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A Sectoral Analysis of Iron & Steel Industry in Germany

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This paper primarily focuses on providing a context for understanding the Indo-German story focusing on the Iron and Steel industry sector using the SWOT analysis method. The intent is to provide its readers the ability to understand the various dimensions of the German Iron and Steel Industry and thus develop a suitable engagement strategy.



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1. Executive Summary:

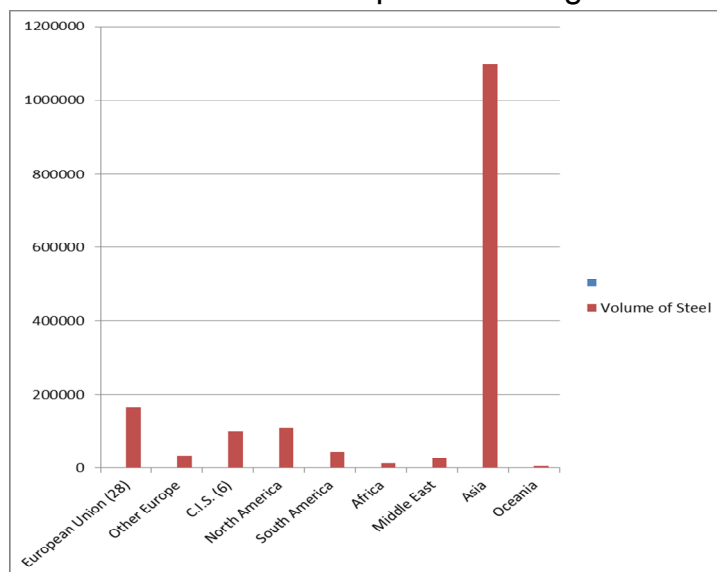
Perhaps no single element has been used by human beings as much as Iron. Germany has been pioneering the development of Iron and Steel industry in the modern industrial era since early 18th century. Its ability to develop the industry was dependent on the easy availability of raw material. Since the 20 century the industry has scaled massively and hence has encountered various limitations. These limitations were surmounted innovatively. Steel continues into the 21st century as a material that has withstood the test of time with Germany especially investing significantly in its development.

Brief overview of methodology: We have used the SWOT (Strength, Weakness, Opportunities and Threats) analysis as a framework to analyze the sector in Germany. The framework helps us to understand the industry along defined dimensions and enables us to develop our own approach to it.

2. A snapshot of the Global Iron and Steel Scenario:

- In 2015, the world crude steel production reached 1,622.8 million tonnes (MT) and showed a reduction of 2.8% over 2014.
- China remained the world's largest crude steel producer in 2015 (803.8 MT) followed by Japan (105.2 MT), and India (89.6 MT) at the 3rd position.
- Total crude steel production for Asia for the year 2015 remained at 1,113.8 MT
- For European Union the total crude steel production is 166.2 MT. Germany leads Europe with 42.7MT (*Source: World Steel Association*)

A brief overview of steel production figures worldwide



(*Source: World Steel Association*)

Ranking of the Steel producing countries

Rank	Country	Quantity of Steel in MT
1	China	803.8
2	Japan	105.2
3	India	89.6
4	United States	78.9
5	Russia	71.1
6	South Korea	69.7
7	Germany	42.7
8	Brazil	33.2
9	Turkey	31.5

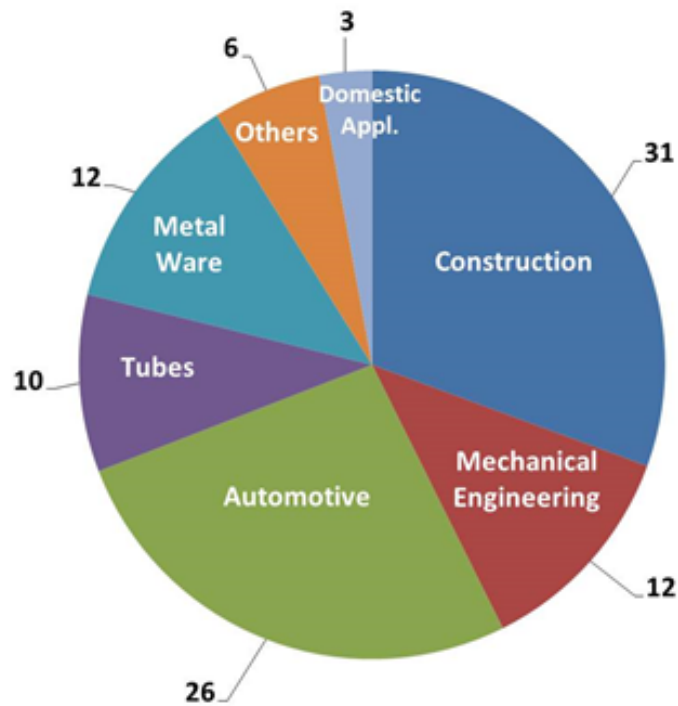
(Source: World Steel Association)

3. An Overview of the German Steel Industry:

The German steel and metal industry includes Iron, steel, steel and metal working industries and foundry. It is tightly coupled with industrial sectors like the automotive industry, building and construction, mechanical engineering and electrical industry. Since it is a basic industry, it researches and develops new materials, products and intermediary products, and is a significant contributor to the improvements of the process industries which consume a lot of steel and metal.

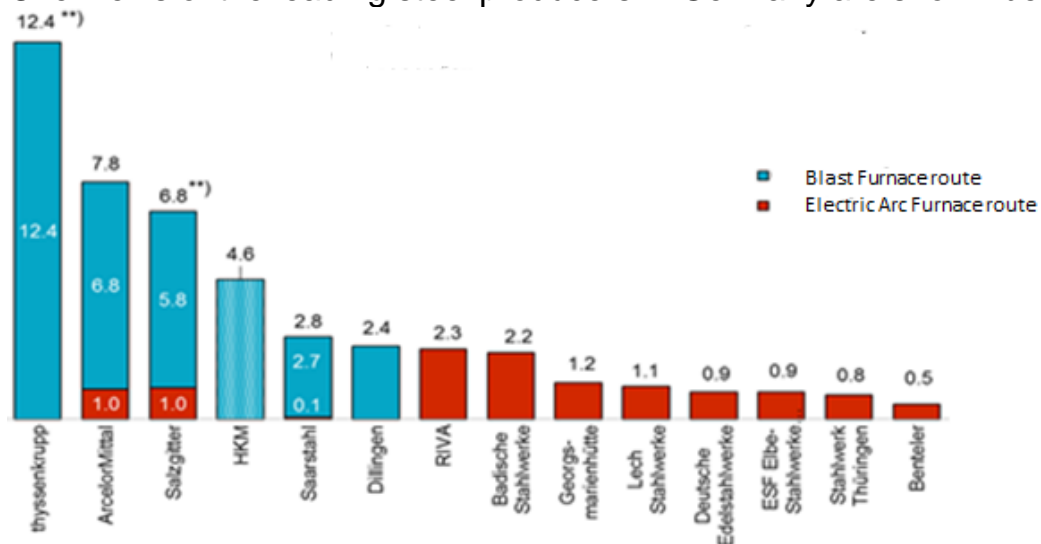
On account of its leadership in innovation and high-quality products, the German steel industry is an established leading producer of steel in European Union. Approximately half of the total production is exported. The non-ferrous metals like Aluminum, Copper and foundry (casting) industries are also similarly competitive. At pan European level, the German foundry industry is the leader in production. From a global perspective, it ranks behind the leading producers like China, India and Japan. Overall, the industry employs 450,000 workers in 5,200 companies (2013). The metal industry employs a large proportion of university graduates in science, technology, engineering and mathematics. In 2009, this group accounted for almost 60 percent of all university graduates employed in this industry.

Steel is utilized in multiple sectors as input material. A brief overview of the utilization of steel as input material is provided in the graph shown below.



Source: <http://en.stahl-online.de/>

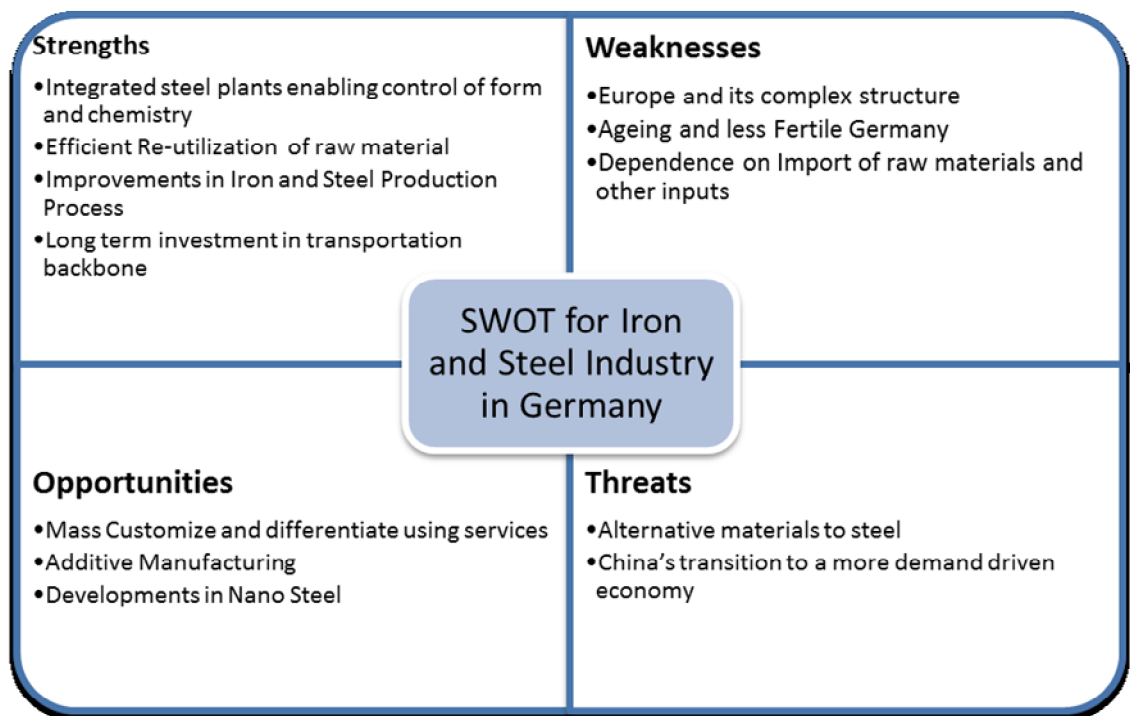
Overviews of the leading steel producers in Germany are shown below.



Source of <http://en.stahl-online.de/>

4. Iron and Steel Industry in Germany – SWOT Analysis:

Brief Overview of Methodology: SWOT is an acronym for Strengths, Weaknesses, Opportunities and Threats analysis. This is the methodology we have used to assemble and disseminate information in this paper. Using this framework we have processed and structured information along the dimensions of S, W, O & T to enable readers to engage with details. The approach in this paper is to give a brief overview of these dimensions. Further information can be gained from the information websites listed in the Bibliography.'



4.1. Strengths:

- i. *Integrated steel plants enabling control of form and chemistry*
- ii. *Efficient Re-utilization of raw material*
- iii. *Improvements in Iron and Steel Production Process*
- iv. *Long term investment in transportation sector*

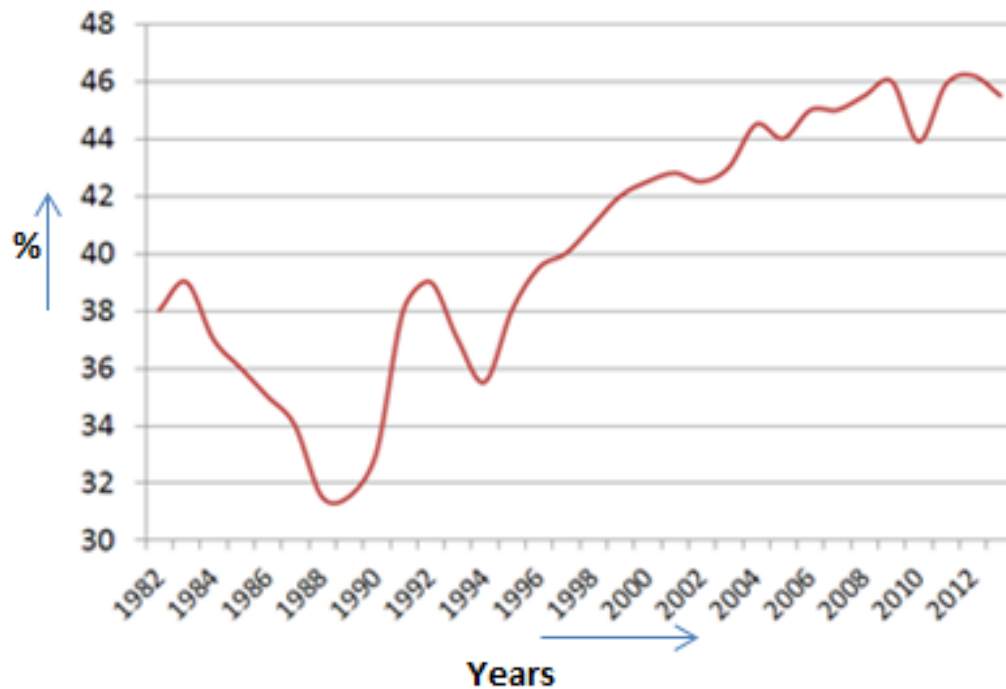
1. Integrated steel plants enabling control of form and chemistry: Steel is produced broadly using two different routes.

Route 1. Using the Iron ore via the Blast furnaces and thus producing molten iron to which various metal and chemical additives are added in various stages to enable creation of different grades of steel.

Route 2: This is typically the Electric Arc furnace used to melt recyclable steel scrap. A third route exists in the form of direct reduction of Sponge Iron, which is a sort of hybrid of these two methods.

The important point here is that approximately 66 % of crude steel produced in Germany is produced via the iron ore blast furnace route and the remaining via the electric arc furnace route. Having the technology to control the chemistry and the form in house gives German Steel makers the ability to control costs and calibrate value addition along the integrated steel plant route.

2. *Efficient Re-utilization of raw material:* In a world which is competing on raw materials which are unevenly distributed, German steel makers and the German government have drawn up policies to enable improvement in usage of raw material. This improvement is visible in the fact that over the last 20 years while production in steel has increased, the amount of raw material consumed has been reduced by approximately 10 million tons. Germany recycles approximately 20 million tons of steel scrap thus reducing the raw material input and reducing the carbon footprint. The German government has legislated a Closed Substance Cycle and Waste Management Act (Kreislaufwirtschafts- und Abfallgesetz, KrW-/AbfG) with the express intent of ensuring conservation of natural resources and ensuring environmentally compatible disposal of waste, thus providing the framework to encourage and measure recycling commitments. As part of this act returning the secondary raw material (for example re-extraction of raw material from condemned automobiles and machinery) back into the resource cycle has been the focus. These measures and the investment in Research and development to maximize raw material usage has resulted in Germany achieving recycling rates of up to 90% for steel.



Percentage of steel scrap used over time in producing crude steel

Source <http://en.stahl-online.de/>

Germany being an overall industrial export driven economy, is particularly reliant on raw material providers and the German government has in association with industry bodies determined and utilized the EU level trade policy to ensure that resolute action is taken to even out the trade barriers. The German government has been proactive in taking up trade issues at the WTO level as well.

Thus the German Government and Iron and Steel industry have a very strong focus on maximizing re-use of raw material and collaborating in search for development of new raw material sources.

3. Improvements in Iron and Steel Production Process: The whole process of production of steel has been the focus of numerous rounds of improvement process, resulting in substantial improvement in production efficiency. This strength is visible throughout the lifecycle of the plant.
 - a. Conceptualization of the plant is undertaken using 3d graphics and other plant simulation software which enables a vital understanding of space and its usage. It also ensures efficient construction of the plants as stage wise development of the plant is modeled on software.
 - b. Maintenance Process is a major competitive advantage for steel manufacturing in Germany. Most steel plants have excellent

maintenance record with workshops supporting rigorous maintenance programs and reducing the chances of a costly breakdown. The rigorous process and close monitoring of critical components of the plant enable the plants and machines to be operated at near maximum capacity.

- c. A significant investment in process automation and decision support layer of software has enabled better decision making and more efficient utilization of Hot molten metal. Significant investments in automation have also been made downstream in the hot and cold rolling process enabling better quality of steel to be produced.

These initiatives enable German steel producers to minimize cost of operations, scale operations and better react to demand signals. This overall improvement in productivity is achieved along multiple dimensions. The Organization for Economic Co-operation and Development (OECD) has pegged the improvement across industries to an average of 23.1 by Germany versus 12.3% by UK and 13.3% by US

- 4. Long term investment in transportation sector: Steel is a transport intensive sector. Most steel companies in Germany have made long term investments in dedicated rail infrastructure and inland waterway infrastructure. Bulk transportation of raw materials and transportation of finished goods to customers represent a significant cost. Early and mature investments in these sectors and their subsequent management has ensured that the wide spread rail network is used to transport more than 50% of finished goods. Last mile connectivity is maintained by road transport especially where customers do not have access to rail or waterways.

A brief overview of rail freight over the last 14 years is shown below

Year	Total	Of which				
		National transport	International transport total	International transport loaded	International transport unloaded	Transit
2014	365,003	238,687	107,777	45,888	61,889	18,538
2013	373,738	247,472	108,449	45,53	62,919	17,817
2012	366,14	247,117	103,512	45,286	58,226	15,512
2011	374,737	257,202	102,579	46,256	56,323	14,957
2010	355,715	242,073	97,206	45,117	52,089	16,437
2009	312,087	210,722	86,009	41,779	44,231	15,356
2008	371,298	239,266	111,889	54,336	57,553	20,143
2007	361,116	226,307	115,526	56,425	59,101	19,283
2006	346,118	217,89	110,775	54,628	56,147	17,454
2005	317,294	201,725	99,344	48,22	51,124	16,225
2004	310,261	200,102	97,36	46,063	51,296	12,799
2003	303,757	203,23	88,7	41,3	47,4	11,8
2002	289,205	193,2	85,3	40,5	44,8	10,7
2001	291,1	192,4	88,5	41,3	47,2	10,2
2000	299,1	198,6	90	42,3	47,7	10,5

Source : Deutsche Bahn

4.2. **Weaknesses:**

- i. *Europe and its complex structure*
- ii. *An Ageing and less Fertile Germany*
- iii. *Dependence on Import of raw materials and other inputs.*

It is important to note that most of the weaknesses mentioned are relevant across sectors and not just Iron Steel and Metals. Cost of importing raw materials is more specific to steel

1. *Europe and its complex structure:* The European union is a collection of 28 member states which have tried to join together in a political, legal framework and economic framework. However, the union is far from operating as a single nation. The older intra national rivalry is frequently whipped by the Eurosceptic parties. The union has afforded Europe a single market, currency and the necessary stability. Trade with other EU partner countries has been pegged at 58% of total exports. Total imports for Germany has been pegged at 58.2% (Foreign trade report for 2014 by BMWi).

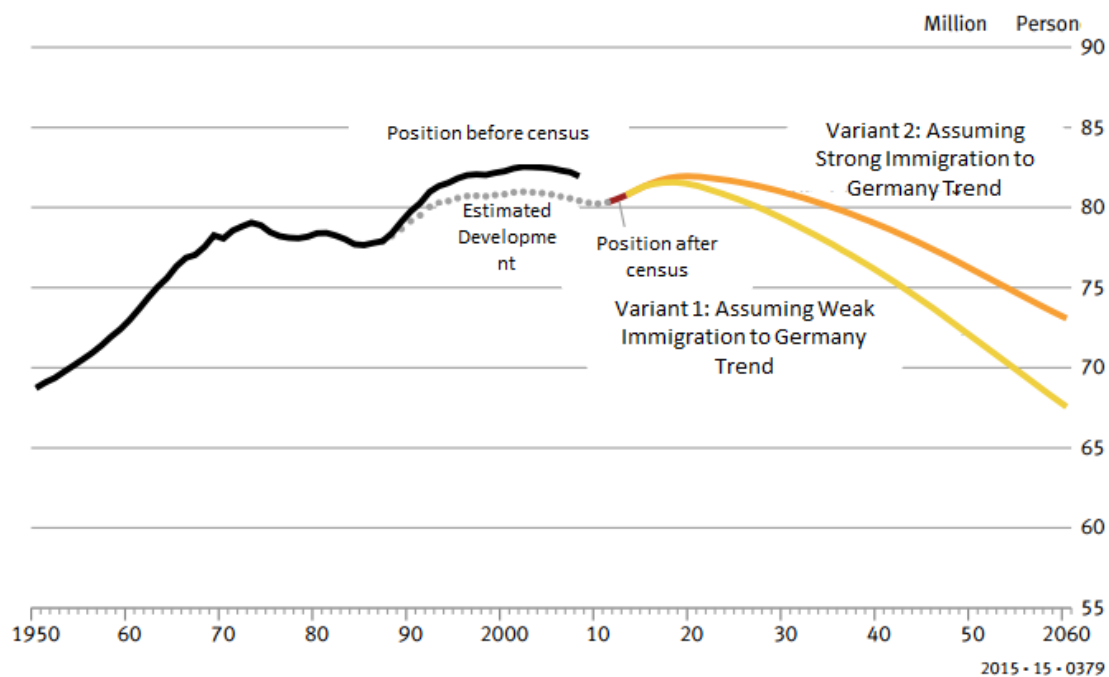


Source Federal Statistical Office of Germany

Thus, Germany and its trade with its European neighborhood are vital to Germany's economic well-being. This focus on trade with Europe is also a sign of weakness, because if any of the partners sneeze Germany will catch a cold. Overall the weakness of the less performing economies and the recent refugee crisis is ratcheting up the pressure coupled with poor Pan European Governance and implementation of initiatives.

2. *An ageing and less fertile Germany:* This is a serious challenge for the German Steel Economy since it is reducing the number of available employees. According to forecasts, Germany's population will decline from the current figure of 82 million to 77 million by 2025. The average age of this population is also likely to shift to an older population. In purely statistical terms, there is likely to be a ratio of 0.9 pensioners to each economically active individual. The figure for 2010 is 0.6 pensioners. By 2030, the economically inactive population will account for more than 50% of total consumption. The consumption pattern of the pensioned population will also be significantly different with an increased focus on medical requirements. Germany will need to significantly scale up Capital intensive investments and ensure technological progress to increase productivity to prevent a drop in per capita income. This problem is acute in the cutting edge sectors of Mathematics, Information technology, Nano technology, Science and Engineering.

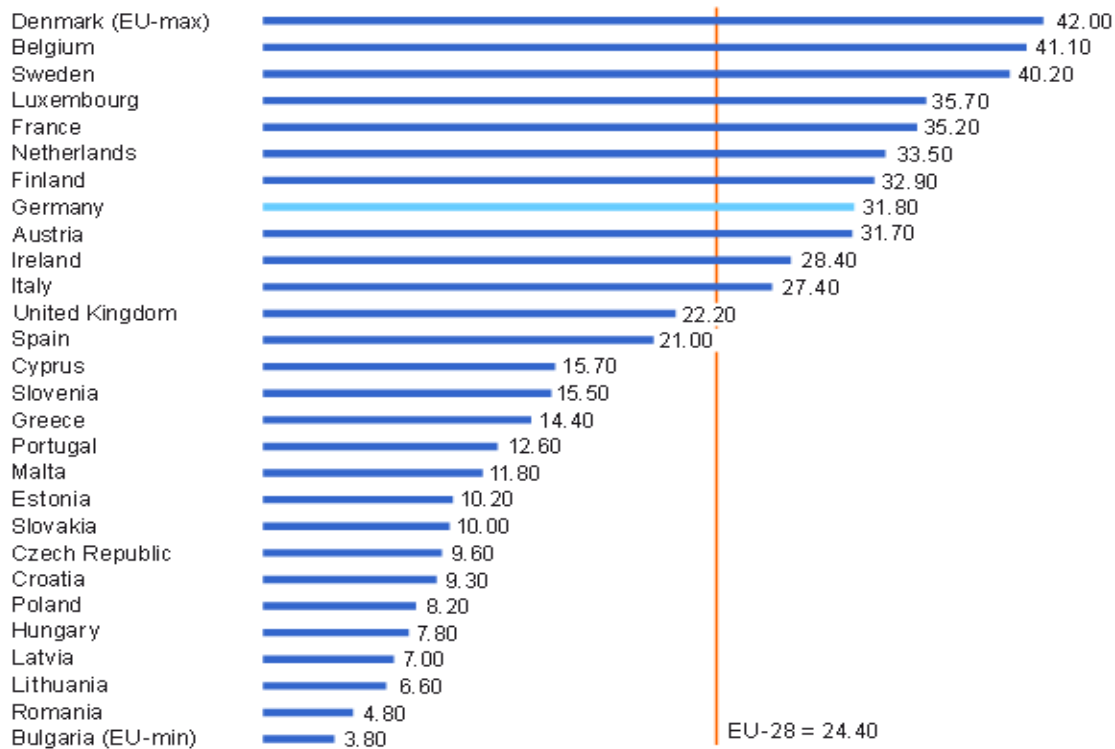
Population statistics 1950 to 2060



This shortage in labour has caused the cost in the labour market to also increase and this is evident from a chart comparing wages across countries in the EU

Labour cost in the private sector, 2014

per hour worked in EUR



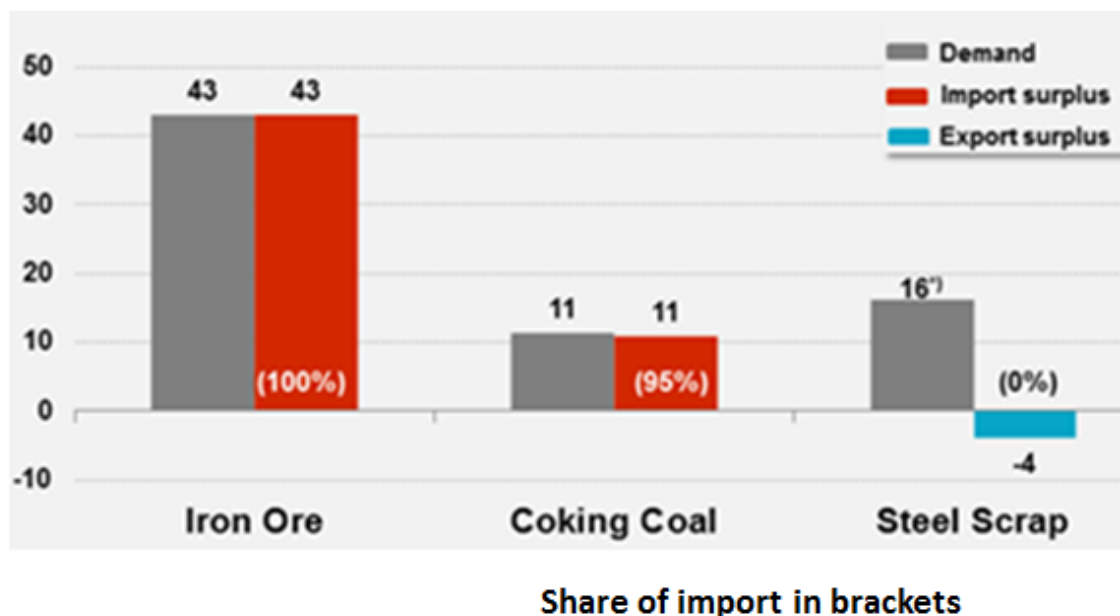
Source: Own computations on the basis of Eurostat data.

© Statistisches Bundesamt, Wiesbaden 2015

The German government is aware of this weakness and has earmarked approximately 12 Billion Euros in education and R&D. Yet, this is an area of significant weakness

3. *Dependence on Import of raw materials and other inputs:* Iron Metal and Steel in Germany is an import intensive industry. The three main components of Iron ore, coking coal and steel scrap are all imported by Germany; the fourth main input cost factor is power. The availability of raw material needed for steel and metal manufacturing is concentrated in a few countries and is highly concentrated with a few large miners and is complicated by the imposition of trade barriers by different countries. Trade barriers regarding steel scrap are in force currently in approximately 20 countries. Matters are also complicated by the deteriorating quality of raw material and the increased cost of extraction. Overall Germany is a net exporter of steel scrap.

Chart Depicting dependence of steel industry on raw material import



Source: <http://en.stahl-online.de/>

The German government has undertaken the following initiatives which support the German business to diversify the supply of raw material.

- Provides unsecured loans to finance raw material projects against commercial and political risk
- Provides Investment Guarantees to support direct investment
- Export Insurance (Hermes insurance) to allow for development of new markets
- The Federal institute of Geological studies undertakes surveys to carry out targeted exploration

The steel industry uses approximately 23 Terawatts of electricity and cost of electricity has a significant bearing on cost of production. The industry has over the years increased its energy efficiency with many initiatives and has reduced its energy consumption by 39.2% per ton of steel. However, the recent initiative of the German government in increasing dependence on renewable energy has certainly made the steel industry nervous despite the subsidies in place to countermand the increased cost of production of clean energy.

4.3. Opportunities:

- i. Mass Customize and differentiate using services*
- ii. Additive Manufacturing*
- iii. Developments in Nano Steel*

1. Mass Customize and differentiate using services: Iron and Steel manufacturing have engaged their primary customers early in the product development phase and co-developed products jointly. This deep engagement and subsequent joint ownership of engineering solutions is a bulwark against cheap competition. There are forums like the autosteel.org which have enabled steel and automobile sectors to collaborate and generate value.

Broadly there are two approaches to mass customization which could be adopted by the steel industry. In the early phase of product the Steel industry could adopt A) Early involvement in product development approach. Further as the product matures to reduce cost the sector should endeavor to B) Making steel solutions which are compatible to multiple applications in different types of industry. To further differentiate to the above developed concept, perhaps the Iron Steel and metal industry could collaborate on services as well. Extending services could be typically in the area of failure analysis or in the consulting and design phase of engineering solutions as well.

2. Additive Manufacturing: A recent development in the manufacturing space has been the innovation in manufacturing technology in the form of various additive manufacturing technologies. The field is fast developing and represents a significant breakthrough in manufacturing technology. Numerous technologies exist in the area like.

- a. Fused layer Modelling for plastics (filler materials) used in Models, Prototypes and Consumer goods.
- b. Selective Laser Metal Melting/Sintering for metals and plastics used in, Prototypes small batch series, assembly of parts, repairs and Tools.
- c. 3d printing for Silica, metals and plastics, used in models prototypes and casting molds

- d. Polyjet: for Photopolymer and wax used in models prototypes and casting molds
- e. Laminated object modelling: Paper, Plastics, Carbon fiber reinforced polymer used in models and casting molds
- f. Stereo-lithography: for photopolymers used in models and prototypes
- g. Hybrid Systems: for Metals, used in repair works, single parts, small batches

It is also important to note that additive manufacturing allows us to reimagine the way products function as well.

With organizations like the Airbus and Boeing investing and planning significantly in additive manufacturing we will certainly see an uptake in this form of manufacturing.

3. Developments in Nano Steel: Significant Investments in research in steel at the Nano structure level are being made. These investments have enabled a better understanding of how the alloying process is capable of modifying the properties of steel. As a result research institutes seek to control the properties of steel better by controlling the deposition of the alloying elements. For example Scientists at the Max Plank institute have analyzed manganese steel and found that different crystal structures are available at linear defects than is typical for the material. The individual crystal grains of which any metal is composed can be considered as a stack of individual atomic layers. Linear defects, or more precisely edge dislocations, occur when a layer remains incomplete so that the layers above and below it must take a step. These findings represent a significant opportunity in improving the quality and performance of steel. These investments will enable the creation of higher quality of steel while reducing the weight of steel.

4.4. Threats:

- i. *Alternative materials to steel*
- ii. *China's transition to a more demand driven economy*

i. Alternative materials to steel

Various alternatives to steel are being engineered around the world. The most promising one is carbon fiber. Automobile manufacturers are investing in using carbon fiber to engineer low weight and high strength cars which have better mechanical properties. From cost perspective Carbon does represent a challenge, which is difficult to surmount. However there is no telling, with volumes of carbon fiber manufacturing increasing, the future market might be tilted more in favor of carbon fiber.

A comparison chart of physical properties is shown below

<u>Material</u>	<u>Longitudinal Tensile Strength</u>	<u>Density</u>
Carbon Fiber	approx average value 300 ksi	1.55 g/cm ³
Steel	approx average value 100 ksi	7.7 g/cm ³
Titanium	approx average value 120ksi	4.34 g/cm ³
Aluminim	approx average value 35ksi	2.7 g/cm ³

*ksi: Kilo pounds per square inch

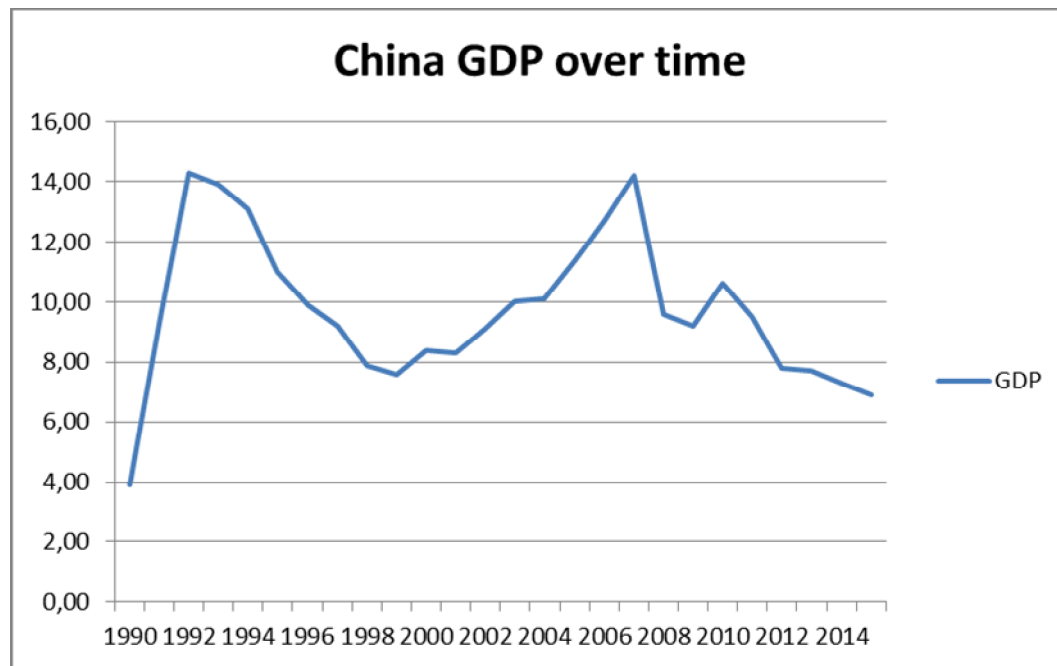
Information Source:

<http://www.clearwatercomposites.com/resources/Properties-of-carbon-fiber>

ii. China's transition to a more demand driven economy

China is transiting from its near double digit growth miracle to being behind the Indian economy as its growth engines seek to cool down. The Chinese economy reported growth figures of 6.9% last year with more than half the economy being accounted for by services. This cooling off is not without impact in the steel market. 35 years of buildup in capacity has meant china is capable of operating with huge economic efficiencies. As China seeks to cool and seeks to increase internal consumption and to be more demand driven economy, the Chinese will grow more slowly. However the impact it will have on already created capacities in iron steel and metal is questionable. Will they seek to compete with greater emphasis on price? Crude steel production reduced by 5.7% in the first 2 months of 2016. Finished steel production reduced by 2.1% in the first 2 months of 2016

The current situation in China may however restrict rationalization of capacity. While the Chinese economy has managed to lift almost a quarter of its populations living standards, and has used economic progress as the story to forestall any social uprising, the complex demand and supply process in international trade with tariff barriers might prove lethargic to change in the near future, thus making the years 2016 onwards extremely challenging both for Europe and its steel trade and China's Iron and Steel Market.



Chinese Growth Story rate of GDP from 1990 to 2015

The way China handles its transition to a more market driven economy will have serious implications and represents a key challenge and threat to the German Iron Steel and Metal market.

5. Outline of Indo-German Co-operation:

Indo-German Co-operation has a long and fruitful history. It was initiated shortly after the Second World War with Nehru and Konrad Adenauer establishing new relations between the Republic of India and the Federal Republic of Germany. Numerous successful initiatives include the establishment of the Rourkela Steel Plant in Orissa collaboration with Fried. Krupp and Demag AG.

As of 2015, India ranks 25th in the volume of import into Germany. Germany ranks 10th on volume of Imports into India. The total bilateral volume was €17.29 Billion. Other than the traditional sectors there is considerable cooperation in the field of Bio technology, green technology, renewable energy, urban mobility and entertainment industry. Indo-German Bilateral Trade (in € Billion)

	2013	2014	2015	2016 (Jan-Feb)
Total Trade	16.10	15.96	17.29	2.70
Indian Exports	6.91	7.03	7.53	1.29
Indian Imports	9.19	8.92	9.75	1.41
Balance of Trade	-2.28	-1.89	-2.22	-0.12
Major Indian Exports to Germany	Textiles, Metal & Metal Products, Electro Technology, Leather & Leather Goods, Food & Beverages, Machinery, Pharmaceuticals, Auto Components, Chemicals, Gems & Jewellery and Rubber Products			
Major Indian Imports from Germany	Machinery, Electro Technology, Metal & Metal Products, Chemicals, Auto Components, Measurement & Control Equipment, Plastics, Medical Technology, Pharmaceuticals, Paper & Printing Materials			

(Source: Federal Statistical Office, Wiesbaden)

6. **Recent Developments:**

1. The Frankfurter Allgemeine on the 26th of May 2016 reported that G7 including Germany is seriously considering imposing import tariff barriers on steel from China. Import Tariff barriers to the tune of 450% are being considered as measure to stop China from dumping Steel.
2. The Rhein-Neckar-Zeitung reports a year on year increase in production of steel for the month of May 2016 of 4%. The total reported production for Germany for Steel was 3.9 million tons. The sharp rise was attributed to downstream processors filling up inventory. The overall production month on month for the first 5 months has been 1 percent less than last year.
3. Handelsblatt reported on the 13th of April 2016 that there are rumors of the merger of European division of Tata Steel with Thyssen Krupp in bid to consolidate. They also reported that any such move may be strongly opposed by the trade workers union.
4. China agreed to not being recognized as a market economy by the WTO for 15 years from 2001 to enable it to gain entry to the WTO. This allows for imposition of Tariffs preventing dumping of imports by China.

However this expires end of 2016. This leads to a critical and tense situation with workers and unions across EU seeking an extension of the prohibition of China being declared a "Market Economy".

5. The Singapore based Amtek Engineering solutions a part of the Indian group Amtek Auto has for an undisclosed sum made a bid for the German Trader Rege Holding which belonged to INA Schaeffler.
6. The Hindu Business line recently reported that Amtek Auto has acquired Scholz Edelstahl. Scholz is a hot die forging manufacturer for auto and non-auto component industries.
7. A recent report in the times of India quoted the world steel association report to state that India was among the top 10 importers of alloyed steel, importing almost 13.3 Million tons in 2015. The times article also quotes the World steel association report to state that steel demand is expected to grow by 5.4% in 2016 .
8. Based on the encouragement for investment by the current government quite a few tech giants have opened 3D printing centers in India. The latest one to join the list is Renishaw UK's only 3D manufacturer who set up shop in Pune.

7. An Overview of steel in India:

Prime Minister Nehru believed that "a country cannot be politically and economically free unless it is industrialized and has maximized its resources utilization to the utmost". Free India's first Industrial Policy resolution adopted Nehru's ideas and the same was passed by the Constituent Assembly in 1948. The resolution accepted the principles of mixed economy. Industries were divided into four categories. In the first category were strategic industries which were made the monopoly of the Government. In the second category were six industries which included, among others, coal, iron and steel.

In alignment with the intent of this resolution the Government started building a chain of Iron and Steel plants all over the country. The first such plant was at Rourkela in Orissa, the second at Bhilai in Madhya Pradesh, followed by Durgapur in West Bengal. The Durgapur steel plant was closely followed by a steel plant at Bokaro. These and several other such social entrepreneurship lead to the maturation of the industrial revolution in India.

7.1. Domestic Scenario:

Production Statistics

- Today, India is the 3rd largest producer of crude steel in the world.
- In 2014-15, production for sale of total finished steel (alloy + non alloy) was 91.46 mt, a growth of 4.3% over 2013-14.
- Production for sale of Pig Iron in 2014-15 was 9.7 mt, a growth of 22% over 2013-14.
- India is the largest producer of sponge iron in the world with the coal based route accounting for 90% of total sponge iron production in the country.
- Data on production for sale of pig iron, sponge iron and total finished steel (alloy + non-alloy) are given below for last five years:

Indian steel industry : Production for Sale (in million tonnes)					
Category	2010-11	2011-12	2012-13	2013-14	2014-15
Pig Iron	5.68	5.371	6.870	7.950	9.694
Sponge Iron	25.08	19.63	14.33	18.20	20.38
Total Finished Steel (alloy + non alloy)	68.62	75.70	81.68	87.67	91.46
Source: Joint Plant Committee					

Demand - Availability Projection

- Demand – availability of iron and steel in the country is projected by Ministry of Steel in its Five Yearly Plan documents.
- Gaps in availability are met mostly through imports.
- Interface with consumers by way of a Steel Consumers' Council exists, which is conducted on regular basis.
- Interface helps in redressing availability problems, complaints related to quality.

Imports

- Iron & steel are freely importable as per the extant policy.
- Data on import of total finished steel (alloy + non alloy) is given below for last five years:

Indian steel industry : Imports (in million tonnes)					
Category	2010-11	2011-12	2012-13	2013-14	2014-15
Total Finished Steel (alloy + non alloy)	6.66	6.86	7.93	5.45	9.32
Source: Joint Plant Committee					

Exports

- Iron & steel are freely exportable.
- Data on export of total finished steel (alloy + non alloy) is given below for last five years:

Indian steel industry : Exports (in million tonnes)					
Category	2010-11	2011-12	2012-13	2013-14	2014-15
Total Finished Steel (alloy + non alloy)	3.64	4.59	5.37	5.98	5.59
Source: Joint Plant Committee					

8. Conclusion and Summary:

In summary one may conclude on the following aspect from our analysis.

1. German iron and steel industry has better weathered the storm than most other European Iron and Steel manufacturers on account of its variegated and nuanced innovations. These innovations in improved productivity represent large investments in intellectual property which can be capitalized on. This sale of intellectual property and its subsequent adaption into India remains a largely unexplored prospect. The current EU wide tariff barriers and Germany's ability to engineer a Pan European cause will come under duress as it seeks to protect the domestic market from an increasing price pressure in steel imports.
2. Indian Industry and its scale present several opportunities for engagement in iron and steel product development and applications. Also the per capita consumption of steel at about 60 kg is still quite low and represents significant opportunities.
3. Increasing focus on environmental sustainability also is a prospective area of collaboration to enable Indian organizations to be more efficient and sustainable in iron and steel production
4. The present Indian Governments focus on improving the Manufacturing, Mining and Transportation sector will certainly trigger ripple effects into the iron and steel trade. Early detection of trends will enable prospective cooperation between well positioned partners
5. Joint prospecting for raw material sources and sharing the outcome for industries on both the German and Indian side should be a priority.
6. Joint development of Intellectual Property with Indian firms of products with specific applications into Indian conditions should also be a possible area of co-operation.
7. Better business to business partnership enabling in finding areas of synergy in the areas of sales, production and management of all resources.

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<http://www.fairobserver.com/region/europe/challenges-facing-the-eu-today-23190/>
https://ec.europa.eu/research/social-sciences/pdf/policy_reviews/kina26426enc.pdf
<http://www.bmwi.de/English/Redaktion/Pdf/germany-industry-nation,property=pdf,bereich=bmwi,sprache=en,rwb=true.pdf>
<http://www.bmwi.de/English/Redaktion/Pdf/facts-about-german-foreign-trade-in-2013,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf>
<http://www.ecofys.com/files/files/ecofys-fraunhoferisi-2015-electricity-costs-of-energy-intensive-industries.pdf>
<http://qz.com/394456/the-numbers-behind-germanys-demographic-nightmare/>
https://www.destatis.de/DE/Publikationen/Thematisch/Bevoelkerung/Vorausbe-rechnungBevoelkerung/BevoelkerungDeutschland2060Presse5124204159004.pdf?__blob=publicationFile
https://www.destatis.de/EN/PressServices/Press/pr/2015/05/PE15_160_624.html
<https://group.atradius.com/publications/market-monitor-steel-germany-2015.html>
<http://en.stahl-online.de/index.php/topics/energy-and-environment/energy/>
http://www.metal-am.com/introduction_to_metal-additive_manufacturing
<http://www.goldmansachs.com/our-thinking/pages/china-an-economy-in-transition.html>
<http://www.bloomberg.com/news/articles/2016-03-12/china-steel-output-declines-as-economic-transition-cuts-demand>
<http://www.germany-and-india.com/en/event/486>
<https://www.indianembassy.de/pages.php?id=90>
http://kpmg.de/docs/inside_01.pdf
<http://steel.gov.in/overview.htm>
<http://pib.nic.in/feature/feyr2000/fmar2000/f060320002.html>
<http://www.mpie.de/3348597/science-ponge>
<http://www.clearwatercomposites.com/resources/Properties-of-carbon-fiber>
<http://am.vdma.org/en/technology>
<http://www.makeinindia.com/home>
http://www.rnz.de/wirtschaft/wirtschaft-ueberregional_artikel,-Stahlproduktion-in-Deutschland-gestiegen-_arid,198209.html

<http://www.faz.net/aktuell/wirtschaft/wirtschaftspolitik/g7-gipfel-freihandel-stahl-konjunktur-und-merkel-mitten-drin-14253953.html>
<http://www.tagesspiegel.de/politik/angela-merkel-in-peking-deutschland-und-china-in-konkurrenz-vereint/13702126.html>
<http://www.automobil-produktion.de/hersteller/wirtschaft/indische-amtek-steht-vor-uebernahme-von-zulieferer-rege-111.html>
<http://timesofindia.indiatimes.com/business/india-business/India-among-top-10-steel-importers-in-2015-WSA/articleshow/52492521.cms>
<http://www.engineering.com/3DPrinting/3DPrintingArticles/ArticleID/12395/Renishaw-Opens-Metal-3D-Printing-Center-in-India.aspx>

10. Appendix 1: List of Associations and Forums for the Iron and Steel Industry in Germany:

1. The Information Center Stainless Steel (ISER)

ISER is a neutral central contact; ISER offers comprehensive services involving all aspects of stainless steel. ISER's activities mainly focus on: Application-related, target group-oriented publications. ISER offers the industry numerous technical data sheets as well as application documentation on the application-specific selection of materials and the material-specific preparation and processing of stainless steel. ISER supports the process for obtaining National Technical Approvals from the German Institute for Building Technology (DIBt). Another of ISER's aims is to implement and participate in joint appearances with associated companies at trade fairs – at BAU in Munich, for example, the world's leading construction fair.

Address/Contact:

Informationsstelle Edelstahl Rostfrei (ISER)
Sohnstraße 65, 40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 835
Fax: +49 (0) 2 11-6707- 344
E-mail: info@edelstahl-rostfrei.de

2. Special Steel Association (Edelstahl-Vereinigung)

This is an alliance of companies in the special steel industry. Its history began when the plants first came together in an association in response to the rising demand for increasingly high-quality steels – the special steels – in order to meet their specific special steel-related interests. It represents the interests of its members (mostly SMEs) and is solely concerned with topics specific to special steels and focusing on the economic needs of the special steels industry

Address/Contact:

Edelstahl-Vereinigung
Sohnstraße 65,
40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 693
E-mail: info@stahl-online.de

3. The Stahleisen Publishing House

The Stahleisen Publishing House is one of the steel industry's leading specialist publishers worldwide. In addition to numerous specialist periodicals, industry-directories and books in German and English, it offers online electronic media. Its range of services is rounded out by its daily online news service specialising in the steel sector. Specialist periodicals on steel, worldwide 'Stahl und Eisen' ('Steel and Iron'): A journal of record for the production and processing of Iron and Steel. The journal also informs about latest trends regarding companies and steel markets and offers its readers valuable 'stahlmarkt' ('steel market'): A leading German-language magazine for steel distributors, steel service centres, traders and processors.

Adress/Contact

Verlag Stahleisen GmbH
Sohnstraße 65
40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 517
E-mail: stahleisen@stahleisen.de
Website: <https://www.stahleisen.de>

4. VDEh Institute for Applied Research (BFI)

The VDEh Institute for Applied Research (BFI) is one of Europe's leading institutes for applied research and development in the area of steel technology. In international comparisons the BFI offers the steel industry world-class research and development. Its field of activities range along the entire steel production process chain – from the input materials to the end products. Core competences include measurement technology, process technology and process automation. The BFI collaborates closely with similar institutes throughout Europe. The BFI is based in the Stahl-Zentrum in Düsseldorf .

Adress/Contact

VDEh-Betriebsforschungsinstitut GmbH (BFI)
Sohnstraße 65,
40237 Düsseldorf

Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 310
Website: <http://www.bfi.de>

5. Max-Planck- Institut für Eisenforschung GmbH (MPIE)

The Max-Planck- Institut für Eisenforschung(MPIE) is a legally autonomous research institute that carries out fundamental research in the field of high-performance materials, particularly steels and related metallic alloys. The Institute has been in existence for about one hundred years – examining and further developing complex chemical-physical processes, the characterization and simulation of materials, as well as the link between the atomic structure and material properties. The research projects are characterised by a highly interdisciplinary approach and close interaction between experiment and theory.

Address/Contact

Max-Planck- Institut für Eisenforschung GmbH
Max-Planck- Straße 1,
40237 Düsseldorf
Tel.: +49 (0) 2 11-6792- 0
Fax: +49 (0) 2 11-6792- 218
E-mail:info@mpie.de
Website:<http://www.mpie.de/>

6. The Research Association for Steel Application (FOSTA)

FOSTA is a non-profit and legally autonomous research association within the steel sector. As an association, it represents the interests of the steel industry – as well as those of the users of the material steel and its various products – in the field of application research. Research at the forefront of progress FOSTA's research focuses on a wide range of topics, whereby the research work is also oriented upon public debate. Topics such as resource efficiency and the reduction of CO₂ emissions are also of relevance to FOSTA.

Address/Contact

Forschungsvereinigung Stahlanwendung e. V. (FOSTA)
Sohnstraße 65
40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 310
E-mail:foستا@stahlforschung.de
Website:www.stahlforschung.de

7. The German Steel Federation (WV Stahl)

The German Steel Federation is the political-economic association of the steel industry in Germany and is based in Düsseldorf. It represents the sector's political interests in contacts with politicians, business and the public for steel producers in Germany and associated foreign member companies.

Address/Contact

Wirtschaftsvereinigung Stahl
Sohnstraße 65,
40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 310
info@stahl-online.de
Website: www.stahl-online.de

8. Stahlinstitut VDEh

Arising from the Association of German Steel Manufacturers (VDEh), the Düsseldorf-based Steel Institute VDEh has been the forum dealing with technical-scientific and technical-economic aspects of the steel industry since 1860. Whereby, in addition to steel producers, both plant manufacturers and other suppliers of the steel industry are also involved. The Steel Institute VDEh currently has about 6,600 members in Germany and abroad, as well as 160 supporting and collaborative member companies in the steel and supplier industry.

Address/Contact

Stahlinstitut VDEh
Sohnstraße 65,
40237 Düsseldorf
Tel.: +49 (0) 2 11-6707- 0
Fax: +49 (0) 2 11-6707- 310
info@vdeh.de
www.vdeh.de

11. Appendix 2: Summary for Practical considerations for buyers and strategy suggestion for suppliers:

Practical consideration by the Buyers	Strategy that can be adopted by Suppliers
Buyers like political and economic stability. Buyers will look at general economic development and trends of that country's market, or the common market to which it belong. They will cover mid- and long-term macro-economic regulations, policy trends, legal conditions etc, e.g., national policies trademark and patents protection; currency exchange, cost of labour; logistics and banking. Buyers are eager to benefit from favourable govt. policies. For instance, a favourable govt. policy regarding the development and promotion of iron and steel supplier (tax benefits, duty reduction etc.) can be an important criteria for EU buyers in assessing a country's iron steel export potential	<p>i) To provide prospective buyers with reliable information on the country or region. Make oneself acquainted with all relevant legal matters regarding import/ export, particularly customs regulations in Indian and Germany.</p> <p>ii) Study the exchange rates of INRs vis-à-vis US\$ and Euro.</p> <p>iii) Find out whether your government offers foreign investors any specific benefits. If yes, market this fact positively in contacting potential buyers and help them access these benefits</p>
Beyond low prices, EU buyers expect a functioning infrastructure like good access to ports and airports and an acceptable road transportation system as transportation costs are a crucial part of product cost calculation	Get information from freight forwarders to make sure you can offer a competitive deal that includes shipping. Implement a monitoring system for your shipment for the benefit of the Buyers
As raw material is a key factor in cost calculation, regardless of labor cost, this can outweigh the choice made by buyers.	To overcome this challenge, make sure to regularly check the availability of raw material and prices in India/region. If you have access to low-cost raw material, market this fact positively
Buyers are interested in new source of supply, many OEMs and automotive	i) Realize that to become a part of supply chain at Tier I is a long and complex process. The supply chain

<p>industry are downsizing their network of so-called Tier I supplier (suppliers of systems). However, suppliers that do not fit the bill as Tier I may qualify as element sourcing or modular sourcing. The decisive factor for many buyers is whether a supplier can easily be integrated in supply chain. Among other things it also means that the suppliers who offers compliance with standards, guaranteed delivery capacity and reliable logistics. A new supplier would have difficulties gaining access to the intricate network of OEMs. For new suppliers it would be easier to operate on a Tier 2 or 3 level- or to serve the aftermarket provided that again require fulfilling detailed requirement of Buyers</p>	<p>is a tight network dictated by the buyer.</p> <ul style="list-style-type: none"> ii) It may be advisable to focus on Tier 2 or 3 iii) The aftermarket (channel for replacement products) offers even better chances iv) Check your production capacity in terms of product category. Contract manufacturing is often outsourced to third parties, and consider it as a possible alternative v) Be aware of the fact that exporting your branded product may not work vi) Before contacting buyers, acquaint yourself with the standards and procedure in the German automotive industry. Familiarity with the EU's quality and safety standards as well as import & other legislative regulations is a prerequisite for even getting in touch with European buyers on automotive market
<p>Buyers want suppliers who can offer standard quality on sustainable basis and seek suppliers who can add high productivity to low costs. Buyer view experience as added value</p>	<p>As an exporter, must ensure that sustained quality is vital to export success. Get information on quality standard on http://www.tuv.com/de/deutschland/home.jsp</p> <ul style="list-style-type: none"> ii) Develop Quality Assurance system in-house iii) Maintain your machines and tool to ensure consistent quality iv) In view of stiff competition, buyer may easily switch to suppliers with a better offer v) Increase process flexibility to quickly respond to business change and be proactive vi) Try to get all the experience you can
<p>Suppliers transparency gives buyers confidence. This include documentation</p>	<p>Develop comprehensive documentation on you company,</p>

covering the organization, management structure, business figures and product	processes and products and update it regularly. Operating figures and key data should be computerized, reflecting the real status quo of the company
Buyers are more likely to partner with innovators and therefore investment in R&D is a relevant key figure	Be innovative and screen your product range, analyze the competition and invest in machinery, tools and staff education. Go for computerization with latest technologies
Buyers expect suppliers to be export ready in every way that include modern production standards, ability to meet both quality and quantity demands, a degree of automation, an appropriate range of product and international standard of packaging procedure	Make sure that the company is fit in every sense of the word
Buyer to take due consideration of exchange rate as decisive in doing business. Buyers want complete insight into price calculation. As price competition is very fierce, a tenth of a Euro may tip the scales towards acceptance or refusal of a deal	Be careful about exchange rate and if the local exchange rate is favourable, market this fact positively. Set up a computerized cost-based pricing system to recognize buyers' need for transparency and accurate cost calculation
Buyers view written statements and strategies as vital to communication	Draw up company strategy in writing and convert it into marketing concepts targeting different products and /or makers
Buyers get most of their information from your website and business card. Company website is used as an important tool by the buyer for collecting up-to-date information about company and product. Buyers use trade fairs and buyers missions for identifying potential trade partners. Buyers expect suppliers to	Make sure that your business cards look professional and contain accurate web addresses. Compare your website with those of international leading automotive suppliers and adapt it, if necessary. Register your company with international IT platforms as a supplier

communicate according to international standards. This means they expect company's brochure, catalogues, flyers etc to be complete, accurate, attractive and easy to read.	Participate in European trade fairs. Make sure that your promotional material are complete and attractively designed by professionals. Invest in language training for your staff particularly staff connected to export.
German Language: Though most of the top managers in Germany do speak English, the layperson understands the product description better when written in German language	Indian Steel Suppliers could give a the details of their products in German language, translated by professional translators, so that the layperson could understand the Indian product in a better way.

12. **Appendix 3: Important Websites:**

1. Website listing international trade fairs in Germany
<http://www.auma.de/en/messedatenbank/deutschland/seiten/default.aspx>
2. Website of the German Steel Federation <http://en.stahl-online.de/index.php/about-us/wv-stahl/>
3. The German government website for Trade and Energy
<http://www.bmwi.de/> and Facebook page:
<https://www.facebook.com/bundeswirtschaftsministerium>
4. The organization structure of the German Government for Trade and Energy
<https://www.bmwi.de/BMWi/Redaktion/PDF/M-O/organisationsplan-bmwi,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf>
5. Information from the German Government on Renewable energy:
<http://www.erneuerbare-energien.de/EE/Navigation/DE/Home/home.html>

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(Note: The information and data contained in this report have been checked and verified from published sources. In case any error or discrepancy is noted, it may be brought to the attention of Consulate General of India, Munich. The information contained in the report is purely for the purpose of reference and for internal use only.)

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