tool breakage and hence unnecessary supervision is eliminated. HYDAX 15 is suitable for example for components of the hydraulics and pneumatics industry, such as hydraulic pistons and rotors for screw compressors. A typical application of HYDAX 25 is a connecting block, which needs a lot of drilling.

When comparing free-cutting steels with Imatra Steel s HYDAX, the differences are smaller than compared with other M-steels. This is mainly because of the higher sulphur content of HYDAX. Chemical compositions of free-cutting steels 11SMn30 (former 9SMn28) and 11SMnPb30 (former 9SMnPb28) are illustrated in appendix III. It shows that although the sulphur (S) content in HYDAX is higher than in other M-steels, the amount of sulphur in free-cutting steel grades is essentially higher. And naturally, there is no lead in HYDAX.

Imatra Steel has done a lot of machinability tests concerning free-cutting steels and HYDAX. In appendix IV the results of the turning test can be seen. Two free-cutting steel types are compared to HYDAX 15 and HYDAX 25 by using uncoated and TiN coated HSS tool. The test shows that with a 30 minute tool life cutting speed is higher with free-cutting steels than with HYDAX. Also it can be seen that the leaded free-cutting steel grade get the best results. Appendix V illustrates the same test using carbide tools both uncoated and TiN-Al_2O_3-TiC coated. Using uncoated carbide tool, HYDAX is better than free-cutting steel grades. And also by using coated carbide tool, HYDAX is considerably better than leaded free-cutting steel grade. However, the unleaded free-cutting steel grade got the best results. These tests show that free-cutting steels have very good machinability properties when using HSS tools. However, when using carbide tools the situation may be contrary.

3.4 The Use of Lead in Steel

The use of lead in steel is quite a complicated issue. All compounds of lead are toxic. The use of lead in steel production is already forbidden in

Scandinavia, because of its harmful environmental effects. The prohibition has been discussed for a long time also in Central European countries, but the car industry is strongly fighting against it. Leaded steels are commonly used in the components of vehicles and also in the hydraulics industry. A great amount of leaded steels are free-cutting steels. Lead is used to improve the machinablity of steels and thereby it reduces the production costs. The UK Steel Association estimates that the European Union makes about 1 300 kilotons of leaded steels annually. This represents a business value to the EU steel industry of approximately 760 million euros. So the market is huge and the economical effects of the prohibition would be enormous.

3.4.1 The Advantage of Using Lead in Free-cutting Steels

The lead content of free-cutting steels is typically 0,25 by weight and these steels are used in the manufacturing of machined parts for use in motor vehicles. The UK Steel Association (http: www.uksteel.org.uk elv.html) sees the benefits of leaded free-cutting steels in improved machinability, which enables:

- Faster machining speeds that bring economic advantage from greater throughput. It is claimed that lead alloying means 20-30 improvement in machinability.
- Better precision and complexity of machine parts.
- Improved yield of machined stock and machining tools.

The UK Steel Association claims that there are seen no viable alternatives to leaded steels that provide the necessary performance and cost advantage. It is obvious that the opinion of large European steel producers and of the car industry as their most important customer weigh a lot in the process towards the prohibition.

3.4.2 Effects of Lead on Man and Environment

Lead has been mined and produced into useful articles for more than 2 000 years. It is one of the most widely used non-ferrous metals because of its immense range of applications. Lead is also one of the most harmful metals, whose production and use cause occupational risk and cause apparent contamination of the environment. About 1 of the working population is estimated to be exposed to significant amounts of lead. The environmental pollution from lead affects the general public as well. (Keinonen, 1989, p.7)

Today, approximately three million tonnes of lead is produced worldwide each year. The production of batteries is the widest target of use of lead. About 50 of refined lead goes to battery production, about 10 is used as anti-knock additives in gasoline, and about 12 goes to pigments and chemicals. (Keinonen, 1989, p.11) Lead based pigments are used as a protective coating for steel structures and for paints used on highways. Lead chemicals are used in glassware and ceramics and as stabilisers in plastics. (Merian, 1991, p.975)

Industries and workplaces, where the employees are exposed to lead and its compounds:

- lead production (quarrying, enriching)
- melting, casting and working of lead
- machining of leaded materials
- production and use of paints containing lead
- production of plastic products (PVC)
- production of glass and ceramic
- production and distribution of motor petrol
- use of vehicles functioning with motor petrol

- processing of lead scrap

(Jaakkola, 1992, p.14-15)

Sources and emissions of lead

Lead and its compounds may enter the environment at any point during mining, smelting, processing, use, recycling, or disposal. Mobile and stationary sources of lead emissions tend to be concentrated in areas of high population density, and near smelters. From these emission sources, lead moves through the atmosphere to various components of the environment. It is deposited on soil, surface waters, and plants and thus is incorporated into the food chain of animals and man. Atmospheric lead is also an important component of street dust. Furthermore, humans and animals inhale lead directly from the atmosphere.
(Merian, 1991, p. 977-987)

The greatest pollution source of lead is the emission from vehicles burning leaded gasoline. Its relative importance is diminishing, however, in pace with progressive introduction of gasoline with reduced lead concentration and non-leaded gasoline. Most of the lead is emitted by car deposits nearby. Other important sources are industrial activities, including the metallurgy of non-ferrous metals, and iron and steel production. Industrial sources are typically point sources of emission and cause a more local deposition than automobile emissions. (Keinonen, 1989, p.11-12)

Absorption and distribution of lead in man

Overexposure to lead is one of the most common overexposures found in industry. It is also a major potential public health risk. Lead poisoning is the leading environmentally induced illness in children. At greatest risk are children under the age of six because they are undergoing rapid neurological and physical development.
(http: www.osha-slc.gov SLTC lead index.html)

The major route to absorption is through the gastrointestinal tract. In Finland about half of the daily uptake of lead by man originates from food and the other half is inhaled. (Keinonen, 1989, p.15)
The major health risks of lead concentrates on blood, nerve tissue and muscles. In the blood lead binds itself with red cells and decreases the red cell survival and inhibits heme synthesis. (Jaakkola, 1992, p.8)
As regards the general population, adults should not have higher concentrations than 35 to 40 µg Pb in 100 mL blood. For the protection of special risk groups (fetus, young children) concentrations in pregnant females and in children should be below 20 µg 100 mL. (Merian, 1991, p. 971) The biological half time of lead in the blood is 30-40 days. In the bones lead has a half time of 10 years. The most typical symptom of lead poisoning is anemia. (Jaakkola, 1992, p.8)

In recent years lead consumption has been decreasing partially because leaded gasoline is used less, because of attempts to substitute heavy batteries, and because lead tubes for many applications are not allowed any longer. (Merian, 1991, p.976)

3.4.3 Life Cycle of Lead in a Vehicle

H.U. Steil (1999) has undertaken an estimation of the environmental effects caused by the use and disposal of lead containing vehicle components. In the analysis has been assumed that the lifetime of a vehicle is 12 years. Lead and lead containing parts are used in the following vehicle applications:

- starter battery (with an average weight of 17 kg and lead content of approximately 10 kg the battery contains the highest lead content of any vehicle component)
- balance weights on vibration dampers

- coating of steel petrol tanks
- electric and electronic solders
- brass alloys
- free-cutting steel
- aluminium casting alloys
- stabilisers in plastics
- ceramic coatings
- glasses and glass coatings
- sliding bearings
- hot dip galvanised steel
- lamps
- printed circuit boards

It has been assumed that the total weight for lead-compounds is 12,5 kg per vehicle, of which the battery represents 10 kg. During routine vehicle use, releases of lead are limited to those parts, which are exposed to the weather or experience mechanical stress. Of the applications mentioned above, the following constitute possible inputs to the environment. The car user in not impacted by lead.

Dismantling of a vehicle

Depending on the type and condition of the scrap vehicle, some components may be taken out to be used as spare parts. In addition, liquids and the battery will be removed as well as radiator, alternator, starter motor, and some cables to improve the quality of the steel scrap. Cars, which have been badly damaged in accidents, may not undergo this process. This can result in the lead-acid battery being left in the car.

Lead in the steel production process

Once a vehicle has been shredded the material is separated into a steel-scrap fraction. Lead that appears in steel production process and later in the air of steel mills is a consequence of impurity of scrap used. The scrap that Imatra Steel uses is quite clean. The Imatra Steel s steel-making process does not produce much filter dust, only 7 kg per smelted ton and also the lead content is quite low (approximately 2,5). It is very rare that filter dust ends up to the dumping ground. Authorities require processing of the dust and the most common way is the recycling of zinc by using pyrometallurgic or hydrometallurgic methods. In this process lead follows zinc and remains as a waste in zinc production. After that it ends up in the lead production plant. So the recycling process for lead exists, but it is quite complicated.

Imatra Steel has a very effective filter dust removal system. At Imatra Steel the emission of lead from the smelting plant is very minimal. The average amount of stored filter dust per year is about 2 000 tons of which the amount of lead is about 50 tons. In 1998 the emission of lead was 60 kg. So the emission of lead is only 0,12 of the total amount.

The effects of the current emission on the environment are possible to detect only by using bio-indicators. Because of the efficient filter dust removal system the emission of lead at Imatra Steel is very low. Naturally, the earlier emissions of lead can still be seen in the soil, but those are not regarded as being very harmful.

3.4.4 End-of-Life Vehicles Directive

The End-of-Life Vehicles Directive that has been prepared in EU for years has been considered in the meeting of the Ministers of Environment in June 1999. According to the proposal car producers would be responsible for the recycling of vehicles after the year 2006, no matter when they are designed or produced. In practice, it means that recycling costs will be added to the price of vehicles. (Helsingin Sanomat, 1999)

The objective of the End-of-Life Vehicles directive is to reduce the amount and harmfulness of scrap vehicles and to develop their recycling. So the aim is to make the utilisation of scrap vehicles more effective and improve the recycling activity. Finland supports the principle of producer s responsibility, according to which, the producer and importer of a vehicle are responsible for recycling costs.
(http: www.vyh.fi ajankoht tiedote ym tied99 ym9936.htm)

The directive concerns also leaded steels used in vehicles, because lead makes the recycling of vehicles more difficult. In the beginning, it was proposed in the directive that the use of lead in steel would be totally prohibited. That proposal faced a strong opposition among the car industry and its steel suppliers. British Steel has provided its customers with a summary of the disadvantages of the prohibition of lead. According to the summary, the amount of lead in steel (at most 0,25) is claimed to be so low that prohibition would have only minimal effects on the environmental protection. On the other hand, the prohibition would cause enormous economical and social costs in the steel and car industries. If the production of components made from leaded steels were prohibited, vehicle production costs would increase approximately 140 million per year. That would have an effect on the competitiveness of the European steel and car producers. If the use of lead were to be prohibited there would be an increase in machining costs and also in energy consumption in the machining process. As a consequence the price of vehicles would become higher.

According to the final proposal the use of lead is prohibited in the vehicles coming to the market 18 months after the directive becomes valid. However, there are exceptions for some cases, for example for lead in steel. Lead is allowed in steel as an alloying material up to 0,3 . So there will be no change compared to the current situation. At the moment the proposal is heading the discussion in the European Parliament.

According to latest information, ACEA, the association of European automobile manufacturers, has started legal investigations to make the proposal legally impermanent. Car manufacturers have calculated that recycling costs of one car are approximately FIM 1 000. There are approximately 160 million vehicles in Europe. (Marttinen, 1999, p. 9)

3.4.5 Alternatives to Lead

The users of leaded steels claim that there are no potential alternatives to lead among other alloying materials. At the moment sulphur (S), phosphorus (P), tellurium (Te), and bismuth (Bi) are used in unleaded free-cutting steels to improve the machinability. The disadvantage of using sulphur is that it causes poorer mechanical properties and makes the hot rolling difficult. The problem with tellurium is that it is also a hazardous material. Bismuth, on the other hand, is ecologically a clean metal. It is scientifically recognised as one of the safest elements. It is also non-carcinogenic. (http: www.bismuth.be)

Researchers at the University of Pittsburgh, USA have received patent approval for a green alternative to leaded steels that substitutes tin for lead. The use of tin instead of lead in free-cutting steels could save money and make bars easier to machine. Late last year, USS Kobe melted a full production heat of 200 short tons of the tin-bearing free-cutting steel without problems. Tests of the resulting bars so far have been favourable. (Metal Bulletin, 1999, p.24) According to Iron and Steel Engineer (1999, p.55) the University of Pittsburgh has also created the Non-leaded Free Machining Steel Consortium, LLC, an international consortium of steel producers and manufacturers to commercialise the technology. In addition to American members there are also two companies from Germany:

Saarstahl Steel and Volklingen. Members of the consortium helped to finance the research for the past few years.

The drawback of using tin instead of lead is the much higher price of tin. Tin is about ten times more expensive than lead and that is a disadvantage from the viewpoint of car industry. That is the problem also with bismuth. Bismuth is even more expensive than tin. The prices of lead, tin and bismuth are compared in table 3.

Table 3. Prices of lead, tin and bismuth. (Metal Bulletin, 1999, p.25)

	Price (Metal Bulletin)	**Price** (FIM kg)
Lead (Pb)	550 euros tonne	3,30
Tin (Sn)	5 330 tonne	29,30
Bismuth (Bi)	4,20 lb	50,90

4 MARKET POTENTIAL

4.2 Concept of Market Potential

When clarifying the term market potential an adequate startpoint could be the definition of market:

A market is the set of all actual and potential buyers of a product.

Given this definition, the size of market is related to the number of buyers who might exist for a particular market offer. The potential market is the set of consumers who profess a sufficient level of interest in a defined market offer. (Kotler, 1997, p.131)

Consumer interest is not enough to define a market. Potential consumers must have enough income for the product, and they must have access to the product offer. (Kotler, 1997, p.131)

The industrial marketing manager must analyse organisational demand from two perspectives:

1. What is the highest possible level of market demand that occurs to all producers in this industry in a particular time period?
   The answer constitutes the market potential for a product. It is influenced by the level of industry marketing effort and the assumed conditions in the external environment.
2. What level of sales can the firm reasonably expect to gain, given a particular set of environmental conditions?
   The answer to this constitutes the firm s sales forecast.

(Hutt, 1992, p.184)

This work will concentrate on examining the concepts of market demand and market potential. In Imatra Steel s case it is impossible to determine the sales forecast for free-cutting steels because they do not yet belong to Imatra Steel s product range.

4.2 Market Potential, Market Demand and Demand Function

According to Kotler (1997, p.133) the first step in evaluating marketing opportunities is to estimate total market demand:

> *Market demand for a product is the total volume that would be bought by a defined customer group in a defined geographical area in a defined time period in a defined marketing environment under a defined marketing program.*

Market demand is not a fixed number but rather a function of the current conditions. This is why it can be called the market demand function. The dependence of total market demand on underlying conditions is illustrated in figure 4. The horizontal axis shows different possible levels of industry marketing expenditure in a given time period. The vertical axis shows the resulting demand level. The curve represents the estimated market demand associated with varying levels of industry marketing expenditure. Market minimum Q_1 (some base sales) would take place without any demand-stimulating expenditures. Higher levels of industry marketing expenditures would yield higher level of demand, first at an increasing rate, then at decreasing rate. Marketing expenditures beyond the certain level would not stimulate much further demand, thus suggesting an upper limit to market demand called the market potential Q_2.
(Kotler, 1997, p.133)

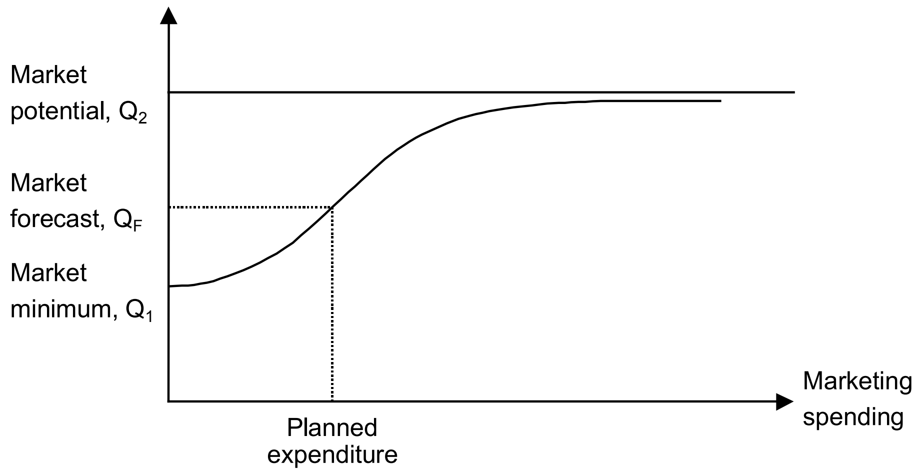

Figure 4. Illustrations of different market definitions. (Kotler, 1997, p.132)

The distance between the market minimum and the market potential shows the overall marketing sensitivity of demand. An expansible market is very much affected in its total size by the level of industry marketing expenditures; the distance between Q_1 and Q_2 is relatively large. At nonexpansible market the distance between Q_1 and Q_2 is relatively small. Organisations that are selling in a nonexpansible market must accept the market s size and direct their marketing efforts to winning a larger market share for their product. (Kotler, 1997, p.133)

There is only one level of industry marketing expenditure that actually occurs. The market demand corresponding to this level is the market forecast Q_F. Market forecast shows expected market demand, not maximum market demand. (Kotler, 1997, p.133)

The difference between market forecast and market potential is that a forecast is typically performed on a product or market segment that already exists. Market potential is typically the measurement of how much

the market can absorb of a given product in a future.
(http: www.frost.com market engineering b1c9.htm)

Market potential is the maximum possible sales of all sellers of a given product in a defined market during a specified time period.
(Hutt, 1992, p.184)

As illustrated in figure 4:

> *Market potential is the limit approached by market demand as industry marketing expenditures approach infinity, for a given environment.*

The phrase for a given environment is crucial in the concept of market potential. Consider the market potential for a product in a period of recession versus a period of prosperity. The market potential is higher during prosperity. (Kotler, 1997, p.133) The dependence of market potential on the environment is illustrated in figure 5.

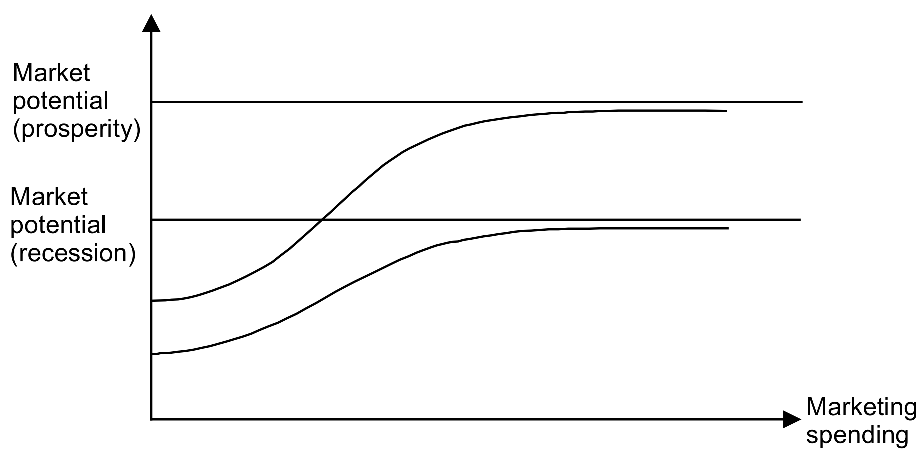

Figure 5. Marketing demand as a function of industry marketing expenditure (two different environments assumed). (Kotler, 1997, p.132)

Companies can not do anything about the position of the market demand function, which is determined by the marketing environment. Companies influence their particular location on the function when they decide how much to spend on marketing. (Kotler, 1997, p.133)

4.3 Methods of Measurement

To estimate current demand, companies attempt to determine total market potential, area market potential, industry sales and market share, and sales potential. (Kotler, 1997, p.142)

4.3.1 Total Market Potential

Total market potential is the maximum amount of sales that might be available to all firms in an industry during a given period under a given level of industry marketing effort and given environmental conditions. According to Kotler (1997, p.135) a common way to estimate total market potential is as follows:

$$Q \quad nqp$$

where:

Q total market potential [USD FIM etc.]
n number of buyers in the specific product market under the given assumptions
q quantity purchased by an average buyer
p price of an average unit

4.3.2 Area Market Potential

Companies face the problem of selecting the best territories and allocating their marketing budget optimally among these territories. Therefore they need to estimate the market potential of different market areas (cities, nations, etc.) Two major methods of assessing area market potential are available: the market-buildup method, which is used primarily by business marketers, and the multiple-factor index method, which is used primarily by consumer marketers. (Kotler, 1997, p.136) This work concerns industrial markets, so, only the market-buildup method is introduced.

The *market-buildup method* requires identifying all the potential buyers in each market and estimating their potential purchases. This method produces accurate results if we have a list of all potential buyers and a good estimate of what each will buy. Unfortunately, this information is not always that easy to collect. (Kotler, 1997, p.136)

In this work the information is collected by interviewing only some potential customers on each market area. The results of the interviews are representing only the interviewee s opinions, but it is assumed that the results are reflecting the situation in the whole free-cutting steel markets.

4.3.3 Industry Sales and Market Shares

To find out the actual industry sales taking place in the market, a company has to identify its competitors and estimate their sales. The industry s trade association often collects and publishes total industry sales, although it usually does not list individual company sales separately. Using this information, each company can evaluate its performance against the whole industry. Another way to estimate sales is to buy reports from a marketing research firm that audits total sales and brand sales. (Kotler, 1997, p.138)

4.3.4 Sales Potential

To determine the maximum sales opportunities for a product of an individual company one has to define sales potential, which is the maximum share of market potential an individual company might expect for a specific product or product line. (Hutt, 1992, p.184)

There are several methods available for estimating sales potential.
The primary methods are:

- End-user surveys
- Purchase proportion
- Correlative indexes

End-user surveys can be performed to measure market potential. These can be particularly useful when trying to measure the market potential for a product that does not currently exist or does not belong to company s product range. The key to these interviews is to explain adequately to the interviewee, how the product works, the benefits of the product, and what it costs. If this is done properly, a good idea is received of what the market potential will be by asking respondents if they would buy and how much they would buy over time.
(http: www.frost.com market engineering b1c9.htm)

A purchase proportion-based measurement is one in which you compare the sales of the product under investigation to sales of a related market or product segment. This is useful with a new product serving as an add-on device to work with an existing product, or when the product is able to replace an existing product on the market. If there are 10 000 units installed of a given device that can be replaced by the new invention, one could argue that there will be a 1 to 1 replacement rate end therefore the market potential is 10 000 units.
(http: www.frost.com market engineering b1c9.htm)

One aspect in this work is the possible prohibition of lead in the future. If the prohibition of lead became true, the demand for unleaded free-cutting steels would increase rapidly. The progress in the prohibition process is very slow and thus the direct comparison between market potentials for leaded and unleaded steels can not be made.

Correlative indexes are used to determine the relative market potential of different market segments. The calculation is based on the premise that when one series of data demonstrates a significant degree of correlation to another, the first can be used to estimate the second. The second is the product on which the measurement is taken.
(http: www.frost.com market engineering b1c9.htm)

In this work the most suitable method is end-user surveys. By interviewing the suppliers and users of free-cutting steels it is possible to find out the technical characteristics demanded from free-cutting steel and attitudes towards unleaded alternatives. That way the potential customers and the market potential for free-cutting steels can be defined.

4.4 Importance of Measuring Market Potential

The primary application of market and sales potential information is clearly in the planning and control of marketing strategy by market segment. Once sales potentials are determined for each segment the manager can allocate expenditures on the basis of the potential sales volume. There is no benefit in spending money on advertising and personal selling in segments where the market opportunity is low. Naturally, expenditures have to be based on both potential and the level of competition. (Hutt, 1992, p.186)

An accurate estimate of market potential is very important because on this measurement will be based a lot of investments in product development, production capacity, and also marketing tools. Because the measurement of market potential is also used in markets that do not currently exist, it is essential to use the measurement as a gauge from which to determine the magnitude and speed of future investments. The following list illustrates some of the applications of this measurement:

- Gauge size of R D budget
- Gauge size of marketing investment
- Could indicate degree to which competition will be attracted
- Helps set sales forecasts
- Helps attract outside investors
- Helps with production planning

(http: www.frost.com market engineering b1c9.htm)

The reason why Imatra Steel wants to examine the market potential for free-cutting steels is distinctly the need to gather information to help in making the decision about product development investments.

5 SURVEY ON THE MARKET POTENTIAL FOR FREE-CUTTING STEELS IN EUROPE

5.1 Survey Contacts

The survey was carried out by conducting interviews and questionnaires. In question formulation the need of information that was determined in objectives of the master thesis was taken into account. The need of information comprises following areas:

- Total market potential
- Free-cutting steel grades and diameter range used
- Price situation
- Issues concerning the machinability
- Attitudes towards forbidding the use of lead

Questionnaires are presented in appendix VI.

Market areas that were taken into closer examination were Germany and Sweden. England and the domestic market were reviewed only briefly. Customer contacts in Sweden are very good. If Imatra Steel would begin to compete on free-cutting steel markets, Sweden would probably be the most important target market. Germany was taken into examination, because there has been a decline in recent sales. Imatra Steel wanted to examine if there would be opportunities in the area of free-cutting steels in Germany. In Germany and Sweden interviews were arranged. England and France are both important target markets of Imatra Steel. However, there has been continuous improvement in sales in France and also in England. At the moment it was seen to be unnecessary to conduct the study of the French market. The situation in England was surveyed by conducting a couple of questionnaires. The situation in the domestic market was also mapped through questionnaires.

Segments from which information was required were stockholders, bright steel converters, and end-users like turning workshops and subcontractors to the car industry.

Imatra Steel s marketing personnel, both in Imatra and its sales offices, was responsible for arranging the contacts and interviews. Imatra Steel has plenty of contacts with European stockholders and bright steel converters. Many of them are customers and some of the bright steel converters can be regarded as competitors.

5.2 Market Area: Germany

To gain detailed information about the German free-cutting steel markets three meetings were arranged in Germany:

- Schmolz Bickenbach
- Alois Berger
- Bosch Development Centre

Schmolz Bickenbach is one of Europe s biggest stockholders and bright steel converters. The company s activity is divided into direct distribution (80) and production (20). Production includes drawing and turning black steel bars into bright steel bars. Net sales is about DM 1 600 million and the amount of personnel 2 000. The target market consists of the car industry (60), engineering industry, and building industry. Earlier they used to sell direct to the car manufacturers, but not anymore, because today the car industry buys more completed parts from subcontractors. Hundreds of subcontractors manufacturing those parts form the customer base of Schmolz Bickenbach. The most important suppliers are British Steel, Saarstahl and Unimetal.
The interview was arranged in the headquarters of Schmolz Bickenbach, D sseldorf, on 9th June 1999. Interviewees were Peter Heydtkamp

(manager of bright steel production unit) and Hermann-Josef Wagels (supply manager).

Alois Berger is one of Germany s biggest turning companies. In addition to plants in Germany it has activities also in USA, Canada and Switzerland. The greatest part (85) of their production goes to the car industry. The most important customers in Europe are Bosch, Daimler Chrysler and Lucas. Raw materials used are steel and aluminium. The proportion of free-cutting steels among steel products is 40 . Leaded and non-leaded free-cutting steels are used in equal amounts, altogether 2 000 tons annually (in Germany). Alois Berger s main supplier is Ziehwerk Plettenberg. Other suppliers are WDI, Schmolz Bickenbach and von Moos.
The meeting took place in Ottobeuren, on 10th June 1999. Interviewee in Alois Berger was Wolfgang Winkler (supply manager)

The interviewee in **Bosch** s development centre was Doctor Dieter Wicke, who is the manager of material development group. His group is responsible for the metallic raw materials development and the heat treatments. So he is not personally working with free-cutting steels and his answers were quite on a general level. Bosch uses turned parts to a value of about billion DM annually. The interview was arranged in Schwieberdingen, on 11th June 1999.

5.2.1 Total Potential

The total potential of free-cutting steels in Germany is estimated to be several hundreds kilotons. Accurate numbers are hard to give, but one estimation was 500 000 tons. However, the share of Schmolz Bickenbach alone is approximately 150 000 tons.

5.2.2 Free-cutting Steel Grades and Diameters Used

The most common free-cutting steel grades in Germany are 11SMn30 and 11SMnPb30, representing about 80 of the market. Minor grades are 35S20 and 45S0, both available as well with lead (Pb). Also lead-alloyed quenching and tempering grades and case hardening steels are in use, like 41Cr4Pb, C35Pb and 16MnCr5Pb. Those grades, however, are not regarded as free-cutting steels. Schmolz Bickenbach is naturally supplying almost all the grades mentioned in the standard and the share of non-leaded free-cutting steel grades is 35 - 40 . Alois Berger uses an equal amount of leaded and non-leaded grades. According to Mr Wicke the greatest share (70 - 90) of free-cutting steel parts that Bosch uses are made from leaded steel.

Schmolz Bickenbach supplies the diameter range of ∅ 5,5 - 160 mm. However, the most used diameter range is ∅ 25 - 40 mm. 70 of their products belong to that dimension range, but only 35 belong to the dimension of 25 mm - 160 mm. So it can be concluded that smaller diameters are the mostly used. In German production plants Alois Berger produces parts up to ∅ 67 mm.

5.2.3 Price Situation

Price situation in the free-cutting steel markets is not any better than in the steel industry in general. Prices tend to decline all the time. According to interviewees in Schmolz Bickenbach, selling prices for drawn free-cutting steels are under 1 DM kg. Mr Winkler in Alois Berger claims them to be 1 - 1,20 DM kg.

5.2.4 Issues Concerning the Machinability

Free-cutting steel bars are usually supplied in drawn condition. Schmolz Bickenbach s customers have requirements for straightness of bars and treatment of bar ends is also required. Machinability is the most important technical characteristic; not many mechanical properties are required.

Product mix of parts made from free-cutting steels is very wide: different kind of components and precision elements like nuts, screws, shafts, gears, sleeves, and also hydraulics parts. Those parts are often produced in mass production and working machines are mostly multi-spindle automatic machines. There also some modern CNC-machines in use. According to Mr Winkler from Alois Berger tool material depends on the processing method. With turning carbide tools are used and with drilling both carbide and high speed steel tools are used. The trend is, however, towards carbide tools. With working machines that Alois Berger uses also unleaded free-cutting steel can be machined, it is only slower (100 m s versus 140 m s). So the machinability of leaded free-cutting steels and also the condition of the machined surface are regarded to be better with leaded grades.

5.2.5 Attitudes towards Forbidding the Use of Lead

Based on the interviews, opinions about the prohibition of lead in steel diverse depending on who is asked. It is commonly known that large car manufacturers also in Germany have the greatest opposition mainly because of the production cost advantages of leaded material. Due to this, subcontractors and steel producers have pressure towards leaded free-cutting grades. However, all interviewees agree that the prohibition will occur some day in the future but not yet within five years. So they were not yet prepared for that. For Schmolz Bickenbach as a dealer and Alois Berger as a subcontractor the problem would not be so big. They sell and use the materials that are required. Schmolz Bickenbach admits, however, that they would have to invest in new machines that would be better suitable for unleaded materials. For Bosch as an end-user the situation would be more complicated. They would have to be prepared to pay more for supplied components because of the increasing machining costs.

When the preparation for prohibition of lead becomes current, the interests of all interviewees would lie in alternative materials and also on the development of working machines. They hope that there will be alternatives to leaded free-cutting steels that would not have such a pronounced negative effect on their production process. Mr Winkler from Alois Berger believes that the positive effects of lead on the machinability could be reached also with other alloying materials like calcium, bismuth and selenium. It is only much more demanding for steel producers. As far as working machines are concerned, they should be developed so that machining of unleaded materials would be profitable. That would require considerable investments.

All the interviewees emphasised the large economical effects of the possible prohibition. It would influence directly the price of components used in the car industry and thereby the production costs of vehicles would increase. Naturally, they all saw also the positive environmental effects of prohibition of lead. Without lead in steel the recyclability of scrap vehicles would be much better.

5.3 Market Area: Sweden

The interviews with Swedish companies were carried out both in Sweden and at Imatra Steel linked to company visits. Two stockholders were interviewed at Imatra Steel:

- Tibnor
- Br derna Edstrand

Two other interviews were arranged in Sweden:

- Boxholm St l
- Torsten Ullman

Tibnor is a supplier to the manufacturing, construction and process industries in the Nordic Area. They stock a broad range of steel, stainless, construction steel, metals tools and industrial supplies. Tibnor has 40 locations of warehousing and production facilities or sales offices in Sweden, Denmark, Finland, Norway and Poland. The number of employees is 1600 and turnover SEK 6 500 million.
(Tibnor, 1999, p.3-5)
The interviewee was supply manager Lars stell and the discussion took place at Imatra Steel on 22nd June 1999.

Tibnor s sells only leaded free-cutting steels and the amount is 4 000 tons annually. Its most important supplier of free-cutting steels is British Steel but they buy from Rasch too. The most important customers are Torsten Ullman, Electrolux and Samhall. The end-user is the car industry.

Br derna Edstrand is a stockholding company, which stocks and distributes commercial steel, special steel, pipes and tubes, reinforcing and stainless steel as well as aluminium. They are established in Sweden, Denmark, Poland, Latvia and Lithuania. In 1998 turnover was SEK 2 328 millions and number of employees 534.
(http: www.trelleborg.com broderna edstrand english company presentation.html)
The interviewee was Hans Andersson, area manager in special steels, and the meeting was arranged during his visit to Imatra Steel on 27th September 1999.

Boxholm St l Ab is the biggest producer and dealer of cold drawn steel bars in Scandinavia. The company had turnover of SEK 236 million in 1997 and number of employees is approximately 100. Its production, composed of structural steel, construction steel and free-cutting steel, was approximately 40 000 tons in 1997. (Boxholm St l, 1997, p.3) The share of free-cutting steel in Sweden is 15 000 tons. The interviewee in Boxholm St l was sales manager H kan Lundberg and the meeting took place in Boxholm on 28th September 1999.

British Steel is a major supplier of Boxholm St l and they buy also some from Saarstahl. All their customers are subcontractors of the car industry (Volvo, Saab, Scania) and they do not have any direct business with the car industry. Torsten Ullman is the most important customer and is a considerably bigger company than the second most important.

Torsten Ullman Ab provides the industry with high-precision products for engines, gearboxes and associated systems. It has four production units in Sweden. Turnover is SEK 470 million and number of employees is 541. (http: sed.swedishtrade.se e pagebody.htm)
The interview was conducted in Kungs r, on 28th September, and the interviewee was logistics manager Curt Jansson.

Almost all (95   ) of Torsten Ullman s production goes to the car industry. They buy free-cutting steels mostly from Boxholm, whose supplier is British Steel. Rasch is also one supplier. When talking about amounts of used free-cutting steel, Curt Jansson s estimation was 5 500 tons annually.

5.3.1 Total Potential

The estimations about the total market potential for free-cutting steels in Sweden differed slightly between the interviewees. H kan Lundberg from Boxholm St l estimated the total potential in Sweden to be at its highest approximately 25 000 tons but it could be also only 15 000 tons. Hans Andersson from Br derna Edstrand estimated the market potential to be even 35 000 tons. It is impossible to get accurate information but, however, the consumption of free-cutting steel is also in Sweden highly dependent on the car industry.

5.3.2 Free-cutting Steel Grades and Diameters Used

The free-cutting steel grade mostly used in Sweden is SS1914, which is a leaded grade, and is equivalent to EN 10087 grade 11SMnPb30. Tibnor, Br derna Edstrand and Boxholm St l estimate that 90 - 95   of the free-cutting steel they supply is that grade. Torsten Ullman estimates that

60 - 70   of the free-cutting steel used is SS1914 and together with grade 1957 they comprise 95   of the used free-cutting steels.

Non-leaded free-cutting steels are not popular in Sweden. Torsten Ullman, which is the biggest subcontractor to the car industry in Sweden, does not use non-leaded grades at all. Because of that Tibnor and Br derna Edstrand do not supply them. Boxholm St l has some exports of non-leaded grades (e.g. SS1912, equivalent to 11SMn30) to Holland.

Stockholders have the diameter range of round 5   100 mm and hexagon 5   70 mm. The diameter range mostly used in Sweden is ∅ 15 - 50 mm. According to Hans Andersson 50   of the total potential belongs to the diameter of 25 - 50 mm. Torsten Ullman uses bars in diameter range of round 8 - 40 mm and hexagon the same. Calculated in pieces more round bars are used, but by weight more hexagon is being used.

5.3.3 Price Situation

The interviewees were not very eager to talk about prices. Naturally stockholders have some kind of standard prices in their stock lists but those are, like Mr Lundberg from Boxholm told, prices that only can be dreamt about. So, also in Sweden the prices are quite low at the moment. The interviewees mentioned prices of 5 - 6 Kr kg.

5.3.4 Issues Concerning the Machinability

According to the interviewees the working machines mostly used for free-cutting steels are six-spindle automatic machines. Also CNC-machines are used and the amount of CNC-machines is increasing gradually through investments. Torsten Ullman has 18 six-spindle machines and 10 CNC-machines. Multi-spindle automatic machines are considered good in mass production because they are usually specialised in machining only one product at time. CNC-machines are considered more flexible and accurate. Also the tools used in them are cheaper. However, the competitiveness of CNC-machines is not so good when producing cheap parts in large series.

A far as to tool materials are concerned, both carbide and HSS tools are used. According to Mr Andersson, five years ago carbide steel was the most common tool material, but today hard metal is becoming more popular.

The most typical part that Torsten Ullman makes from free-cutting steel is a wheel nut for Volvo. Machinability is very important because approximately 30 of the original weight is machined away. No special mechanical properties are required. Chip form is the most important factor of machinability.

Boxholm St l, as a producer of cold drawn steel bars, aims to achieve the best possible straightness of bars, which is becoming more and more important for customers. That is one competitive advantage to make the machining more efficient.

5.3.5 Attitudes towards Forbidding the Use of Lead

Mr stell s opinion about the prohibition of lead was that it would never occur. According to him, there is not enough demand for non-leaded alternatives, because the investments for new working machines would be too expensive. Personally he did not have anything against non-leaded alternatives, but he believes that customers are not ready to pay for them.

British Steel is working very hard to prevent the prohibition of steel and the situation has remained unchanged. Mr Lundberg from Boxholm St l does not believe that there will be any radical changes in the next five years. It may be that the prohibition is current not for 10 or 20 years. Volvo has some departments that prohibit the use of lead. That is, however, still quite on a small scale. The interviewees do not believe in a total prohibition of lead in the near future. One possibility could be that sulphur replaces lead.

5.4 Market Area: England

Information about free-cutting steel markets in England is based on the questionnaires that were conducted with the help of the personnel in the local sales office. Unfortunately it was not possible to get any answers directly from end-users.

5.4.1 Total Potential

Total potential in England is estimated to be 300 000 350 000 tons. The market potential for free-cutting steels in England is quite similar to that of the German market. Those markets together form the greatest share of the European free-cutting steel markets. British Steel as the biggest producer of free-cutting steels in Europe is dominating those markets in England.

5.4.2 Free-cutting Steel Grades and Diameters Used

The most common grade used in England is 11SMnPb30. Other grades mentioned were 10S20 (En 1A) and 35S20 (En 8M). The greatest share (70) of the free-cutting steels supplied are leaded grades. The diameter range in round bar in coil is 12 mm to 45 mm which amounts to 60 or even more of the total volume in free-cutting steels. The most common dimension area is ∅ 12 - 25 mm. It is estimated that 30 000 40 000 tons of the total potential for the European market belong to Imatra Steel s diameter range. Greatest share of the larger diameter is exported to the USA.

5.4.3 Price Situation

Prices in England are quite on the same level as in other market areas. Price for drawn free-cutting steels is 400 - 420 ton.

5.4.4 Issues Concerning the Machinability

Because of the lack of response from the end-user side the information concerning working machines and machinability is not extensive. Based on the respondents opinions the working machines are mainly multi-spindle automatic machines. Also CNC-machines are in use. Opinions about tool material were quite uncertain, but HSS tools were considered to be most common.

5.4.5 Attitudes towards Forbidding the Use of Lead

British Steel is a strong player in the lobbying against the prohibition of lead in steel. It has also succeeded fairly well, so far. Anyhow, the prohibition is seen quite inevitable in the future, but not yet in the next five years. It was also said that there are not enough non-leaded alternatives in the free-cutting steel markets that could replace the leaded grades.

5.5 Market Area: Finland

The use of free-cutting steels is quite minor in Finland because of the small amount of workshops operating in that area. The main reason is naturally the lack of the car industry and subcontracting for the car industry.

In Finland free-cutting steels are supplied by dealers. Starckjohann Steel is the biggest supplier. Flinkenberg, Asva, Kontino, and Tibnor Suomi have minor shares. The amount of end-users is also quite small. One of the biggest domestic end-users is Ensto. Ensto is an international group that manufactures electrical accessories and does contract manufacturing for the electrical and electronics industry. The questionnaires were sent to five dealers and four end-users. The answers were received only from two dealers (Starckjohann Steel, Flinkenberg) and one end-user (Ensto), so the answer percent was only 33 .

Total potential in Finland is estimated to be 3 500 - 4 000 tons and it is totally imported. According to information obtained from Finnish Custom s Statistics (Tullitilasto) the import was 3 900 tons in 1998. The amount was imported mainly from Sweden and Germany, and some from Denmark. The average price from Sweden was 4,43 FIM kg and from Germany

3,97 FIM kg. Ensto is buying free-cutting bars for 6,50 FIM kg so they pay quite a high price. Leaded grades have the major share of Finnish free-cutting steel markets. The most common free-cutting steel grade is 11SMnPb30. In Finland both conventional working machines and CNC-machines are used. Opinions about the prohibition of the use of lead in steel were quite convergent. The probable moment for the prohibition was evaluated to be not earlier than in five years time. The effects of the prohibition on their own activity were seen to be quite minor. Dealers would prepare to supply alternative grades and the end-user should be prepared for a decline in machinability and longer machining times.

5.6 Conclusions

The responses of the interviews and questionnaires showed that free-cutting steel markets in Europe are quite congruent. Total potential in Europe is estimated to be one million tons, of which the shares of Germany and England are the biggest. The free-cutting steel grade in main use is the same in all market areas. Only in Germany non-leaded, sulphured grades are more popular. Diameter range did not vary a lot between the market areas. The most common diameter is between ∅ 12 mm and ∅ 50 mm. However, the greatest deal of the potential concentrates on smaller diameters. The share of the potential for diameters starting from 25 mm varied between 10 and 50 . There were no remarkable differences in the price level. Selling prices for drawn bars were best in Finland and in Sweden, and lowest in Germany.

Working machines were mostly multi-spindle automatic machines, in which HSS tools are used. The direction of development is, however, towards CNC-machines, in which the use of carbide tools is more advantageous. The most important information concerning working machines was that the machining of non-leaded free-cutting steels is not impossible or difficult with the multi-spindle machines, it is only slower.

Opinions about the probable prohibition of lead in steel in the future were also quite congruent. All interviewees were well aware of the situation and no one totally ignored the issue and its importance. Still they did not believe that the prohibition would occur within the next five years, because of the lobbying of the car industry. All interviewees admitted that the use of leaded free-cutting steels is popular only because of the financial aspects. A technical barrier for the use of non-leaded materials does not exist.

Table 4 summarises the results and conclusions made from the interviews and questionnaires.

Table 4. Summary of the situation in the most important market areas

	Germany	Sweden	England
Total potential	500 ktn	25 35 ktn	300 350 ktn
Grades mostly used	11 SMnPb 30 11 SMn 30	11 SMnPb 30	11 S MnPb 30
Diameter range mostly used	25 - 40 mm ∅	15 50 mm ∅	12 45 mm ∅
Estimated share of the potential for diameter range of 25 mm	35	50	10
Price (euros kg) (drawn material)	0,51 0,61	0,58 0,70	0,63 0,66
Most common working machines	multi-spindle automatic machines	multi-spindle automatic machines	multi-spindle automatic machines
Most common tool material	HSS	HSS	HSS
Probable time for the prohibition	after 5 years	after 10 years	after 5 years

Mr Lundberg from Boxholm St l had a table of the international comparison of business conditions and material costs in the steel industry. The survey was conducted by Verband der Deutschen Drehteile Industrie and it was published in the international congress of SID in Munich, on September 13-17, 1999. The situation in selected markets is illustrated in table 5.

Table 5. International comparison of business conditions and material cost survey (SID International congress, 1999)

		Germany	**Sweden**	**England**	**France**
Business development					
Orders received		↘	↗	↘	→
Turnover		→	↗	↘	↗
Development of costs					
Basic material (ex works, based on 2 tons)		euros kg	euros kg	euros kg	euros kg
11 SMnPb 30 free-cutting steel	5mm ∅	0,54	0,85	0,61	0,73
	20 mm ∅	0,53	0,76	0,58	0,58
Personnel costs		euros h	euros h	euros h	euros h
set-up man	hourly wage	13,80	11,83	12,01	11,43
helper	hourly wage	11,20	9,88	8,05	7,17
social costs		75,0	62,6	9,0	41,0

Naturally, the figures illustrated in table 5 are also estimations. However, the information based on the table and given in the interviews are quite convergent, at least concerning the price situation. According to these two data sources it can be said that the view they give about the price situation in the European free-cutting steel markets is realistic.

6 COMPETITOR ANALYSIS

In the literature (Porter, 1980; Hussey, 1991) the competitor analysis is often seen as a process, which begins with defining the level of competition in general, and goes on collecting more exact information about the competitor s actions in the market. Rotschild (1984) begins the analysis by mapping the battlefield, which means to start the strategic thinking from analysing customer needs and wants. Knowing these things helps to anticipate changes, especially in the form of new substitute products.

It is of primary importance to have adequate knowledge about the competition to be able to develop efficient corporate plans. Competitor analysis is the way to attain the knowledge needed in formulation of competitive strategy and corporate plans. A good competitor analysis is a view about the key competitor s actions. The questions that need to be answered are the same that company has to answer in its own corporate planning process. (MET, 1988, p.19)

6.1 Porter s Framework for Competitor Analysis

Porter (1980) suggests a general framework for competitor analysis. He suggests separate models for analysing an industry and a specific competitor.

6.1.1 Industry Analysis

According to Porter (1980, p. 4) the intensity of competition in an industry is dependent on five basic competitive forces:

- suppliers

- buyers
- potential entrants
- substitutes
- existing industry competitors.

(See Figure 6)

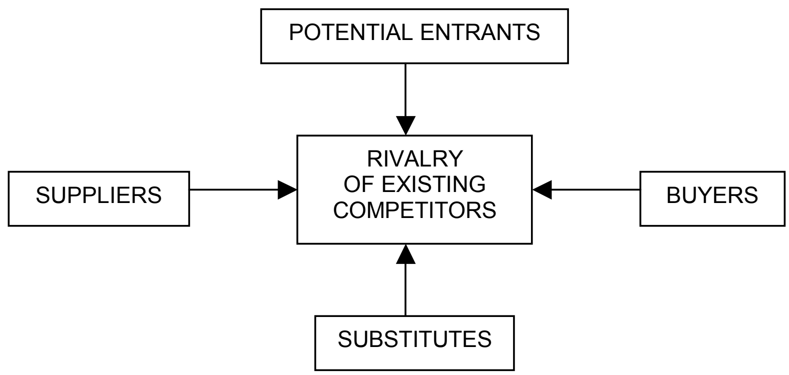

Figure 6. Forces driving industry competition (Porter, 1980, p.4)

The threat of new entrants into industry depends on the barriers to entry and the expected reaction from existing competitors. Rivalry among existing competitors occurs because one or more of them either feels the pressure or sees the opportunity to improve its position. In most industries, competitive moves by one company have noticeable effects on its competitors and thus may incite retaliation or efforts to counter the move. That shows that firms are mutually dependent.
(Porter, 1980, p.7-17)

Apart from its direct competitors a company also competes with industries producing substitute products. Substitute products are those performing the same function as a product of the industry in question.
(Porter, 1980, p.23)

Buyers influence the industry by forcing down prices, demanding higher quality or more services, and by playing competitors against each other. On the other side, suppliers are also affecting the industry with prices and quality. (Porter, 1980, p. 24-26)

According to Porter the purpose of an industry analysis is to gain an overall insight into the forces driving competition and to analyse what the company s strengths and weaknesses are in relation to these forces. This knowledge can be used in formulating an optimal competitive strategy. Industry analysis provides a background to self-analysis and analysis of individual competitors.

6.1.2 Competitor Analysis

Regarding analysing individual competitors, Porter points out that the objective of a competitor analysis is to develop a profile of the nature and success of the likely strategy changes each competitor might make, and each competitor s probable reaction to the array of industry changes and broader environmental shifts that might occur. (Porter, 1980, p.47)

6.1.2.1 The Components of Competitor Analysis

Porter (1980, p.48) divides the competitor analysis into four components:

- future goals of a competitor,
- current strategy,
- assumptions about itself and the industry, and
- capabilities (strengths and weaknesses).

The components are shown in the following figure. (Figure 7)

Figure 7. The components of a competitor analysis. (Porter, 1980, p.49)

By analysing future objectives it is possible to predict whether or not each competitor is satisfied with its present position in the industry, and how likely that competitor is to change its strategy and the vigour with which it will react to outside events or to moves by other firms. Knowing competitor s goals will also help to predict its reactions to strategic changes. (Porter, 1980, p.50)

Identification of competitor s assumptions reflects the competitor s assumptions about itself, and about the industry and the other companies in it. These assumptions guide the way the firm behaves and the way it reacts to events. According to Porter (1980, p.58) the assumptions are not always realistic and correct.

The third component of Porter s competitor analysis is evaluating of the current strategy of each competitor. A competitor s strategy is mostly thought as its key operating policies in each functional area of business and how it seeks to interrelate the functions. This strategy may be either implicit or explicit. One always exists in one form or the other.

An appraisal of each competitor s capabilities is the final step in competitor analysis. Defining competitor s potential strategy is even more difficult than defining current strategy. The analysis is carried out by defining competitors strengths and weaknesses, which will determine its ability to initiate or react to strategic moves and to deal with environmental or industry events that occur.

Competitor s reaction profile is a synthesis of these components (see figure 7). Based on the reaction profile can be evaluated how the competitor is going to react in different market situations.

6.2 Hussey s Approach to Competitor Analysis

Hussey s analysis process has a lot in common with Porter s ideas. According to Hussey the corporate appraisal of the company should provide an understanding of where the company fits in its competitive arena. Techniques of industry structure analysis have been developed to help the organisation to obtain this understanding. Many of the concepts used in the industry structure analysis approach are not new, and have their roots in classical economic principles of market imperfections. Figure 8 illustrates the approach described in the Hussey s book. (Hussey, 1991, p.66)

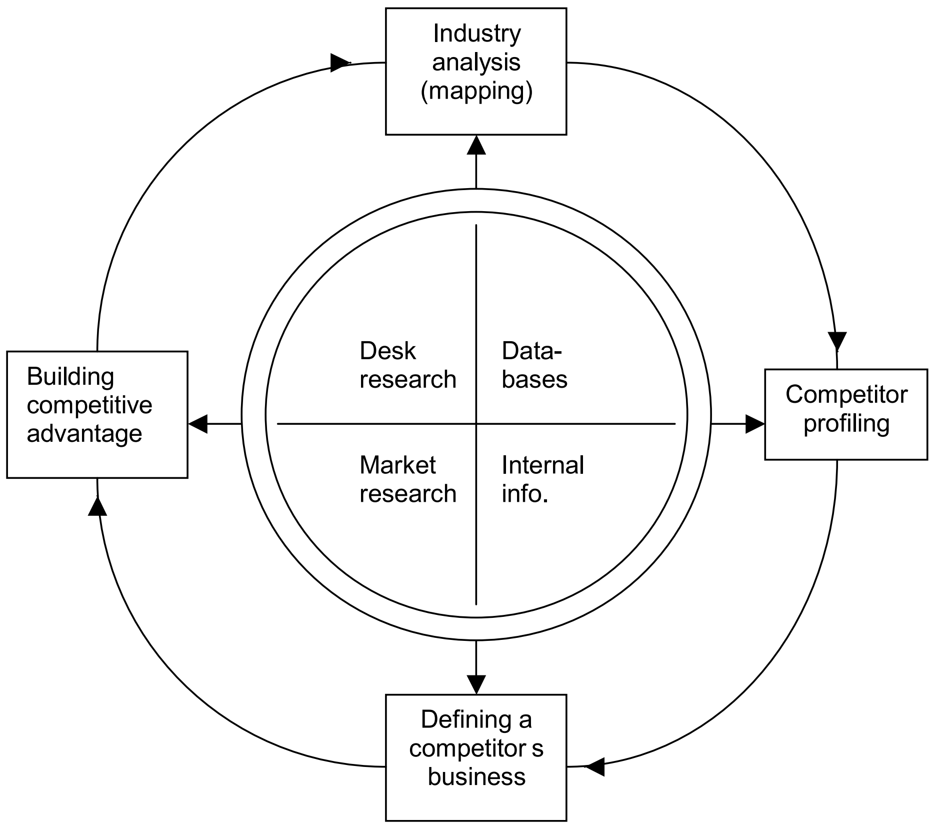

Figure 8. Approach to competitor analysis (Hussey, 1991, p.67)

In the outer ring are the analytical steps, beginning with the mapping approach, which provides a practical application of the principles of industry analysis. Two further analytical aids are recommended. The first profiles major competitors, providing vast amounts of data into a form, which aids strategic thinking. The second contrasts the segmentation approaches of each significant competitor. The box building competitive advantage , is the thinking and decision stage from which strategic actions should emanate. The inner circle examines the four major sources of information for competitor analysis. (Hussey, 1991, p.66)

6.3 Quality of Competitor Information

In-depth competitor analysis requires a great deal of data, much of which is not easy to find without considerable hard work. Many companies do not collect information about competitors in a systematic way, but act on the basis of informal impressions, conjectures, and intuition gained through the titbits of information about competitors that every manager continually receives. The lack of good information makes it difficult to do sophisticated competitor analysis. (Porter, 1980, p.48)

The problem with Porter s competitor analysis is that it produces mostly information that is based on subjective evaluations. The exact knowledge about competitor s objectives, assumptions, or present and potential strategies would require inside information, which is quite difficult to get. Also a structured evaluation of the data and its reliability as well as a systematic derivation of strategies can be difficult. That is why, the intuition can in some cases form competitors reaction patterns best.

6.4 Analysing Competing Firms

A company has to analyse all significant existing competitors in the industry. Closest competitors are those seeking to satisfy the same customers and making similar offers. Part of the closest competitors may exist also in other industries. A company should also pay attention to its latent competitors, who may offer new or other ways to satisfy the same needs. Those potential competitors can be identified from the following groups:

- Firms not in the industry, but who could overcome entry barriers particularly cheaply.
- Firms for whom there is obvious synergy from being in the industry.
- Firms for whom competing in the industry is an obvious extension of the corporate strategy.
- Customers or suppliers who may integrate backward or forward.

(Porter, 1980, p.50)

Porac and Thomas (1990, p.226) distinguish two criteria that are traditionally used by economists in defining competitors and classifying them into competitive groups:

- *The industry criterion* according to which organisations compete with another when they have similar technological attributes and can produce similar outputs.
- *The market criterion* which suggests that organisation compete with one another when their output attributes fulfil similar client functions, and are thus substitutable.

Rotschild (1984, p.59) begins the analysing of competitors by classifying them according to two criteria. The first is the degree of specialisation. This is evaluated by finding out if the competitor is acting only in one or few industries, or is it the company with diversified activities. The other criterion is the company s geographic focus. Companies can be divided into domestic, international and global companies. Only after preliminary screening and broad classification it is time to clarify competitors objectives and goals, priorities, organisation, and the decision-making behaviour.

In some industries the amount of analysed competitors is so large that exact analysis would demand too much resources. In that case the company has to choose the most important competitors based on some criteria. Those criteria could be e.g. market share, growth rate, or the threat the competitor causes. The most important competitors so called key competitors, are those whose present competitive situation and coming strategic moves should be noticed when developing own competitive strategy. (MET, 1988, p.48)

After choosing the key competitors should be answered to certain questions concerning each competitor. Those questions are:

1. What are the competitor s start point and the direction of development?
2. What is competitor s present strategy?
3. What critical success factors does the competitor possess? What are its strengths and weaknesses?
4. Is the competitor satisfied with its present position?
5. What are the essential changes it might make?
6. How strong will the competitor be in the future?
7. Is the competitor going to react to our strategic moves? How?

(MET, 1988, p.52)

6.5 Critical Success Factors

In every industry there are a few things that have to be done really well in order to achieve success. These critical success factors are important parts of functional competitive strategy. Controlling them shows how to be efficient in the business. It is impossible to control all factors, but every company has to choose the factors at which it wants to be good.

In evaluating critical success factors have to be first chosen the criteria with which to measure the success, and then choose the most successful firms in the industry. Critical success factors can be found, for instance, on the following areas: price and price competitiveness, quality, service, certainty of deliveries, flexibility, co-operation possibilities, technology etc. The present position of each factor and possible changes in the future has to be evaluated well to be able to react.

The change in critical success factors can be a consequence of new technology, substitutive products, change in customer needs or other changes in the industry environment. (MET, 1988, p.53-54)

6.6 Meaning of Competitor Analysis

Competitor analysis should be a part of company s strategy formulation and it should function as a tool in every day business and sales work. Otherwise it is only a waste of resources. Competitor analysis is also a good framework for defining the company s competitive advantage. Fast and accurate analysis process itself provides competitive advantage to the company that masters it.

An analysis of each significant existing and potential competitor can be used as an important input to forecast future industry conditions. The questions to answer are numerous and answering these questions about competitors creates enormous needs for data. That is why one essential part of competitor analysis is the systematic control of competitor information. To be able control the information a company needs an organised mechanism competitor intelligent system. To control and report competitor information systematically a company has to develop a manual or electronic competitor monitoring system. How it can be executed is not discussed here.

6.7 Competitive Advantage of Finnish Steel Industry

Increasing demand sophistication throughout the 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 industries. (See figure 9) The close links between the steel industry and related industries have meant synergy advantages in joint problem solving and joint R D. (Kaipainen, 1994, p.32)

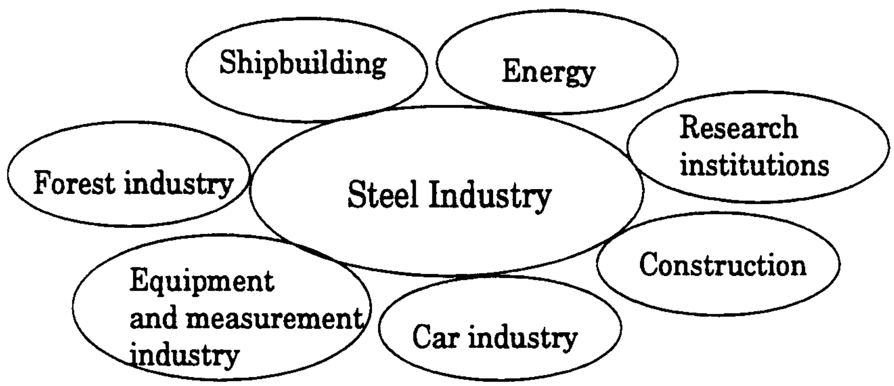

Figure 9. The linkages between the steel industry and other competitive Finnish industries (Kaipainen, 1994, p.32)

The tough rivalry in the world s steel industry has forced Finnish steel producers to introduce both low costs and differentiation at the same time in their strategies. Innovations and upgrading of processes has enabled this. The producers have strong domestic market position, but the growth potential is sought from abroad.

The diamond model in the Finnish steel industry

Figure 10 illustrates the factors which improve the competitive advantage of Finnish steel industry and the important interactions between factors.

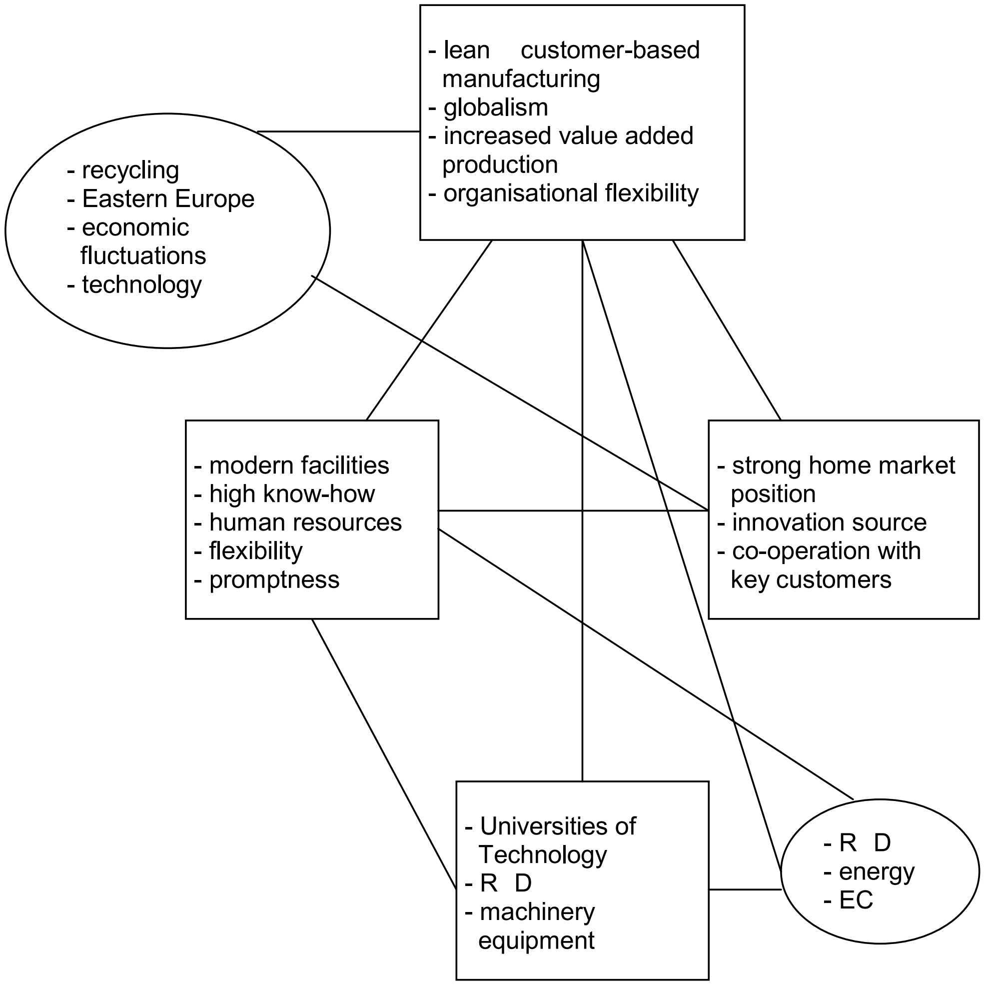

Figure 10. Determinants improving the competitive advantage of steel industry (Kaipainen, 1994, p.63)

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

Strategy, structure and rivalry is also important determinant, because it interacts with factor and demand conditions, and related industries. The missing domestic rivalry has been offset by openness to international competition.

Factor conditions are advanced and specialised in the steel industry. Factor conditions are affected by government, related industries, and by demand conditions through firm strategy decisions. The role of government is moving from direct to indirect in the steel industry diamond.

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 the development create sustainable competitive advantage. (Kaipainen, 1994, p.63-64)

7 COMPETITION SITUATION IN THE FREE-CUTTING STEEL MARKETS AND COMPETITION ANALYSING IN IMATRA STEEL

Thorough and profound competitor analysis concerning the most important free-cutting steel manufacturers in Europe was impossible to conduct within this work. It would have required inside information about each competitor s activity and that was not available. Competitor information that was utilised in this work is based on the pieces of information gathered from the interviews. Important sources of information were Internet and knowledge the people have in Imatra Steel, both at the Imatra Steel works and in its sales offices.

7.1 Competitive Environment in Europe

The competitive situation in the European free-cutting steel markets is regarded to be almost monopolistic. There are only a few manufacturers, which are competing in those markets and controlling the greatest share of deliveries. The number of bright steel converters is bigger, approximately 20-30 companies. Due to the small number of free-cutting steel producers, the competition is not seen to be very hard. But still, the prices tend to be quite low.

7.1.1 Competitors in Europe

According to interviewees British Steel (Engineering Steels), Unimetal, Saarstahl and von Moos are the most important manufacturers of free-cutting steels in Europe. As mentioned before, Imatra Steel is not producing free-cutting steels at the moment, so all of those manufacturers are not direct competitors of Imatra Steel at the moment in those products.

British Steel is regarded today as the biggest and most famous producer of free-cutting steels in Europe. It is estimated that British Steel has a market share of 60   of the free-cutting steel markets in Europe. British Steel has recently merged with Dutch steel company, Koninklijke Hoogovens, to become a bigger international metals group   Corus. In this work, however, the old name is used, because all interviewees still talked about British Steel. In 1998 British Steel had a turnover of   6 947 million. Its area of operation is very wide and the production programme is extensive. In the area of drawn bars the diameter range is 6 - 90 mm (rounds), 8 - 76 mm (hexagons), and 12 - 60 mm (squares).
(http: www.corusgroup.com english)

Despite the dominant position of British Steel, the **ISPAT Group** will be its strongest competitor in the future. At the moment ISPAT is the owner of **Unimetal** (France) and Walzdraht Hochfeld (Germany). It is likely that ISPAT will acquire **Saarstahl** (Germany) as well. Unimetal and Saarstahl are both significant European producers of free-cutting steels. In 1998 Unimetal s steel production was 1 300 kilotons and turnover FF 3 000 million. (http: www.unimetal.fr comp comp.htm)
Saarstahl s corresponding figures are 2 550 kilotons and DM 1 836 million. (http: www.saarstahl.de Englisch Default.htm)
If the acquisition of Saarstahl occurs, the ISPAT Group would become the biggest producer of free-cutting steels in Europe.

In addition to these major players there are **von Moos** (Switzerland), and Esteban Orbegozo (Spain), who have good reputations, but only small volumes available.

All these mentioned companies are producing both leaded and non-leaded free-cutting steels.

As a conclusion it could be said that it seems that ISPAT will be the leading group in future because of its size and complete production program. Also, it is using iron based metallurgy, while British Steel is using electric steel. This can be seen as one of British Steel s' major weaknesses. Another threat for British Steel is the strong pound, which gives low profit when selling to EURO-countries.

7.1.2 Demand in the Market

The demand for free-cutting steels is dependent on different variables, because of the diverse end-uses. That is a general nature of demand for industrial products, especially for raw materials. Figure 11 illustrates the pattern of derived demand for industrial raw materials.

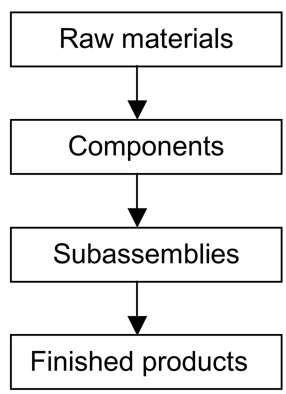

Figure 11. Pattern of derived demand for industrial raw material
(Chisnall, 1989, p.45)

The demand for free-cutting steel as a raw material is generated by the products, which are made from it. As already mentioned in this work, end-uses for free-cutting steel are numerous. However, the most important target of free-cutting steels is components used in the automotive industry. Thus the demand for free-cutting steels is best generated by demand for automobiles.

Imatra Steel s most important market area is Europe, so only the European automotive industry is taken into examination. Automobile production in the European Union has been increasing steadily. According to ACEA s statistics the total production of automobiles in the European Union was approximately 16,6 million units in 1998, of which the amount of passenger cars was 14,5 million. Compared with year 1997, the change was 7,8 . (http: www.acea.be prod95-96-97-98-global.htm) After the beginning of the 1990s there has been steady growth also in new passenger car registrations in EU countries. In 1998 the amount of new passenger car registrations was 13,9 million. (http: www.acea.be U-1990-1998.htm) When comparing the registration figures of years 1997 and 1998, it can be seen that the average growth rate is 7,1 . Figures of selected countries can be seen in table 6.

Table 6. New passenger car registrations by selected countries (http: www.acea.be U-1990-1998.htm)

	Jan - Dec 1997	**Jan Dec 1998**	**Change -**
Iceland	10 146	13 593	34,0
Finland	104 507	125 751	20,3
France	1 713 030	1 943 553	13,5
Sweden	225 263	253 430	12,5
Germany	3 528 179	3 735 987	5,9
England	2 170 725	2 247 403	3,5
Total EU	13 005 029	13 929 821	7,1

The demand in the automotive industry seems to be strong at the moment and dramatic changes can not be seen in the near future. It has been forecast that the strong boom in demand will slow down in the next couple of years. But still it can be said that current and near future demand for free-cutting steels is good.

Although Imatra Steel does not produce free-cutting steels at the moment, its existing steel types are also used in components of automobiles. Following the situation in the European automotive industry is an essential function of the strategic business planning activity in Imatra Steel.

7.1.3 Critical Success Factors of the Industry

According to Schorsch the successful steel companies of the future will have to adapt quickly, aggressively and profitably to the opportunities arising from uncertain conditions.

In the steel industry there are seven core processes that determine an economic profit (see table 7) and that the successful steel company of the future will manage in an out-standing way.

Table 7. Core process contribution to economic profit
(Schorsch, 1999, p.38)

	Optimise yield	**Manage risk**	**Grow**
Market development	- Enrich product customer risk - Reduce costs - Boost pocket price	- Adjust cash flows through spot contract mix of sales	- Target areas for investment and product development
Order generation and fulfillment	- Reduce costs - Improve service performance - Lower working capital		
Operations	- Reduce costs - Improve quality and service performance - improve capital productivity		
Supply management	- Reduce input prices - Reduce costs - Lower working capital	- Adjust cash flows through spot contract mix of purchases and make buy decisions	- Partner with suppliers for joint growth initiatives
Investment management	- Reduce capital employed for given level of effectiveness - Improve operating performance	- Adjust cash flows through timing of short term investment programs	- Manage growth related inverse in capital employed
Planning, control risk management	- Develop institutional skills	- Adjust cost of capital through balance sheet initiatives - Apply appropriate hurdle rates to investments improvement initiatives	- Manage portfolio of assets
Human resources management	←	- Provide trained staff - Develop appropriate incentives	→

To successfully redesign the business around these processes will, according to Schorsch, for most companies be a prerequisite for organisational dedication to economic profit, organiational flexibility in the face of economic uncertainty, and thus for the successful steel company of the future.

The mentioned processes and conducting them successfully are common success factors in many industries, not only in the steel industry. Those processes, however, illustrate the success factors in a general level. Imatra Steel, as an individual steel producer has more exact opinion about critical success factors in their business.

Knowledge about end-user industries is one of the most important critical success factors in the industy where the end-uses of manufactured products are diverse. Good customer contacts enable a clear view about customer s industry and business. That is needed to be able to offer better technical customer service than competitors and additional value to the product. In the case of free-cutting steels expertise in developing machinability properties of steel and also knowledge about customers production process and working machines are critical success factors that create competitive advantage. Special attention must be paid to the ability to react quickly to the changes in the areas of process and product development. Naturally, the economical aspects of cost competitiveness, effectiveness and profitability are also seen as important success factors.

There are some trends in the steel industry on a general level that have an influence on the success of the companies. The trend in the market is towards bigger corporations. European steel producers have merged and will merge to gain more power to compete in the markets. Companies have to be prepared to expand their target markets to American and Asian markets. In Europe the area of Eastern Europe is becoming a more important target market.

Imatra Steel has to pay attention to all these things, however, without letting them affect too much their own strategies. Imatra Steel s strategy of being quite a small producer and concentrating on the areas of their special expertise will be appropriate also in the future.

7.2 Effects of Forbidding the Use of Lead in the Future

Obviously the prohibition of use of lead in the future would have enormous effects on the steel industry and its related industries. In this context only the effects resulting from the prohibition of lead in steel as an alloying material will be discussed, not lead as a part of diverse target of usage that has been mentioned earlier in this work.

When considering lead only in the steel production process the prohibition would still have remarkable economical and technological effects on the different parties operating in the steel industry and its related industries. The prohibition would reflect on the activity of steel manufacturers, who are in the beginning of the chain. They should be able to develop alternative materials to meet customers needs. The subcontractors to diverse areas of industries, mainly to the car industry, would have to give up using leaded steels and find alternative materials for the components. End-users would have to deal with the components made from alternative materials. The chain for the use of lead in steel is two-way. Steel producers claim that the need for the use of lead comes from the users side. End-users claim that leaded steels are often the best, and thus the only, alternative that the steel producers offer to respond to their needs. In the case of the car industry the final end-users, consumers, can also influence the chain by their values and consumer behaviour.

7.2.1 Changes in the Competitive Situation

If the prohibition occurs some day in the future, it is probable that it will not happen suddenly without a transitional period. So all the parties would have time to adapt themselves to the situation. The time before the actual prohibition is essential in building up a competitive advantage for the new situation. Those companies, both on the manufacturer and end-user side, who are well prepared beforehand will gain a competitive advantage. Steel producers who are able to offer best alternative materials will be successful. In the case of free-cutting steels, alternative materials must have the best possible machinability properties. It is likely that already before the actual prohibition process begins, the companies in the industry will increasingly use environmental friendliness and green values as a way to compete in the market.

7.2.2 Changes in Technology

Changes in technology are the most critical on the subcontractor and end-user side. The working machines and tool materials mainly in use at the moment are at their best in machining leaded free-cutting steels. There are no technical barriers for machining non-leaded free-cutting steels. It is slower and thus not so efficient and economical than by using leaded material. There are several options to make the machining of non-leaded free-cutting steels more efficient. Investments in working machines that enable faster cutting speeds also with non-leaded materials would be required. The use of carbide tools would be advantageous in machining non-leaded materials. And naturally alternative materials that would minimise the negative effect on the machining process will have an important role.

In the situation of moving to non-leaded materials the co-operation between steel producers and customers will become even more important. Joint development projects to which both parties are commited would bring the best possible results. That will cause an increasing pressure to the steel producers. They have to be able to develop and produce suitable materials, and also their know-how in machining process is becoming more important competitive advantage.

7.3 Competitor Analysis Activity in Imatra Steel

At the moment Imatra Steel does not have a systematic way to collect and analyse competitor information. However, plenty of competitor information is collected, but it is done by a few persons for single purposes, mainly for the use of executives to help them in decision-making. Executives and persons dealing with strategic business planning collect competitor information to analyse competitor s profitability and competitiveness. Research and development, and production collect information about competitors production processes and test competitors products. Marketing department collects the competitor information available from customers comments and opinions. So the collection of competitor information is quite efficient in Imatra Steel. The problem is in the areas of analysing, interpreting, distributing and utilising the information to the needs of every person working in Imatra Steel.

Strategic business planning activity in Imatra Steel has started to develop a competition and competitor monitoring system. The aim is to create a systematic and consistent way to gather and produce competition information to the needs of the whole organisation. The process has already started by conducting the questionnaire to find out the present situation of competition and competitor monitoring, and to gather opinions and ideas for the development of a new, integrated system. The objective of the development process is to have a functional monitoring system by the end of the year 2000. The structure and technical implementation of the system are still uncertain, but progress should be seen in the next couple of months.

Exact competitor analysis with special emphasis on actions and strategies of certain competitors are not seen to be very useful in Imatra Steel s case. The most important competitors of Imatra Steel are big European steel corporations, whose area and extent of operations are much more extensive than Imatra Steel s. Naturally, information about their production processes, products and strategic directions is very important and useful, but actual benchmarking activity is very difficult. That is a reason why Imatra Steel has always put more emphasis on the general direction of development in the industry. Imatra Steel does not concentrate so much on individual competitors, but tries to get an extensive view of the industry and notice the trends and strategic moves taking place in the steel industry, and also in the related industries.

When comparing the theoretical frames introduced earlier in this work, Hussey s approach of industry structure analysis has most in common with Imatra Steel s actions. The objective of Imatra Steel is to define and find its own place in the competitive arena more than just to compare competitors actions and strategies to their own ones. Naturally, information concerning competitors is taken into account in the strategic planning of Imatra Steel, but it is not the most important perspective.

8 SUMMARY

This master thesis provides information concerning the situation in the free-cutting steel markets in Europe. Within this research the markets in Sweden, Germany, England and Finland were surveyed. Those countries are among the most important market areas of Imatra Steel. Sweden, Germany and England are also regarded as large target markets for free-cutting steels. So it can be said that the research provides quite a comprehensive view about the situation in the markets.

Because of the great amount of suppliers, dealers and end-users in the European free-cutting steel markets the sampling in this survey was limited to the couple of respondents in each market area. Due to this the information collected provides only an estimation about the figures concerning the market potential. To get a realistic view about the situation in the market diverse information was needed. Market potential was evaluated by different free-cutting steel grades and diameter range used. In addition information about prices and the competition situation was also needed. To make it easier for Imatra Steel to define its opportunities on those markets it was essential to gather information about the working machines and tools used for the machining of free-cutting steels. Attitudes and opinions concerning the possible prohibition of lead in steel in the future were important in clarifying the need for alternative materials.

The total market potential for free-cutting steels in Europe is huge. According to estimations total potential is one million tons. The demand is good and there can not be seen dramatic changes in the near future. The greatest volumes are concentrated on small dimensions, ∅ 12 - 50 mm. The markets are mainly managed by a few big suppliers. Imatra Steel as quite a small producer is not able to compete with its volume and product mix with those bigger players in the market. The possible strategy for

Imatra Steel would be to try to find a market niche suitable for its products and know-how. Target segment could be the customers that find more benefit from Imatra Steel's products and technical service than from competitors'.

Imatra Steel has two options to enter the free-cutting steel markets. One possibility would be to develop a totally new steel grade, a traditional non-leaded free-cutting steel, to take market share from those already existing in the market. That would demand considerable changes in production process and would be the result of extensive development and investment inputs. Imatra Steel has also opportunities to enter the market with its existing steel grades, especially with HYDAX. HYDAX and also other M-steels could be developed in the direction of free-cutting steels for example by increasing the sulphur content or by alloying more phosphorus to improve the chip form in the machining process. It is not an easy way either, because of the superior chip form in machining leaded steels. Considerable advantages for Imatra Steel would be the increase in use of modern CNC-machines and carbide tools. That is the direction of development at the moment, but the progress is still slow.

The prohibition of lead in steel does not seem very probable in the near future. However, there is interest towards new non-leaded alternatives in the market. The niche for Imatra Steel could be to find those interested parties, with which the co-operation in development process could take place. Establishing these kind of contacts would naturally require plenty of both marketing and R D efforts. To be competitive also in the future Imatra Steel has to be able to respond to the increasingly demanding situation in the steel industry. Continuous development in all areas of operation will be required.

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