8. The Future of the Steel Industry in Europe

Describing the future of the steel industry in Europe requires the perspective of the global development trends. The author sought out trends that were frequently cited in books. The timeframe for which the prognoses were created, vary greatly. Thus, for the sake of simplicity and clear definition, the year 2050 was chosen as the upper limit for the period under review. Projecting further into the future from today's perspective is not logical, since the challenges that will confront the economy within the next 35 years are already great enough. And what exactly are the challenges for the next decade? According to Laurence C. Smith, they are the four global forces that the world must reckon with and by which it will also influenced. Demography is the first of these trends. Within this frame of reference, it pertains to the aging society in the old industrial nations. The average age of the population is increasingly rising and renders the influx of younger people, which the industry needs, more and more difficult. Another component of demography is migration and its currents. These factors have strongly gained significance, especially most recently, since they represent not only major challenges for Europe, but also the accompanying population growth. [187] According to demographers' estimates, the world population will increase to 9.2 billion by 2050. The second global force involves humanity's growing demand on natural resources.

[187] Cf. Smith, 2014, p. 31-37

These include finite resources (fossil fuels, minerals, etc.) as well as renewable resources such as water (rivers), arable land, plants, etc. There already exists a lack of natural resources today. The Chinese government has confronted this development and is preparing accordingly by purchasing arable land throughout the world and growing food for its own population. Globalisation comprises the third global force. As per Smith, globalisation is the increasing consolidation of nations in the areas of economic, social and technical processes. This consolidation will grow more interdependent over time. Climate change represents the fourth global force. This phenomenon has arisen from the negative repercussions on the climate triggered by mankind's industrial activity. One of its consequences is global warming, which is increasingly transforming the planet. In addition, a fifth force can be cited, which bears influence on all four global forces: technology.[188]

Another important and trustworthy source is a report from the Club of Rome. This report examines global developments respectively for the next 40 years. This report takes a somewhat different approach regarding the world population scenario. It maintains that the world population will reach its peak by 2040 with 8.1 billion people. This projection is based on the drastically falling birth rates corresponding to the rise of highly-populated megacities. An outcome of this phenomenon is the slower than anticipated GDP (gross domestic product) growth demonstrated by nations. Due to resource depletion, environmental pollution, climate change, loss of

[188]Cf. Smith, 2014, p. 37-49

biodiversity and social injustices, the growth rate for global consumption is to decrease as of 2045. Consequently, regions of the world were derived that will be among the winners in the future, namely, China or the BRISE countries (Brazil, Russia, India, South Africa, Indonesia, Mexico, Vietnam, Turkey, Iran, Thailand, Ukraine, Argentina, Venezuela and Saudi Arabia). The Club of Rome's report brands the USA as the absolute loser in this regard. Other countries that were not already mentioned will remain poor.[189]

Even Eberl speaks of a world population of approximately 9 billion in the year 2050, of which 6.5 billion will reside in megacities.[190] The trend towards megacities seems to be consistent with all previously researched sources, which gives credence to the probability of this scenario.

Last but not least, Lyons also addresses urbanisation, demographic trends as well as China's ascent and accompanying emergence of new trade corridors.[191] These factors prompt the question: what are the prognoses for the economy? With this valid question in mind, the focus will rest specifically on the automotive industry, which has been selected as the fundamental industry for this paper.

Simon outlines six economic trends for our future. As previously mentioned, he also supports the notion of accelerating globalisation and regards it as a key capability for companies and their employees to foster respect toward other cultures. This is the only means by

[189] Cf. Randers, 2013, p. 406-408
[190] Cf. Eberl, 2011, p. 4-5
[191] Cf. Lyons, 2014, p. 372-373

which globalisation can be sustained. Politics, in other words the government, will exercise even greater influence on companies. Therefore, management skills, which impact the political decision-making process, will become more significant (lobbyism). Furthermore, a narrower integration of management and capital will ensue. To this end, it is important to ensure that company management is a process that involves all aspects, from the manager to the entrepreneur. Simon also discusses tectonic shifts in the product landscape, by which he means the existence of a new segment at the lower end of the price scale. For the automotive industry, this would concern the ultra low cost car segment, which shows great promise, and customer behaviour will accordingly change increasingly. Rationality will become more prevalent and the cost-use advantages will rise to the fore. Expensive impulse purchases will be eschewed. Complete interlinking is advancing towards the distribution of digital products.[192]

By Hubbert's estimation, consumer behaviour will likewise change by moving away from the status symbol automobile in favour of a total cost of ownership approach, that is, the cost of a vehicle taking all factors into consideration. Emotion as the impetus for making purchases will be replaced by objective, fact-oriented decisions. In the upcoming decades, the automobile will transform into a sensitive vehicle. To elaborate, it will become aware of its environment by means of sensors and react accordingly. Complete interlinking also means that other vehicles in traffic can receive information at an

[192] Cf. Simon, 2011, p. 9-14

early stage and be able to act appropriately. In parallel to the innovations within the Smartphone and smart watch industry, automobile instrument panels will likewise change. They will be able to be individually customised, that is, user-oriented. Information will be displayed according to current importance and only displayed as long as necessary. Alongside the previously mentioned ultra low cost cars, another segment within megacities will be generated: the so-called city car segment. The importance of owning one's own vehicle will lose its significance within megacities. Combined traffic concepts are gaining importance. The appropriate drive concepts during the first phase are leaning towards a hybrid, that is, a combination of combustion engine and electric power system. It is highly probable that over time the electric power system will take precedence in mega cities. What do these developments mean for components and suppliers? Based on the efforts to continually reduce emissions and usage, these also impact vehicle weight, for example the drive assembly. These new developments require alternative materials, which have the same properties, yet are lighter. Possible variations might include aluminium-silicon alloys, magnesium alloys or what are known as TWIP steels, which is an alloy comprising iron, silicon, aluminium and manganese. TWIP steels were also an important subject at the 4th International Conference on Steels in Cars and Trucks in Braunschweig, Germany, and made their debut at SCT 2014.[193] These new, high demands will ultimately lead to a reduction of independent suppliers. All parts

[193] Cf. Wieland et. al., 2014, p. 582-612 and 677-696

and components associated with the fossil drive assembly must accept the reality of severe losses in the future. This development will primarily impact OEMs. Downsizing will be inevitable.[194] This conjecture is supported by a study from the Office of Technology Assessment at the German Parliament. Out of the three developed scenarios (conservative, technology gaps and mobility concepts), the mobility concepts scenario seems the most probable. This perspective envisions the added value transfer shift from conventional vehicle technologies to components suited for electro-mobility. Downsizing is an associated aspect of this shift, unless the German automotive industry orients itself towards mobility providers. In this report, seven central challenges for the German automotive industry within the next two decades were localised:

- development of efficient vehicles
- development of alternative engines
- consolidation of the position of the German automotive industry in the world market as a leader in technology and premium manufacturer
- adoption of small (or smallest) vehicles into the product portfolio
- exploitation of growth markets
- reduction of the number of vehicle platforms
- proactive implementation of new mobility concepts.[195]

Another factor not to be underestimated is the qualification level of employees. Without championing continuous employee training, the

[194]Cf. Hubbert, 2010, p. 37-45
[195]Cf. Schade et. al., 2014, p. 9-15

mandatory changes cited are not feasible. In this context, the Institute of German Economy in Cologne mentions the so-called MINT Qualification. MINT is the acronym for Mathematics, Informatics, Natural Sciences and Technology. The MINT qualification is essential for production on the technological frontier as well as for companies with a strong focus on exports in the high technology sector.[196]

What do these projections and scenarios mean for the steel industry of the future? As reported by PricewaterhouseCoopers in a study from 2014, four competencies are vital in order for European steel producers to use the changing market as an opportunity for optimisation. Material efficiency and plant efficiency make up the first competency. The assumption is that even for the medium-term, cost basis will be the focus of improvement measures for the European steel industry. Delivery service and flexibility constitute the next competency for the future. Efficient design of the customer value chain for customers via high delivery service, short cycle times and volume flexibility are prioritised. By means of geographic proximity, high flexibility as well as reliable delivery service can generate competitive advantages in comparison with overseas competitors.

Product quality and innovation form the third competency. The markets are changing at an increasingly rapid tempo. What is considered a niche product with favourable margins today can

[196]Cf. Institut der deutschen Wirtschaft Köln, 2013, p. 115-116

already be a large volume market by tomorrow, which is a highly competitive market for cost leaders.

Commodity management is the last of the four competencies, whose focal point is on the changes to the global raw materials and steel markets. These lead to price fluctuations and only offer few opportunities for differentiation in raw material procurement.[197]

A study by KPMG AG (accounting firm) from 2013 indicates a similar picture. Elaborating on the previously mentioned currents in the steel industry from the PWC study, KPMG AG sees growth potentials almost exclusively in the emerging countries (Brazil, Russia, India and China (BRIC) as well as Africa). Horizontal integration among steel producers is progressing at a fast pace. The causes are largely due to competitive capacity and improved purchase costs resulting from batching. KPMG AG also notes a significant decrease in loyalty in business relationships within the steel sector, which could precipitate an intense price war. Further, sustainability in the steel sector will determine the economy. Although this trend is already foreseeable today, laws are continually tightening. Even the precarious supply situation is forcing steel producers to implement a recycling scheme.[198] In order to meet these challenges, sufficient capitalisation is required. The steel corporations that are already experiencing losses today under the current situation and do not have sufficient capital resources at

[197]Cf. PWC, Stahlmarkt 2014, Stahl 2025: Quo vadis?, 2014, p. 8-9
[198]Cf. KPMG AG, Stahl 2020, 2013, p. 8-22

their disposal may have difficulty surviving in the future.[199] Prevailing worldwide overcapacities are viewed as the fundamental problem for the current as well as prospective situation, according to the OECD (Organisation for Economic, Cooperation and Development). The organisation also speculates that this will increase in the future.[200] Beddows developed a steel industry scorecard, in which the year 2013 acts as the starting point. Within this scorecard, he examines the situation in 1983 and 2028. The nine dimensions in the scorecard can achieve a maximum of 90 points (9 x 10).

Year / Dimension	1983	2013	2028
Service and Costumer	2	4	8
Managing Volatility	2	3	8
Managing Capacity	2	4	6
Efficiency in Use of Materials	3	7	8
Efficiency in Use of Energy	3	8	8
Efficiency in Use of Labour	2	6	8
Efficiency in Use of Capital	3	5	7
Degree of Appropriate Consolidation	2	4	6
Service to Shareholders	2	3	7
Total (out of 90)	**21**	**44**	**66**

Table21:Steel industryscorecard[201]

The acceleration of development regarding the overall points for the steel industry scorecard is significantly noticeable. While a time frame of 30 years was required for an increase of 23 points, it was

[199]Cf. EY (Ernst & Young), Global Steel 2014, p. 25
[200] Source: Beddows, 2014, p. 194
[201] Source: Beddows, 2014, p. 194

only 15 years for the subsequent 22 points. Dimensions gaining importance over the next 15 years include services and customer focus. No less important dimensions include managing volatility (extent of fluctuations) as well as service to shareholders.[202]

8.1. What can the Supply Chain Management Concept Tangibly Contribute to Improve its Competition Situation and to Safeguard the Future of the European Steel Industry?

Before this can be answered, several points and definitions must be clarified beforehand. The first of these to work out is the current state of readiness for the various supply chain types (by commodity groups). Determining the current readiness level will reveal a potential gap, which can be determined by evaluating the readiness criteria per supply chain type (by commodity group).

Supply Chain / Readiness level	**Iron ScrapSC**	**Alloys SC**	**Electrodes SC**	**Refractory material SC**
1				
2				
3	**x**			
4		**x**	**x**	**x**
5				

Table22:Readiness levelpersupplychain(by commodity group)[203]

[202] Cf. Beddows, 2014, p. 193-208
[203] Source: Own illustration

As is evident in the table, there is a gap in all supply chain types. Whereas alloys, electrodes and refractory supply chain types indicated a value of 4 out of a maximum of 5 points, iron scrap with 3 points is the type furthest removed from the target state. Conversely, this table indicates that the greatest catch-up potential exists for the iron scrap supply chain type. Determining the values for the table, "Readiness level per supply chain type" stems from individual readiness level tables, from which the criteria and preconditions for evaluation were established. A level from the individual criteria was respectively also allocated. The average weight of all readiness level criteria evaluation per supply chain type was the frame of reference for the table "Readiness level per supply chain type". This method is identical for all supply chain types. The same table also includes measures for improving the readiness level. These measures should only be viewed as possibilities as opposed to being regarded as conclusive, since it strongly depends on the respective market. The data provided was thus created with the European sphere and related markets in mind. It must also be noted that the process demonstrated in Chapter 8.1 presents a suitable opportunity to approach the chapter's subject, "What can Supply Chain Concepts Tangibly Contribute to Improve the Competition Situation and to Safeguard the Future of the European Steel Industry?" Nevertheless, every steel company must establish its own ideas of development while taking the readiness level and its evaluation into account. From this viewpoint, various gaps will emerge, which will need to be closed using the proper measures.

Therefore the solution introduced in this paper is only one way to show how the market environment can be represented.

Iron Scrap

Criteria	Requirements for Assessing Level of Readiness	Readiness Level					Measures for Improving Readiness Level
		1	2	3	4	5	
Supply Certainty	What percentage of the demand can be covered by the SC?					**x**	Steel plant sets max. value
Price Certainty	Is there coordination in price adjustment?				**x**		Improved collaboration and supervision
Quality Guarantee	Can the SC ensure a consistent quality guarantee?			**x**			Substantially upgrade goods receiving & goods issue control (improve)
Contract Certainty	Can contract fulfilment be guaranteed by all SC partners?			**x**			Focus on large scrap dealers
Time Certainty	Can delivery deadlines be guaranteed?		**x**				Focus on large scrap dealers
Capacity Guarantee	Can volume fluctuations of plus/minus x% be assured?			**x**			Negotiate long term contracts

Table23:Readiness level criteria for the iron scrapsupplychain[204]

As already cited in the preceding section, the table "Readiness level criteria for the iron scrap supply chain" serves as a basis for categorising the readiness level per supply chain type. However, this is only a proposed categorisation. In this illustration, criteria are defined from supply certainty up to capacity guarantee. Additionally, the preconditions for evaluating the readiness level of the individual criteria are provided. This is apparent for the criterion

[204] Source: Own illustration

of price certainty, namely, whether there is coordination of price adjustment among the participating companies. If the highest possible readiness level for the individual criterion was not achieved, measures for improving the readiness level are provided. For the time certainty criterion for iron scrap, performance for the readiness level is well below average. Improvement can be made by focussing on large scrap dealers. Supply certainty was the only criterion in the iron scrap table to achieve the highest readiness level, whereas improvement measures are essential for all other criteria.

Alloys

Criteria	Requirements for Assessing Level of Readiness	Readiness Level					Measures for Improving Readiness Level
		1			1		
Supply Certainty	What percentage of the demand can be covered by the SC?					**x**	Steel plant sets max. value
Price Certainty	Is there coordination in price adjustment?				**x**		Improved collaboration and supervision
Quality Guarantee	Can the SC ensure a consistent quality guarantee?			**x**			Substantially upgrade goods receiving & goods issuecontrol (improve)
Contract Certainty	Can contract fulfilment be guaranteed by all SC partners?				**x**		Closer cooperation, better contract design
Time Certainty	Can delivery deadlines be guaranteed?					**x**	
Capacity Guarantee	Can volume fluctuations of plus/minus x% be assured?					**x**	

Table24:Readiness level for the alloys supply chain[205]

[205] Source: Own illustration

There are far fewer individual gaps for alloys than for iron scrap. This is attributed to the much lower number of suppliers for this commodity group. Furthermore, the material is mined in order to make production volumes controllable. This was not the case for iron scrap, that is, the scrapper does not determine the quantity amount, rather this is done by the governing authorities (i.e. whoever approves a demolition) or the scrap collectors who determine when it is most favourable to collect the scrap and who ultimately receive it. Moreover, various companies in the steel-processing sector sell their production waste to the highest bidder. This does not only demonstrate that there is a large number of potential iron scrap suppliers, but also it substantially increases its complexity, rendering it difficult to adopt uniform standards. Since the price determines where the material is to be supplied, this virtually eliminates a strong supplier-customer relationship. Consequently, supply control is rife with several obstacles.

Electrodes

Criteria	Requirements for Assessing Level of Readiness	Readiness Level					Measures for Improving Readiness Level
		1	2	3	4	5	
Supply Certainty	What percentage of the demand can be covered by the SC?					**x**	Steel plant sets max. value
Price Certainty	Is there coordination in price adjustment?					**x**	
Quality Guarantee	Can the SC ensure a consistent quality guarantee?				**x**		Substantially upgrade goods receiving & goods issue control (improve)
Contract Certainty	Can contract fulfilment be guaranteed by all SC					**x**	

	partners?						
Time Certainty	Can delivery deadlines be guaranteed?				**x**		Build nearby storage facilities, consignment warehouses
Capacity Guarantee	Can volume fluctuations of plus/minus x% be assured?		**x**				Buffer warehousing, consignment warehouses

Table25:Readiness level for the electrodessupplychain[206]

Appraisal of the readiness level for electrodes on average demonstrates the same results as those for alloys. However with the exception of capacity guarantee, which only garnered two points, all criteria rated more favourably. Depending on the process parameters, the electrodes production process has a duration of between three and five months. This process is very costly and requires many stages of operation, as well as an abundance of energy for the individual baking stages. For these reasons, a short-term capacity adjustment for steel companies is very difficult to implement. Nonetheless, this challenge can be met with the outlined measures. The electrodes market differentiates itself from the other commodity groups vis-à-vis the number of producers. In Europe, there are no longer as many as there were previously. The reasons for the decrease in numbers have been previously cited in Chapter 5.

[206] Source: Own illustration

Refractory material

Criteria	Requirements for Assessing Level of Readiness	Readiness Level					Measures for Improving Readiness Level
		1	2	3	4	5	
Supply Certainty	What percentage of the demand can be covered by the SC?					**x**	Steel plant sets max. value
Price Certainty	Is there coordination in price adjustment?				**x**		More precise & rapid information pro-curement, Adjust contracts
Quality Guarantee	Can the SC ensure a consistent quality guarantee?					**x**	
Contract Certainty	Can contract fulfilment be guaranteed by all SC partners?					**x**	
Time Certainty	Can delivery deadlines be guaranteed?			**x**			Consignment warehouses / VMI
Capacity Guarantee	Can volume fluctuations of plus/minus x% be assured?		**x**				Additional contracts, new suppliers

Table26:Readiness level for the refractory material supply chain[207]

The market for refractory material very strongly differentiates itself in a different form than what was previously acknowledged. The number of suppliers who can deliver products is very negligible. However, this is not associated with the capability of the individual suppliers. Rather, it is a matter of whether the appropriate quality raw materials can be procured. China plays a very large role within this context as a mining country. For delivery time, its results proved identical to those for electrodes. Major manufacturers customarily sell annual production quantities. Consequently, there are very few contracts that have a duration of less than one year. For capacity

[207] Source: Own illustration

certainty, this yields a low grading. Remedial action can also be achieved here with the appropriate measures.

The next step is to define the efficacy profiles for the various supply chain types relevant to profitability, competitive capacity, process time, and risk. These profiles apply to current, future and potential markets. A time frame is to be established in order to demonstrate how the four competition factors are changing. This will provide an indication of which supply chain type gains or loses in importance. The focus is to be placed on it correspondingly.

Efficacy Profile

Today's Market	Impact on																				Ø
	Profitability					Competitive Capacity					Process Time					Risk					
	Relevance					Relevance					Relevance					Relevance					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Iron Scrap SC					x					x				x				x			4.25
Alloys SC				x					x						x			x			4
Electrodes SC			x					x						x				x			3.25
Refractory SC			x				x						x				x				2.5

Table27:Efficacy profile for today's market[208]

The efficacy profile for the present day market shows a clear ranking of the four supply chain types. Iron scrap commands first place with

[208] Source: Own illustration

an average of 4.25 points and has the greatest efficacy in terms of profitability and competitive capacity. The alloys supply chain type illustrates its greatest efficacy in process time. Otherwise, relevance for the other competition factors lies in the mid-range. The refractory material supply chain trails behind with 2.5 points out of a maximum of five points. It has the least efficacy in terms of the four defined competition factors. The average figures on the right hand side of the table are necessary for allocating the outcomes for all three markets.

Future Market	Impact on																				Ø
	Profitability					Competitive Capacity					Process Time					Risk					
	Relevance					Relevance					Relevance					Relevance					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Iron Scrap SC					x					x				x				x			**4.25**
Alloys SC				x					x					x				x			**3.75**
Electrodes SC			x					x						x				x			**3.25**
Refractory SC			x				x						x				x				**2.5**
Average	**3.75**					**3.5**					**3.75**					**2.75**					

Table28:Efficacy profile for the futuremarket[209]

Differences between the present day and future market in terms of supply chain types and competition factors are manifested in the international focus and associated organisational changes. Production locations are not affected in this comparison, thus the

[209] Source: Own illustration

sequence of relevance remains the same. The average value calculation per competition factor varies from the table "Efficacy Profile for the Future Market". In order to specify services in the course of this work, which can contribute to increasing competitive capacity and profitability prior to purchase, at the point of purchase, during usage and post-usage, these averages will provide the benchmark. Individual service will likewise be rated according to their relevance in order to establish comparisons.

Potential Market	Impact on																				Ø
	Profitability					Competitive Capacity					Process Time					Risk					
	Relevance					Relevance					Relevance					Relevance					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Iron Scrap SC					**x**					**x**				**x**						**x**	**4.75**
Alloys SC					**x**					**x**				**x**				**x**			**4.25**
Electrodes SC				**x**					**x**					**x**					**x**		**3.75**
Refractory SC				**x**					**x**				**x**						**x**		**4**
Average	**4.5**					**4.5**					**3.75**					**4**					

Table29:Efficacy profile for the potentialmarket[210]

Much has changed in the efficacy profile for the potential market compared to the other markets. Steel companies now have a much wider activity range and operate according to the motto, "think globally, act locally". All associated activities are thoroughly detailed in the following table. The four various supply chains will rise in

[210] Source: Own illustration

importance within the potential market. Average values for nearly all competition factors have sharply increased, with the exception of the process time relevance. Moreover, average values for the supply chains have also notably increased. This also demonstrates that the supply chain management approach for the potential market has gained substantial importance.

Outcomes

	Markets for the European Steel Industry							
	Today	Future	Potential	Relevance				
				1	2	3	4	5
Iron Scrap	Steel supplier	Global supplier of products and services	Global, flexible solutions and service provider				**T F**	**P**
Alloys	Steel supplier	Global supplier of products and services	Global, flexible solutions and service provider				**T F P**	
Electrodes	Steel supplier	Global supplier of products and services	Global, flexible solutions and service provider			**T F**	**P**	
Refractory material	Steel supplier	Global supplier of products and services	Global, flexible solutions and service provider			**T F**	**P**	

Table30:Marketsfor the European steel industrytoday,future,potential[211]

The table above is a summary of all preceding efficacy profiles for the individual markets, wherein the market designation T stands for

[211] Source: Own illustration

today, F represents future, and the potential market is denoted by P. A new feature in this table is the description of the markets and their associated characteristics or operating principles unique to the steel companies. The starting position for today's market is defined as an individual steel company or as an operating company along with a smaller group, which predominantly distributes its products in the nearest country overseas. Additional services are only offered in direct relation to the finished product. Supply chain management is not a major issue, since even knowledge regarding the scope of this approach is not evident or is only partially evident. As a result, great value is placed on optimising internal processes as well as reducing the associated costs.

The future market is not merely different from today's market on a small scale. The steel company for the future market has an international focus on the sales side, and customers are served on a global basis. These consulting services differ insofar as the total cost of ownership calculations are also made in order to facilitate the optimal variant. A new service provides real-time quality monitoring for the customer. This method reduces costs for complaints and reinforces the relationship with the customer. Another issue gaining increasing attention is recycling. It is guaranteed that wastes produced by customers will become fully recyclable. The potential market constitutes the greatest change for the steel industry, and a steel company's strategic focus will be influenced to a considerable degree. It has reached a size that allows it to provide its local customer the desired product from any of its worldwide locations.

Supply chain management is enacted at all levels and encompasses the entire supply network. Consulting services can be offered around the world, customised to the local customers' needs. Information technology is fully operational at all stages of service. The customer is included in the steel company's information network and comprehensively informed at every site. The customer designs his products with a 3D designer according to his specifications. Product feasibility is already provided via parameterisation within the computer program.

The starting position for the various markets has thus far been outlined. From this vantage point, it is now possible to describe services prior to purchase, at the point of purchase, in usage and post-usage for future and potential markets. A description of today's market will be excluded, since at this juncture it is assumed to be generally known.

	Markets for the European Steel Industry and Corresponding Services		
	Today	**Future** Global supplier of products and services	**Potential** Global, flexible solution and service provider
1. Prior to purchase	Steel supplier	Comprehensive consulting concerning material properties Steel, application areas and costs along the entire SCM	Comprehensive consulting concerning material properties of various raw material (i.e. steel, carbon, synthetic materials, etc.), areas of application and costs along the entire SCM. Determing product features via a digital 3D steel product designer. Data transfer into a planning system for steel producers.
2. Point of purchase	Steel supplier	Global arrangement of terms, TCO calculations for customers, logistics consultation	Production of desired steel quality at customer's production location worldwide. Customer relationship via information technology to steel producers worldwide that encompasses technical, administrative and strategic areas of operation.
3. During usage	Steel supplier	Product quality monitoring for the direct customer in real time	Product quality monitoring along the entire supply chain in real time, including OEM.
4. Post usage	Steel supplier	Comprehensive recycling of returned steel products	Reduction of all customer generated recycling products (all materials) and their processing or compatible disposal.

Table31:Services corresponding to the various markets for the European steel industry[212]

The services offered will need to strongly develop over the upcoming years, so the existing and emerging customer demands can be met. One such example is monitoring product quality. Today's standard practice of only checking product quality before it leaves the steel company will no longer be sufficient in the near future. Quality in the future via information technology for customers in real-time will need to be checked along the entire supply chain. This is the only way to ensure a stable level of quality that stands the test of time. A pressing need is the return and disposal of recyclable materials

[212] Source: Own illustration

according to their usage. What is common in present day and future operations in terms of redemption of product wastes of respectively supplied products and their accompanying recycling will take on a greater dimension in the potential market. Meeting the correspondingly increasing demands requires an appropriate disposal system, which can be customised to customer specifications. This is not only a matter of recyclable material made out of steel, but all waste products that can pose a burden to customers. Services for the various markets will now be outlined to some extent. The next step is to determine which of the cited services are actually relevant for the two markets (future and potential). To this end, the projected services for both markets were individually specified and evaluated over a specific time period. These outcomes were then compared with the respective average value of the competition factors for the market concerned. If the matching rate was 50% or higher, it was categorised as relevant. The following services have been determined from the derived information.

Future Market Services prior to purchase	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Consulting for steel material properties				**x**					**x**				**x**						**x**	
2. Consulting for application areas			**x**					**x**				**x**						**x**		
3. Consulting costs along SCM					**x**				**x**			**x**						**x**		

Table32:Services for the future market prior to purchase[213]

[213] Source: Own illustration

For the future market, consulting in terms of material properties prior to purchase was significant, as was previously the case. Since the steel producer has the comprehensive know-how and there are no other sources, a consultation was requested. However, for the usage areas, it portrayed a different scenario. Because the customer is more experienced in this regard, he does not deem the service as desirable. Nevertheless, costs along the supply chain are sought out as a service offering. This requires a great deal of acquired knowledge on the part of the steel company, knowledge that is also important for profitability and competitive capacity.

Future Market Services at the Point of Purchase	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Globalarrangement of terms				**x**				**x**					**x**					**x**		
2. TCOcalculations for customers					**x**					**x**			**x**							**x**
3. Logistics consulting worldwide incl. costs				**x**					**x**					**x**					**x**	

Table33:Services for the future market at the point of purchase[214]

For services offered at the point of purchase, it is necessary to think outside the box, as per the following hypothetical situation. The customer would like a comprehensive consultation, demands that the product is in optimum condition and wants to obtain it at a random location somewhere in the world. For most steel companies,

[214] Source: Own illustration

this necessitates connecting with logistics companies in order to take this customer request into account.

Future Market Services During Usage	Impact on																			
	Type of Return					Competitive Capacity					Process Time					Risk				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Product quality monitoring for the direct Customer in real time				x					x					x						x

Table34:Services for the future market during usage[215]

At the usage stage, monitoring product quality is the crucial point. The relationship between the customer and the steel company is continually governed by a basis of trust, which the steel company enables by keeping the customer appraised of product data in real time. This level of service monitors quality for the customer and directly informs him of any postponements or deviations concerning the specified original product. Thus it is possible to immediately pinpoint higher consumption values and initiate remedial measures, as well as reduce accident risk and strengthen the relationship of trust.

Future Market Services Post-Usage	Impact on																			
	Type of Return					Competitive Capacity					Process Time					Risk				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Comprehensive recycling for customer returns of steel products					x				x				x					x		

Table35:Services for the future market post-usage[216]

[215] Source: Own illustration

As already mentioned in this paper, recycling and reprocessing usable materials is gaining in significance. In the future market, the issue of dealing with production wastes on the customer end will become more important. Recycling and reprocessing reusable materials means a win-win situation for all parties concerned. The customer receives a favourable price for the reusable material from the steel company while the latter can correctly sort the material for remelting thus transform the material into the same commercial product. Thus the recycling process has come full circle and can be continually repeated. At the same time, the steel company gains the advantage of forgoing the procurement process for new raw materials on the market such as alloys. As a result, a steel company can impel production without additional procurement in the free market by implementing a recycling scheme.

Potential Market Services prior to purchase	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Consulting for material properties			**x**						**x**				**x**						**x**	
2. Consulting approaches			**x**					**x**					**x**					**x**		
3. Consultation costs				**x**					**x**				**x**					**x**		
4. 3D Steel product designer			**x**							**x**				**x**					**x**	
5. Data transfer into a planning system			**x**						**x**						**x**				**x**	

Table36:Services for the potential market prior to purchase[217]

[216] Source: Own illustration
[217] Source: Own illustration

Services that continue to play a role prior to purchase for the future market are no longer relevant for the potential market. However, this does not imply a lack of customer demand for these services. But for the most part they are no longer required and are replaced by information technology. Via a 3D steel product designer, customers can customise as well as assemble the product themselves according to their specifications and necessary properties. Everything in this program that is possible the world over can also be produced by the steel plant. If the customer is pleased with the result, he can display the asking price as well the conditions directly. If the customer complies with the product design and corresponding price, he will pay the necessary amount, indicate the required delivery deadline and then receive the order confirmation online directly.

PotentialMarket Services at the Point of Purchase	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Steel production at customer location				**x**						**x**					**x**				**x**	
2. Customer IT connection to the network																				
2a. Technical			**x**						**x**					**x**						**x**
2b. Administrative				**x**					**x**						**x**				**x**	
2c. Strategic					**x**					**x**			**x**					**x**		

Table37:Services for the potentialmarketat the point of purchase[218]

[218] Source: Own illustration

As per the previously mentioned slogan "think globally, act locally", steel production at the customer production facility will become eminently significant. Further, customer connectivity to the steel company's network is in high demand at the technical (as already mentioned in the preceding section), administrative and strategic level. The connection in the strategic arena merits the most emphasis, since it demands a close relationship of trust among all companies concerned. However, the potential is of great interest. Strategies can be synchronised and the emerging synergy potentials fully exploited as a result. For example, pending tasks can be carried out by companies that have the necessary know-how to complete the work. It is also possible to improve the optimum use of total resources from all companies involved. The resulting potential will boost profitability and competitive capacity for all parties.

PotentialMarket Services During Use	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Product quality monitoring along the SC in real time					**x**					**x**				**x**						**x**

Table38:Services for the potential market during use[219]

Product quality monitoring in real time was already comprehensively outlined for the future market. For the potential market, the product quality of the customer is not only monitored,

[219] Source: Own illustration

but the entire supply chain is also monitored. This puts the steel company in a position to report the current quality level for the entire chain at any time. Deviations could then be detected at the earliest stage and remedial measures initiated and adapted to the supply chain. Supply certainly for qualitative products would be guaranteed as a result, and production would proceed without interruptions.

PotentialMarket Services Post-Usage	**Impact on**																			
	Type of Return					**Competitive Capacity**					**Process Time**					**Risk**				
	Relevance					Relevance					Relevance					Relevance				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Redemption of recycling products				**x**					**x**				**x**					**x**		
2. Processing of recycling products					**x**					**x**				**x**				**x**		
3. Compatible disposal of recycling products			**x**						**x**				**x**						**x**	

Table39:Services for the potential market post-usage[220]

For the potential market, it is not only important to reprocess reusable materials that accrue for the customer, but their preparation is also important. The steel company then becomes the reusable material processor and can then integrate a level into the supply chain accordingly, which demonstrates great cost-saving potential. This concept must be implemented in tandem with the customer production site, and in so doing, the steel company transfigures into a global processor of reusable goods.

[220] Source: Own illustration

8.2. Requirements for Implementing Supply Chain Management Concepts

The prerequisite for implementing supply chain concepts is the volition of top management. Since this involves a massive organisational change, this support is absolutely crucial. Another important component concerns the power structures for the already existing unmanaged supply chains. For a company that only generates a small share of revenue from suppliers and customers and that is not leaders in technology, implementation will be relatively difficult. A best-case scenario in this instance is to focus on the internal supply chain whereas the opposite would manifest itself in the total integration of the entire supply chain. However, in practise this is not a strong likelihood.[221] Further explanations in this section for both introduced options will not be pursued. In their place, a variant suitable for daily use will be developed by which an internal and external supply chain can be controlled. Nevertheless, this does not concern the last level of this chain. Additional parameters that are necessary to consider for implementing supply chain concepts include governance by means of a central authority. This authority is essential, as otherwise additional interfaces are created that could jeopardize its execution. Transparency of the necessary data is imperative, since it can ensure gaining trust the network partners. Realised savings potential as a consequence of implementing and executing supply chain management is to be distributed among the

[221] Cf. Essig et al., 2013, p. 146

companies involved according to a justifiable key. Last but not least, it is important to establish the time frame for collaboration.[222]

Since 1996, the Supply Chain Council has been a constant element in supply chain management research. Its SCOR model (Supply Chain Organisation Reference Model) is the basis for introducing supply chain management and illustrates the reference processes along the supply chain. Thus individual activities within these processes are continually outlined and substantiated on a continual basis. In this way, processes are subdivided into partial processes, sub processes and ultimately into activities. Subdividing enables the definition, operationalisation, measurement and evaluation of the respective process levels.[223] These subdivisions will be described in the following figure.

[222] Cf. Lehrstuhl Fördertechnik und Materialfluss, Supply Chain Management, p. 1
[223] Cf. Kurzmann und Langmann, 2015, p. 221

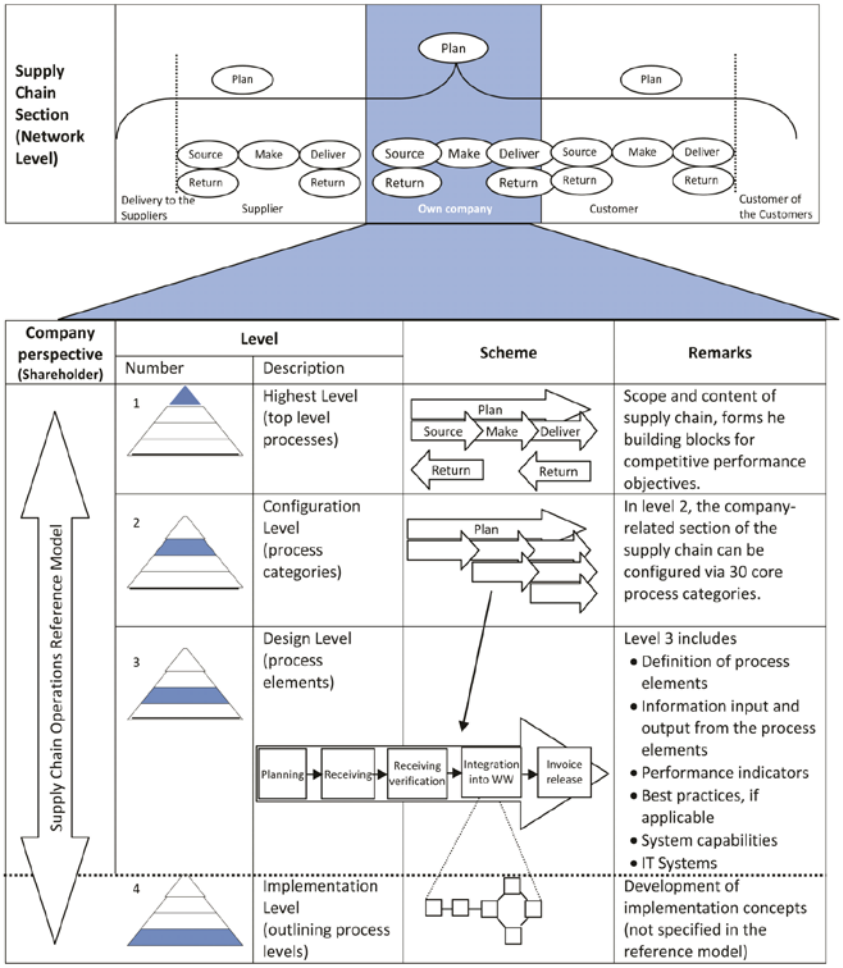

Figure 33: SCOR Model hierarchical levels[224]

Description of the supply chain section (network level) is omitted, since it was thoroughly outlined in Chapter 3 of this paper. The SCOR model extends over the entire supply chain, from the source of supply up to the point of consumption. It is made up of different

[224]Source: Essig et. al., 2013, p. 289

levels, by which the degree of establishment continually increases. Level 1 (top level) defines the content and scope of the supply chain, which is specified into five different process categories. The categories concern planning (Plan), procurement (Source), manufacturing (Make), delivery (Delivery) and return (Return).[225]

At Level 1, for example, divided locations are established. Individual locations and processes are linked with the companies involved.[226]

At the second level (Configuration Level), various standard modules are defined, which enable potential supply chain configuration. Thus, the supply chain is to be dissected into different sub-processes. For this reason, the five process categories that were already described for the first level are used and are displayed horizontally. Three process types are added to these categories, namely, planning, execution and infrastructure. These are displayed vertically. This categorisation yields a matrix, which is labelled as a configuration toolbox by the Supply Chain Council.

On Level 3 (Process Element Level), process categories are dissected into individual process elements, the objective of which is to define each process element and convey the input/output relations.[227]

It also serves to illustrate and form the sub-processes from Level 2 in detail. At this point, service attributes (i.e. flexibility, costs) and best

[225]Cf. Werner, 2013, p. 65
[226]Cf. Brown, 2009, p. 61
[227] Cf. Werner, 2013, p. 66-70

practice (i.e. combining several products into a single delivery) can be defined.[228]

Level 4 is concerned with implementation, which forms the transfer from standardised, cross-industry process elements to sectors and company-specific process steps. On account of individual design possibilities, this level will not be further outlined in the SCOR model.[229]

The Supply Chain Differentiation Guide is another new approach for implementing targeted supply chain management. The Department of Logistics Management at the St. Gallen University has long pursued this approach. Renowned companies took part in the study and offered their knowledge to this end. The difference between existing approaches forms the unconditional focus on the customer and his or her requests. This approach acknowledges that the various world market places have completely different needs. To elaborate, a company purchases product X in Europe and in Asia. It stands to reason that the European customer has different requests relating to the product than his Asian counterpart. Therefore it would be expedient to operate the differing markets with the same supply chain. This is why segmentation is mandatory. Segmentation bolsters the success of supply chain management since customer needs are better satisfied.

[228] Cf. Hertel et al., 2011, p. 108
[229] Cf. Brown, 2009, p. 62

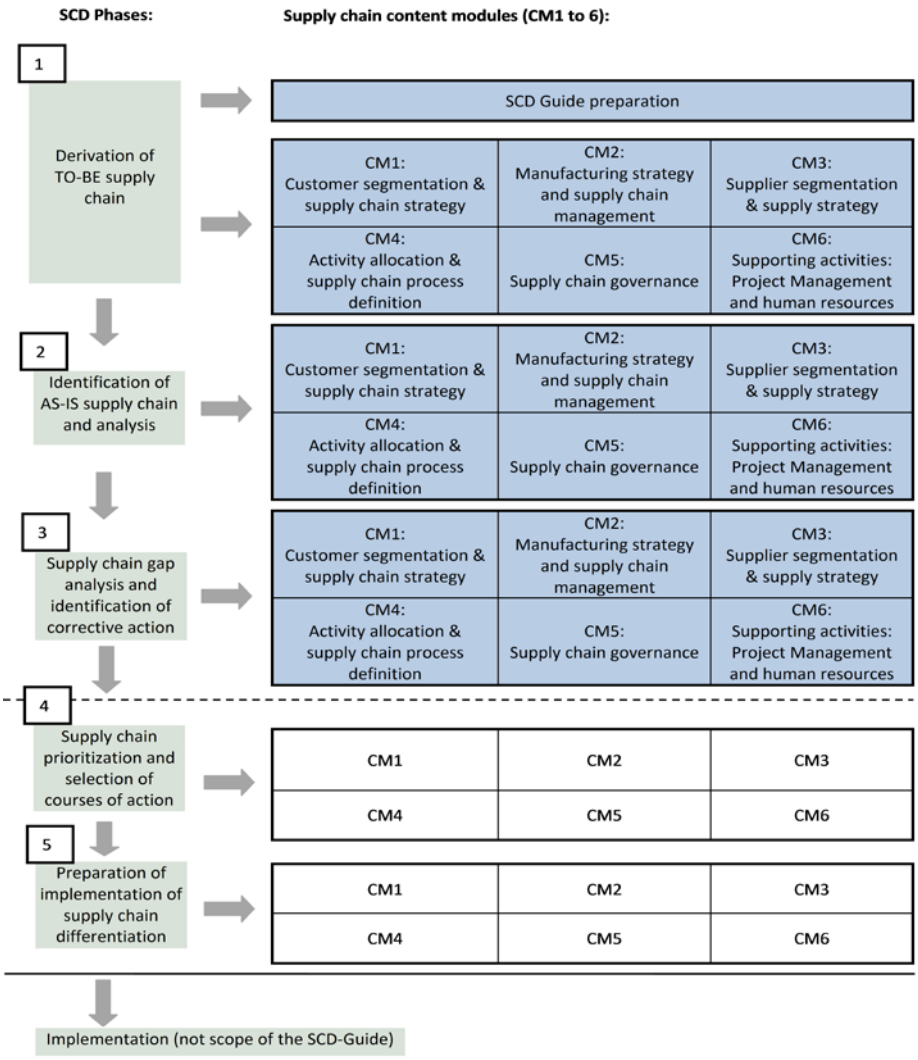

Figure 34: Structure of the supply chain differentiation guide[230]

[230] Source: Hofmann et al., 2012, p. 17

The Supply Chain Differentiation Guide consists of five steps. Implementation analogous to the SCOR model was not included for observation. The first step is to design a prospective supply chain that focuses on customer requests, while the second step is concerned with the appearance of the existing supply chain.

In the third step, the existing and prospective supply chains are compared in order to be able to recognise gaps. If there are identifiable gaps, measures are to be determined and implemented so that the desired form of the future supply chain can be achieved. The fourth step prioritises the supply chain and chooses the sequence of measures. Preparing for implementation constitutes the fifth and final step of the Supply Chain Differentiation Guide.[231]

8.3. Potentials Across Supply Chain Management in the Steel Industry

Supply chain management offers the steel industry true added value in positioning itself for the future. As a result, the industry can regard approaching changes as an opportunity rather than a threat. However, potentials derived from the survey were not as high by far from those cited in several literary sources, which in no way questions the validity of these sources. Rather, it should be regarded as the multifaceted and varied nature of supply chain design and its achieved potentials accordingly. In the questionnaire, on which this paper is based, specified commodity groups were surveyed vis-à-vis application of supply chain concepts. There was only a fixed set of

[231] Cf. Hofmann et al., 2012, p. 17-27

supply chain types. This restriction was necessary in order to make a statement with emphasis. Be that as it may, the spectrum of options could not be covered in its entirety. The segmentation approach, which was brought to bear in the supply chain differentiation approach, was also omitted since it would have substantially increased the complexity of the survey. A guarantee of a statement for the research questions would not have been possible on account of the modest response rate. In order to make the potential more tangible, the hypothetical company XX will be created. The following basic information pertains to company XX:

Revenue 600 million, material costs 400 million, EBIT 40 million, transport costs 20 million, customer cost complaints 5 million and a net working capital of 120 Million (corresponds to two months or 60 days). These statistics could easily reflect figures for an actual steel company. However, a 100% agreement with an existing company would be purely coincidental. In the next step, potentials from the questionnaire will be extrapolated to company XX in order to calculate an overall potential. Other achieved improvements in the areas of delivery capacity, overall cycle time, etc. will not be included in the following table.

	Company XX Data in Millions	Improvements as per Survey Responses (Ø)	Potential for Company XX via SCM Usage
Revenue	600 mil.		
Material Costs	400 mil.	3%	12 mil.
Transport Costs	20 mil.	5%	1 mil.
Customer Complaint Costs	5 mil.	5%	0.25 mil.
Net Working Capital	120 mil.	35 Days	50 mil.
EBIT	40 mil.	10%	4 mil.

Table40:Projection of possible improvement potential forcompanyXX[232]

As is depicted in Table 41, a considerable improvement is feasible, even with a rather low potential. For a greater potential as described by Locker and Grosse- Ruyken or Beckmann as illustrated in Table 3 of this paper, the outcome is significantly higher. For example, Beckmann indicates a profit increase of up to 30%, achieved by an identified Net Working Capital reduction of 50 million, which is an actual reduction. It prompts the question of company XX's capital base in terms of interest savings. For the purpose of this fictitious scenario, we will set the rate of interest at 5% for incorporated borrowed capital. This results in a reduction of interest charges to the effect of 50 million. Multiplied by 5%, that is 2.5 million. This figure was not evident in either the EBITDA or in EBIT, yet quite visible in the shareholder value. Even so, all supply chain finance options are far from being exhausted. There also remains additional potential that can be raised. Further improvements, which were visible in the evaluation of the survey, included raising supply capacity between 1-30%. Conversely, the overall cycle time could be reduced by 1-30%.

[232] Source: Own illustration

Comparing these figures with the information provided by Locker and Grosse-Ruyken as well as Beckmann, which specifies changes from 25-50% for improving delivery reliability and overall cycle time reduction, statistics derived from the questionnaire are too low. Moreover, adopting supply chain management concepts lowered storage costs between 1-20%. For several years, there has been discussion around the subject of supply chain management or supply (chain) network management. Virtually no company has only one supply chain, since this would indicate that for every respective level of the supply chain there would only be one company. This does not reflect a true scenario. Indeed, every company is a part of a comprehensive network of customers and suppliers. This approach offers additional options, which can contribute to improving competitive capacity as well as to increasing returns.