WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

World Economic Forum: Mining & Metals Industry Partnership
In collaboration with Accenture

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Scoping Paper:
Downstream value chain opportunities and challenges in steel and aluminium

WORLD ECONOMIC FORUM

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TABLE OF CONTENTS

1. Executive summary

Objective

At the Annual Meeting 2013 in Davos, the Mining & Metals Governors asked the World Economic Forum to prepare a scoping paper looking at how **changing customer requirements are likely to affect the steel and aluminium sectors** to inform the Forum's future programme of work. This scoping paper is not intended to summarize a comprehensive research project; rather it highlights the key issues and trends on the topic to inform the Governors at the Annual Meeting 2014 so they can identify which work activities the Forum's Mining & Metals team should pursue in 2014 and beyond to best support the Industry Partners.

Background

The steel and aluminium sectors have grown in the last ten years despite the global financial crisis. However, both sectors have faced significant challenges in recent years in the form of persistent overcapacity, squeezed profit margins, and constantly evolving energy and carbon constraints. Broader trends such as sustainability and environmental factors are also emerging, with the transition to a circular economy creating both challenges and opportunities for the sectors. The steel and aluminium sectors are keen to understand how to address these trends and become a sustainable industry. Given the context this paper explores changing customer requirements across a five to ten year time horizon and outlines the areas where the Forum can complete future work to support the Industry Partners.

Current situation

Interviews with experts across the steel and aluminium sectors and key customer representatives suggest that in the short-term (i.e. five to ten years) changing customer requirements are not going to have a material impact on the industry. Some customers are beginning to change their requirements, for example high-end automotive companies are looking for lighter, stronger, and more flexible and durable materials but these trends are not consistent across all customer segments or regions. However, according to the latest UNGC CEO study consumer/customer demand is becoming increasingly important when taking action on sustainability issues, with 47 per cent of respondents identifying it as a key factor in 2013 compared with 39 per cent in 2010[1]. Our research suggests that both steel and aluminium companies will start to see a more significant shift in customer requirements as the circular economy is considered more in global markets, broader sustainability and environmental trends gain traction, and regulatory requirements related to these trends begin to take shape in the next 10-20 years. There is increasing interest in how companies and governments can utilize lifecycle approaches to ensure actions, policies, and budgets are focused on the areas of greatest environmental impact. However, application of lifecycle approaches can be challenging; in particular to ensure that consistent data is available and appropriately applied to draw the right conclusions on what action is needed where along the value chain.

Future implications

Steel and aluminium companies need to simultaneously navigate the current challenges of overcapacity and squeezed profit margins, and anticipate how customer requirements may change in the future given that any required modifications to product design or operational processes could take time to implement. This paper explores, at a high-level, two potential avenues for doing so: process innovation and product innovation.

There has been significant progress in process innovation in the steel and aluminium sectors due to environmental and cost pressures driving efficiency. Further major gains are therefore unlikely in the main production process, especially for leaders in the market. In terms of product innovation, the transition to a circular economy could be an opportunity in sectors such as construction where there is scope for further collaboration and product development, and there is also an opportunity to extend existing product innovation concepts across developing regions especially.

[1] The UN Global Compact-Accenture CEO Study on Sustainability 2013: Architects of a Better World, September 2013 http://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_ Study_2013.pdf

Interviewees also identified that management practices were being impeded by trade restrictions which influence global competitiveness and this was flagged as an area for further attention.

Potential roles for the World Economic Forum

There are three key roles which draw on the World Economic Forum's unique ability to create communities of shared interest that makes the Forum well placed to help the steel and aluminium sectors respond to downstream opportunities and challenges:

1) **Accelerate product innovation:** Convene different industrial customer segments for a dialogue with the steel and aluminium sectors to explore how to catalyse product innovation through active participation in the Forum's Circular Economy project, to launch at the Annual Meeting 2014
2) **Address trade issues:** Conduct research on the impact of trade policy on the steel and aluminium industries and link with the broader project the Forum is launching in this area
3) **Explore life cycle implications:** Review current and emerging customer requirements for steel and aluminium and understand the lifecycle implications of these requirements. Work with customers, industry, and civil society to foster a consistent understanding of what key priorities are and what actions are required to focus attention on agreed impact areas

2. Introduction

Steel and aluminium are essential materials that are critical to the development of a plethora of structures and products that we perhaps take for granted. It is easy to overlook how pervasive the spread of steel and aluminium is across our urban landscapes and personal possessions because they are frequently intermediate materials which are used to make final products. For the purposes of this paper, customers purchase steel and aluminium finished materials to manufacture their products which are subsequently bought by consumers[2].

As intermediaries the steel and aluminium sectors are particularly susceptible to downstream value chain challenges and opportunities. They have limited means to control the costs of input materials and prices of finished products and both sectors are struggling to eliminate global overcapacity and secure satisfactory profit margins.

At the Annual Meeting 2013, the Mining and Metals Governors asked the World Economic Forum to prepare a scoping paper looking at how changing customer requirements are likely to affect the steel and aluminium sector to inform the Forum's future programme of work. This paper explores how changing customer requirements are impacting the steel and aluminium sectors in the next 5-10 years and potential roles for the Forum to support their industry partners to remain sustainable in the face of current challenges and trends.

3. Key issues and drivers

There are a number of key issues and drivers affecting steel and aluminium companies today, most pressing of which are overcapacity and price pressures. Further drivers include limited access to affordable, reliable and clean energy, global trade restrictions and the opportunities afforded by the shift towards a circular economy. These trends and how companies respond, have implications for the industry in both the near and medium term. Details of how these trends are specifically affecting the steel and aluminium industries are summarized below with further details available in the Appendix.

Steel – Supply, Demand and Overcapacity

The key supply and demand trends affecting the steel industry are resulting in chronic overcapacity across global markets with experts estimating there is between 300 and 500 million tonnes of overcapacity globally. Capacity growth is exceeding demand growth in part because of the long lead time for steel plant construction and the continued effect of non-market forces increasing and sustaining non-economic capacity. Global steel production increased 15 per cent between 2008 and 2012 to over 1.5 billion tons[3] whereas demand for steel has not recovered following the financial crisis – for example in Europe, consumption has fallen more than 25 per cent in 2013 compared to 2007[4].

The short-term demand outlook for steel is positive but slower than before the financial crisis. The World Steel Association estimates global growth rates of just over 3 per cent in both 2013 and 2014 compared with 9 and 7 per cent in 2006 and 2007[5]. The long-term demand growth prospects for steel are positive but the rate of growth will be smaller in developed regions than in developing regions that are experiencing increased urbanization and a growing middle class and the majority of demand by volume will be concentrated in China.

Another relevant trend has been the volatile price of iron ore. Between 2008 and 2011 the average price of iron ore increased 30 per cent, 83 per cent and 14 per cent each year before dropping 23 per cent in 2012[6]. This, alongside an imbalance between supply and demand, has contributed to squeezed profit margins for steel companies. A review of the

[2] For the purposes of this paper, downstream refers to customers and consumers. Customers refer to those who buy finished materials from steel and aluminium companies who subsequently use the materials to manufacture their products. Consumers refer to those who purchase products that contain steel and aluminium
[3] World Steel in Figures 2013. World Steel Association
[4] *Major overcapacity in the global steel industry*. October 2013. Euler Hermes Economic Research
[5] "Short Range Outlook for Apparent Steel Use". World Steel Association, http://www.worldsteel.org/dms/internetDocumentList/press-release-downloads/2013/SRO-tables-by-region-Oct-2013/document/SRO%20tables%20by%20region-Oct%202013.pdf. 2013
[6] Indexmundi. http://www.indexmundi.com/commodities/?commodity=iron-ore&months=120. 2013

leading manufacturers by region shows that the operating profit rate has fallen dramatically between 2008 and 2012 (as shown in Table 1).

Table 1: Profitability for the main companies

Operating Profit/Revenues	2008	2009	2010	2011	2012
China	8.2%	4.5%	4.0%	2.4%	1.3%
US	12.9%	-9.1%	0.9%	4.0%	3.7%
Europe	12.6%	-1.3%	5.0%	6.0%	2.8%
Japan	7.2%	2.0%	4.7%	1.9%	0.8%

Source: Euler Hermes Economic Research

Aluminium – Supply, Demand and Overcapacity

The key supply and demand trends affecting the aluminium industry are also leading to overcapacity for primary aluminium, which is estimated at 12 million metric tons, equivalent to 25 per cent of annual global demand[7]. The global supply of primary aluminium increased 19 per cent between 2008 and 2012[8] and global demand for primary aluminium has grown at nearly 5 per cent per year since 2002[9].

The forecast for primary aluminium demand is also strong with some estimates suggesting a 5 per cent growth per year is achievable for the next two decades due to urbanization, industrialization and economic development in developing countries[10].

The aluminium sector is also experiencing squeezed profit margins due to a combined effect of higher costs and lower prices. Since January 2000 the price of primary aluminium has increased just 20 per cent and when adjusted for inflation aluminium is below its 2000 value[11].

Energy and Carbon

Reliable and affordable access to energy is a key strategic driver for steel and aluminium – energy can account for up to 40 per cent of the finished steel product costs[12] and about one third of the total production costs of primary aluminium[13]. Both sectors are also focused on reducing emissions associated with their production processes as they account for 7 and 2 per cent of global CO2 emissions respectively[14,15].

Steel and aluminium companies and governments are interested in lowering the energy and carbon footprint of the sectors to drive cost savings, reduce environmental impacts and support the green growth agenda. There are multiple life cycle assessment methodologies available to help stakeholders identify reduction opportunities but they are complicated to apply. For companies and governments to effectively target high impact areas, allocate budgets and inform business and policy decisions life cycle tools must be applied consistently and be based on comparable data. Further work is therefore required to ensure the right conclusions are being drawn from life cycle approaches to deliver the goals of green growth, drive efficient and cost effective operational processes and lower global GHG emissions.

[7] The International Aluminium Institute
[8] The International Aluminium Institute
[9] *The Global Aluminium Industry 40 years from 1972.* February 2013. International Aluminium Institute
[10] The International Aluminium Institute
[11] *The Aluminum Industry CEO Agenda, 2013–2015: Understanding the Challenges and Taking Action.* June 2013. The Boston Consulting Group
[12] Remaking the global steel industry. Lower-cost natural gas and its impacts June 2013. Deloitte
[13] The Aluminium Association
[14] *Impacts of energy market developments on the steel industry* July 2013. La Place Conseil
[15] International Aluminium Institute and IndexMundi

Circular Economy

In order to address the trends such as a growing middle class, commodity price volatility, growing waste volumes and environmental regulations there is an emerging shift towards a circular economy. The circular economy refers to decoupling growth from resource use, environmental and social impacts. It embodies a move from linear business models, where products are manufactured from raw materials and then discarded, to circular business models where products or components are repaired, re-used, returned and recycled.

Steel and aluminium customers are considering what the circular economy means for their supply chains, manufacturing processes and relationships with consumers. For example, 43 per cent of CEOs in the automotive sector are looking to the circular economy as a source of competitive advantage[16].

Steel and aluminium products will be highly desirable materials in a circular economy due to their high recyclability and reusability. Steel is currently the most recycled material on the planet - the overall recycling rate reached 88 per cent in 2010[17]. Aluminium also has high recycling potential and it requires around 95 percent less energy to produce a recycled aluminium ingot compared with producing a primary aluminium ingot[18]. Across both sectors product design will have a greater focus on adaptability, ease of repair and deconstruction and traceability to facilitate material re-use. There is an opportunity for increased collaboration between steel and aluminium companies and key industrial customer segments to ensure steel and aluminium products are designed to support customers' transition to circular business models.

Trade

Trade policies impact the global steel and aluminium market in a number of ways including in access to affordable raw materials, finished products and carbon pricing.

With the recent agreement on a modest WTO package in Bali, attention is turning to the possibilities for a new trade policy agenda that responds to the major changes in the world economy over the past 15 – 20 years. For the first time since the formation of the Uruguay Round in 1980s, there is an opportunity for a truly strategic thought process about how the international trading system and its enabling arrangements and institutions should evolve in line with new economic and political realities. The Forum's Enabling Trade Platform brings together key actors in the global trade arena with the objective of linking transformative global issues to practical regional steps to help businesses source, trade and distribute their products.

Further research is needed to understand the impact of current trade barriers and on the steel and aluminium sectors and identify priority areas for improvement.

4. Changing customer requirements

Changing customer requirements are beginning to affect product specifications for steel and aluminium products. For this paper we considered the requirements coming from customers making products for transport, construction and consumer goods as they are critical for both the steel and aluminium sectors.

Some requirements are present across all sectors but there are also requirements specific to particular sectors (detailed in Table 2). The key trends on changing customer requirements are:

- Steel and aluminium with a higher proportion of recycled sources; increased yield improvement
- Reduced overall environmental impact (e.g. lower CO_2 emissions, lower energy, reduced waste)
- Positive societal benefits throughout the steel and aluminium value chain (i.e. contribution towards sustainable development)

[16] *The UN Global Compact-Accenture CEO Study on Sustainability 2013: Architects of a Better World,* September 2013 http://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_ Study_2013.pdf

[17] "Steel is the World's Most Recycled Material". Steel Works. http://www.steel.org/sustainability/steel%20Recycling.aspx. 2013

[18] "Aluminum is sustainable". The Aluminum Association. http://www.aluminum.org/Content/NavigationMenu/NewsStatistics/Sustainability/. 2013

- Higher transparency and certification of environmental and social impacts (e.g. cradle to grave certification, life cycle assessments)
- Responsible sourcing – avoid conflict regions

Table 2: Changing customer requirements in specific sectors

Transport	Construction	Consumer Goods
• Lighter steel and aluminium for all types of transport vehicles (e.g. automobiles, trains, planes and ships) to enhance fuel efficiency • Stronger steel and aluminium for transport vehicles to improve capacity (e.g. heavier load) • Higher-tensile and higher-strength steel and aluminium to improve vehicle safety • Types/grades of steel and aluminium with longer lifespans for component re-use and 'cascading' across different types of infrastructure • Improved metal performance (e.g. flexibility)	• Higher-strength steel grades • Reduced product thickness, high weldability and toughness at low temperatures for more sustainable construction (e.g. in cladding, structural sections and reinforcing bars) • Steel and aluminium with higher durability (e.g. better corrosion-resistant coatings) to withstand a changing climate • Harder and more resistant materials, particularly for transport infrastructure (e.g. rail, bridges) • Aluminium with reflective finishes allowing for efficiency light management and thus lower energy consumption • Improved structural characteristics and flexibility to enable innovative design • Pre-fabricated products to speed-up construction times	• Types/grades of steel and aluminium with longer lifespans for appliance component re-use (e.g. designed for disassembly) • Stronger aluminium and steel grades, to enable more re-use (avoiding costs of recycling) • Preference for products with lower energy requirements and CO_2 emissions

Our research suggests that changing customer requirements will gain momentum at different rates across the various customer groups and regions. At least initially, changing product specifications are more likely for high-end luxury goods in the developed market. Over time we expect to see increased momentum for changing customer requirements across the various segments as broader sustainability trends are embedded in the market and with the transition towards the circular economy but it is unlikely to happen in the next 5 to 10 years.

5. Changing role of consumers

In the latest UNGC CEO study 64 per cent of CEOs ranked consumers as the most influential stakeholder group[19]. A transition to a circular economy will increase opportunities for consumers and steel and aluminium companies to interact and consumers will play a key role in ensuring resource use is minimized across the value chain. Table 3 shows some of the likely consumer demands in a circular economy and the potential implications for steel and aluminium sectors.

Table 3:

Consumer demand in a circular economy	Potential implications for steel and aluminium sectors
1) Products that can last longer while delivering high performance standards at lower cost	• Increased collaboration required with customer during the design phase to ensure materials support longer life • Requirement for stronger, more durable and flexible materials

[19] *The UN Global Compact-Accenture CEO Study on Sustainability 2013: Architects of a Better World*, September 2013 http://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_ Study_2013.pdf

	• Life cycle costing replaces production process costing
2) Improved product collection processes to facilitate material re-use and recycling	• New/greater business opportunities to expand into material re-use and recycling • Increased collaboration with customers to design products with greater re-use potential • Slower demand growth for products that can be repeatedly re-used/recycled • New pricing models, incentives and/or customer contracts may be required to reflect repeated material use
3) Greater transparency on product sourcing and impact	• Effective product certification required to ensure quality and facilitate re-use/recycling

The changes outlined in Table 3 are unlikely, however, to materialize across steel and aluminium customer segments in the next 5 to 10 years as it is not clear that consumers are willing to prioritize sustainability in their purchasing decisions - 46 per cent of CEOs believe price, quality and availability of goods are more important to consumers than sustainability performance[20].

6. Responding to challenges and opportunities with innovation

With the exception of high-end product lines in developed markets, customer requirements do not appear likely to change materially in the next five to ten years. In the context of global overcapacity and squeezed profit margins steel and aluminium companies therefore need to get creative to grow and protect their market position. As price takers in the market, our research suggests that innovation is the best approach for them to respond to industry challenges and opportunities. There are two broad categories of innovation:

- **Process innovation:** reducing energy intensity, driving lean operations, lower costs, improving yield, increasing tolerances and manufacturing flexibility and shortening the supply-chain
- **Product innovation:** developing innovative new products to address specific customer needs

Effective management also emerged as an underlying requirement to ensure that best practices in these areas are uniformly adopted across the industry.

Process innovation

Process innovation focuses on improving operational and manufacturing efficiencies, improving environmental impacts and delivering cost savings.

Improving the environmental performance of operating processes is a familiar process improvement category, alongside cost savings and yield improvement, and an area that many steel and aluminium companies have been exploring for over 20 years. In addition, increasing customer expectations for companies to be more efficient, minimize raw material use and develop products with a lower environmental impact presents an opportunity for steel and aluminium companies. Leading steel and aluminium companies have already made significant progress in process innovation and further gains will be more challenging to achieve. A step change is required.

In the steel industry 48 companies and organizations have formed a consortium, ULCOS – Ultra-Low Carbon Dioxide Steel, dedicated to reducing CO_2 emissions from steel making by at least 50 per cent. They have identified four process components that are especially promising[21]:

[20] *The UN Global Compact-Accenture CEO Study on Sustainability 2013: Architects of a Better World*, September 2013 http://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_ Study_2013.pdf
[21] ULCOS http://ulcos.org/en/research/where_we_are_today.php 2013

- **Top Gas Recycling Blast Furnace with Carbon Capture Storage (CCS) –** recycling the off gasses so that the useful components can be recycled and used as a reducing agent
- **HIsarna with CCS –** a production technique that requires significantly less coal usage and thus reduces the amount of emissions and allows partial substitution of coal by biomass, natural gas or even Hydrogen
- **ULCORED with CCS –** a process that will remove the need for coke ovens
- **Electrolysis –** this process would allow the transformation of iron ore into metal and gaseous Oxygen using only electrical energy

The Aluminium industry is also developing new technologies and processes to reduce the environmental impact of production:

- **Reduced energy intensity:** 90 per cent of plants have moved away from older, more energy intensive Soderberg smelting technology towards more modern Pre-bake technologies (employing advanced electrolytic technology which will produce lower emissions and concentrate CO2 for potential capture and sequestration.
- **Reduced electricity consumption:** Continual R&D investment to find additional energy efficiencies over the last 20 years has led to around 20 per cent gains through the existing core technological process[22]. Technologies aim to drive down electricity consumption, reducing emissions and recycling key waste streams internally.
- **Resource recovery:** New technologies may enable alumina (and other metals) to be recovered from coal combustion. The Chinese state-owned mining and energy company Shenhua has, for example, begun construction of a coal ash-based alumina refinery[23].
- **Operations transformation:** A combination of training, auditing pollution control equipment and operational technologies such as boosted suction systems in the potlines are helping to reduce environmental impact and costs.

The most significant opportunities for further process innovation in steel and aluminium production may be in shortening the processing stages. The most energy intensive components of the steel and aluminium production processes are attributed to heating and reheating metals. If processes can be redesigned to eliminate the need for heating and reheating significant environmental savings can be achieved. Thin strip and direct casting are examples of two developing processes steel companies could deploy that could reduce the number of times metal has to be heated and reheated before developing the final product. The technology for these processes is available but they are unlikely to be widely adopted by steel and aluminium companies in the next 5 to 10 years due to issues of scale.

Product innovation

Customer requirements and sustainability trends are beginning to drive a series of product innovations in the steel and aluminium industries. Across all customer segments there are requirements for lighter, stronger, more flexible, more durable materials. Currently these changing requirements appear to be limited to high-end product lines in developed markets. In time all steel and aluminium companies will be expected to minimize the life cycle impact of their products, reduce the amount of raw materials required and consider the disposal and re-use options available for the product at the end of its life. Factoring these considerations into strategic planning will allow steel and aluminium companies to take advantage of a critical growth opportunity. There are different categories of product innovation described in Table 4 below:

Table 4: Examples of product innovation in steel and aluminium

Category	Description	Example
New product specification	• Increasing demand for lighter, stronger, more durable, more flexible steel and	• Alcoa has developed MagnaForce, a new, lighter, stronger alloy, for application in wheels for

[22] The Aluminum Association. http://www.aluminum.org/AM/Template.cfm?Section=The_Industry. 2013
[23] "China Recovers More Aluminum Ore from Coal Ash" West Virginia Coal Association. http://www.wvcoal.com/Research-Development/china-recovers-more-aluminum-ore-from-coal-ash.html. 2013

Category	Description	Example
	aluminium with higher recycled content	commercial transportation that are 16.5 per cent stronger than the industry standard[24]
New materials	• Developing stronger, lighter, thinner products	• GE aviation's GE9X fan blade for next generation jet engines will feature new high-strength carbon fiber material and a steel alloy leading edge[25]
Closed loop design	• Assembling all of the decision makers across the product development life cycle during the design phase to ensure that products are designed to minimize metals consumption necessary for current purposes while maximizing opportunities for re-use at the end of the product life	• Modular steel buildings can be erected faster, in a safer working environment and at a lower cost while simultaneously allowing future flexibility and adaptability
Enhanced environmental credentials	• Considering importance of product life cycle emissions when designing products	• The new Ford F-150 will feature an aluminium body to reduce the weight of the truck by almost 15 per cent and ensure the vehicle will meet enhanced fuel economy standards in the US[26]

Steel and aluminium companies looking to integrate product innovation into their strategic vision will need to invest heavily in R&D and building strong, collaborative relationships with customers and suppliers. Pursuing these avenues will help to focus efforts and create demand.

7. Potential roles for the World Economic Forum

The World Economic Forum's unique ability to create communities of shared interest to catalyse necessary action makes them well placed to help the steel and aluminium sectors further transform into a sustainable industry. The key focus areas should be around accelerating product innovation and addressing trade issues and Table 5 outlines the potential roles for the World Economic Forum.

Table 5: Potential roles for the Forum

Objective	Potential roles for the Forum
Accelerate product innovation	• Develop specific steel and aluminium cuts of the Forum's work on the Circular Economy • Create a platform for key customer segments to convene with the steel and aluminium industry to facilitate a mutually beneficial, cross-industry dialogue on the impact of a shift to the Circular Economy
Address trade issues	• Connect with the Forum's E15 initiative (a partnership between the Forum and the International Centre for Trade and Sustainable Development) to research the implications of current trade policy on the steel and aluminium sectors • Bring together industry and government to discuss the impact of current trade policy on the steel and aluminium sectors and outline potential solutions to address
Explore life cycle implications	• Review current and emerging customer requirements for steel and aluminium and understand their life cycle implications • Develop guidelines on how to use life cycle approaches across the steel and aluminium value chain • Convene industry, government and customers to foster a shared and consistent understanding on how to apply and interpret life cycle approaches in development of

[24] "Alcoa Reinvents the Wheel Alloy". Alcoa. http://www.alcoa.com/alcoawheels/north_america/en/news/releases/news_detail.asp?xpath=2013_10_20_magnaforce. 2013
[25] "GE Fans Out on Testing of New GE9X Fan Blades; New Material and Design Improvements Drive High Aerodynamic Performance". ENP Newswire. http://www.hispanicbusiness.com/2013/8/23/ge_fans_out_on_testing_of.htm 2013
[26] Ramsey, M. "Ford's Trade-In: Truck to Use Aluminum in Place of Steel". The Wall Street Journal. http://online.wsj.com/news/articles/SB10001424052702303612804577531282227138686. 2013

8. Contributors

We are particularly thankful to our interviewees, who include the following:

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9. Appendix

Steel – Supply, Demand and Overcapacity

Global steel production increased 15 per cent between 2008 and 2012 to over 1.5 billion tons[27]. Asia is a dominant player in the steel market and new steel plants and further planned capacity additions in Asia are increasing global capacity. In India alone the steel industry has grown 10% per year from 2001 to 2011 and is expected to continue to grow steadily. Meanwhile in Europe, whilst production dropped 7% between 2008 and 2012, pressure from unions and governments makes it difficult and expensive for companies to close down underperforming plants to help reduce costs and limit excess supply[28].

Global demand for steel has not recovered following the financial crisis – for example, in Europe, consumption has fallen more than 25 per cent in 2013 compared to 2007[29]. The short-term demand outlook for steel is positive but slower than before the financial crisis. The World Steel Association estimates global growth rates of just over three per cent in both 2013 and 2014 compared with nine and seven per cent in 2006 and 2007[30]. There is significant regional variation for demand, however. For example, in 2012, European consumption was still 30 per cent below pre-crisis levels[31] while demand has grown in China by an average of 10 per cent a year between 2003 and 2012[32]. The long-term demand prospects for steel are positive but the rate of growth will be smaller in developed regions than in developing regions that are experiencing increased urbanization and a growing middle class and the majority of demand by volume will be concentrated in China.

Industry experts estimate there to be between 300 and 500 million tons of overcapacity in the global steel market. Overcapacity is not a new issue for the industry to contend with. In the 1980s the European steel industry experienced significant overcapacity which was countered with the Davignon Plan, a strictly enforced combination of actions including

[27] World Steel in Figures 2013. World Steel Association
[28] *World Steel Recycling in Figures 2008-2012. Steel scrap a raw material for steelmaking*. May 2013. Bureau of International Recycling Ferrous Division
[29] *Major overcapacity in the global steel industry*. October 2013. Euler Hermes Economic Research
[30] "Short Range Outlook for Apparent Steel Use". World Steel Association, http://www.worldsteel.org/dms/internetDocumentList/press-release-downloads/2013/SRO-tables-by-region-Oct-2013/document/SRO%20tables%20by%20region-Oct%202013.pdf. 2013
[31] 'An inferno of unprofitability'. The Economist. http://www.economist.com/news/business/21580458-worlds-overcapacity-steelmaking-getting-worse-and-profits-are-evaporating-inferno 2013
[32] "Steel consumption growth patterns". OECD and World Steel Association. http://www.oecd.org/sti/ind/steel.htm 2013

production quotas, minimum price mechanisms and plant closures, which successfully reduced overcapacity and restructured the market in a more efficient configuration[33]. When the European steel industry once again reached crisis levels in the 1990s European governments supported the industry by facilitating further market restructuring and providing significant social support for redundant labourers. History therefore suggests that government policies play a significant role in addressing overcapacity in the steel sector.

In China, where a majority of the global production is concentrated it is uncertain how long it will take to implement the government objectives to close inefficient capacity and increase industry consolidation (see "China Overview" below). In Europe, excess capacity is estimated to be around 50 million tonnes[34] but the steel industry has high closing costs, in part driven by government reluctance to see labour force reductions in the austerity period following the financial crisis, which is preventing the closure of inefficient or unnecessary capacity.

Another relevant trend has been the rising price of iron ore. Between 2008 and 2011 the average price of iron ore increased 30 per cent, 83 per cent and 14 per cent each year before dropping 23 per cent in 2012[35]. Through 2010, iron ore prices were agreed annually between big steelmakers and miners. Now the spot-market prices are the key pricing determinant, exposing the industry to far greater volatility and making it harder for steel companies to agree long term contracts with their customers. The futures market is currently underdeveloped, with low volumes and thin liquidity making hedging difficult, however with time and investment this could become one means by which producers can better manage volatility and protect against downside risks. The transition to using spot prices has resulted in steel companies earning a much smaller profit margin.

Aluminium – Supply, Demand and Overcapacity

The global supply of primary aluminium increased 19 per cent between 2008 and 2012[36]. Geographically, China's production increased 63 per cent compared with a 3 per cent decrease for the rest of the world's producers as China increased its share of global production from 34 per cent to 47 per cent over the same time period[37].

Global demand for primary aluminium has grown at nearly 5 per cent per year since 2002[38]. Similar to the steel market, demand for aluminium is split geographically with the demand growth rate in Asia outstripping the wider global market. The compound annual growth rate (CAGR) in China and India in the last decade was almost 17 per cent and 10 per cent respectively compared with almost 1 per cent globally[39]. Some estimates suggest the demand for primary aluminium demand could sustain a 5 per cent CAGR for the next two decades due to urbanization, industrialization and economic development in developing countries[40].

Overcapacity also affects the aluminium industry. New capacity in China is one of the key contributors to global overcapacity. In 2012, China added about 8 million tons[41] of new aluminium capacity such that total capacity was more than 26 million tons; approximately 47 per cent of global capacity[42]. As a result China is a largely self-sufficient primary aluminium market. Global producers who expected high Chinese demand for primary aluminium did not adjust their capacity quickly enough, as China developed their own capacity, resulting in the global overcapacity issue. Overcapacity is the primary cause for the decreasing price of aluminium which hit a four year low in November 2013. Since January 2000 the price of primary aluminium has increased just 20 per cent and when adjusted for inflation aluminium is below its 2000

[33] "Policy responses to steel crises". OECD http://www.oecd.org/sti/ind/42980369.pdf 2013
[34] "An inferno of unprofitability'. The Economist. http://www.economist.com/news/business/21580458-worlds-overcapacity-steelmaking-getting-worse-and-profits-are-evaporating-inferno 2013
[35] Indexmundi
[36] The International Aluminium Institute
[37] The International Aluminium Institute
[38] *The Global Aluminium Industry 40 years from 1972.* February 2013 International Aluminium Institute
[39] *The Global Aluminium Industry 40 years from 1972.* February 2013 International Aluminium Institute
[40] The International Aluminium Institute
[41] CNIA, China Nonferrous Metals Industry Association
[42] CNIA, China Nonferrous Metals Industry Association

value[43]. The combination of lower global prices and higher costs means that margins are being squeezed and the industry is looking for options to remain sustainable in the medium to long term.

China overview

The Chinese market has played a key role in the global dynamics of the steel and aluminium market. This snapshot provides some context to the macroeconomic environment contributing to China's activity in the past and outlines some of the potential policy implications that can be expected in the future and their effect on the global steel and aluminium industries.

Macroeconomic overview:
From 2000 to 2011, China's annual GDP growth never fell below 8 per cent, reaching a peak of 14 per cent in 2007. Since 2007, China's economy has gradually slowed down. In order to facilitate economic growth, the government launched an economic stimulus package which helped for a period but by 2012 growth dropped to 7.8 per cent.

In March 2013, China's newly elected leadership signaled that they would target a 7 to 8 per cent annual growth rate rather than focusing on maximizing GDP growth. There is widespread opinion that shifting the economy away from industry and towards service sectors is a crucial step in China's development in the next decade. The government is moving quickly to implement the new strategy; industry investment in the first half of the 2013 decreased 7.6 per cent, marked by an 8.1 percent reduction in new fixed asset projects, compared with the same period in 2012 while investments in non-industrial sectors increased by 6.5 percent .

A strategic shift away from industry combined with lower capital investment will have profound implications for Chinese steel and aluminium companies. The industry has already been struggling to manage increased costs and reduced prices and going forward there will be an even greater focus on process efficiency and refining product portfolio to maximize returns on market opportunities.

Policy overview:
In addition to the economic reform outlined above the Chinese government is adjusting the policy landscape. There is a new focus on optimizing property rights management for state owned companies, introducing stricter social and environmental standards for industrial processes and updating the finance and tax frameworks. Of particular significance to the steel and aluminium sector is that unacceptable levels of pollution may accelerate the closure of coal intensive operations and Premier Li Keqiang has pledged to curb overcapacity as part of efforts to restructure the economy.

On 25 July 2013, the Ministry of Information and Industry Technology (MIIT) announced the first round of closures for obsolete capacity covering 19 industries and 1,294 companies including 6.98 million tons of steel and 0.26 million tons of aluminium. According to the minister of MIIT, there will be two more rounds of closures by the end of 2013. These closures are regarded as a vital step for the government in taking practical steps to resolve the overcapacity issue.

Just three months later, on 15 October 2013, the State Council released national level guidance on reducing overcapacity in the steel and aluminium industries by reducing capacity and increasing domestic demand. The central government will ban new capacity projects and seek to eliminate outdated capacity by setting more stringent environmental, safety and energy standards, promoting industrial mergers and acquisitions and inviting the private sector to play a role in restructuring oversized firms. The steel industry has a specific target to eliminate 80 million tons of steel capacity. With regard to the aluminium sector, the government is going to set up graduated electricity prices to encourage plants to shift to more environmentally efficient energy sources such as hydropower. The industry will seek to absorb overcapacity by stimulating domestic demand and will encourage competitive firms to explore the overseas market and use innovation as a growth driver. There is some evidence that local governments are responding to the new policy.

[43] The Aluminum Industry CEO Agenda, 2013–2015: Understanding the Challenges and Taking Action June 2013. The Boston Consulting Group

On 8 November 2013, the Hebei local government closed eight blast furnaces and 15 converters across five different steel plants reducing steel capacity by 6.2 million tons. If local governments continue to enforce capacity reductions and no additional capacity is brought online, it will begin to have an impact on the global market.

Energy and carbon

In 2012, the steel sector consumed five per cent of all primary energy produced worldwide and, as a high portion of the energy mix in the steel industry comes from coal, seven per cent of global CO_2 emissions[44]. Energy costs in the steel industry can account for up to 40 per cent of the finished product[45]. Technology advances are, however, enabling the steel industry to reduce the energy and carbon intensity of steel production. Some studies suggest that the most efficient method for improving carbon intensity is to replace basic oxygen furnaces (BOFs) with electric arc furnaces (EAFs) that are between 21 and 36 per cent less carbon intensive than BOFs[46]. At a high level, BOFs offer companies greater product flexibility, typically use 10 to 25 per cent scrap and the process is more carbon intensive. EAFs are more dependent on scrap availability and secure electricity supplies. However the environmental benefits of EAFs are not guaranteed. The embedded carbon in the EAF processes, when considering the electricity supply and scrap re-use, may nullify the perceived benefits of EAF depending on the source of electricity.

In 2012, the primary aluminium sector consumed three per cent of the electricity produced worldwide and two per cent of global emissions[47]. Energy in the aluminium industry accounts for around one-third of the total production cost of primary aluminium[48]. The exact portion of operational spend on energy will of course vary based on the sites' energy contracts and efficiency. Currently there are no viable alternatives to the highly energy intensive electrometallurgical process used in aluminium production; however, it is conceivable that with the continued rise of energy costs and sustained investment in this area that new technology breakthroughs will be made in the longer-term. In the interim there has been a visible shift in production centers in the last ten to fifteen years to countries and regions with lower energy costs and more favorable energy policies (e.g. the Middle East, west and north-west China, Russia). For example in 2000, Japan, Western Europe and North America produced 40 per cent of aluminium but this dropped to 20 per cent in 2012, in the same period production in Brazil, Russia, India and China increased from 35 to 60 per cent and Gulf Cooperation Council production increased from four to eight per cent.[49]

Both the steel and aluminium sectors are considering their role in reducing product life cycle emissions and governments are considering implementing policies that will regulate energy use and carbon emissions. Life cycle assessment methodologies can be used by companies and governments to understand the real impact of process and products. Steel companies, for example can use them to understand whether to switch from BOF to EAF furnaces, customers can use it as a means for determining the optimum materials for products and governments can better anticipate the impact of policy designed to drive green growth.

However there are still challenges in how life cycle approaches can be appropriately applied to ensure interventions are targeted in the areas of greatest emissions or environmental impact. For example, both the United States and EU governments have imposed stricter fuel efficiency requirements which have intensified competition for steel and aluminium companies in the automotive sector. Average car weights have increased by about a quarter in the last 30 years to 2006 in response to consumer demand for more space, conveniences such as electric windows and GPS systems and improved safety[50]. Now, in order to meet the fuel efficiency standards, companies are increasingly looking to decrease the weight of vehicles and finding ways to reduce the weight of car frames may be received better by consumers than cutting back on vehicle accessories. Focusing solely on fuel efficiency requirements may not, however,

[44] Impacts of energy market developments on the steel industry July 2013. La Place Conseil
[45] Remaking the global steel industry. Lower-cost natural gas and its impacts June 2013. Deloitte
[46] Steel's Contribution to a Low-Carbon Europe 2050. June 2013. The Boston Consulting Note: assumes 80% DRI and 20% Scrap EAF production
[47] International Aluminium Institute and IndexMundi
[48] The Aluminum Association. http://www.aluminum.org/Content/NavigationMenu/TheIndustry/GovernmentPolicy/Energy/default.htm. 2013
[49] *The Global Aluminium Industry 40 years from 1972* February 2013 International Aluminium Institute
[50] Foy. Henry. 'Bodywork: Aluminium leads the greater race for efficiency' Financial Times. 2013

reduce the overall environmental impact of the vehicle over its lifetime and life cycle as it does not necessarily consider the impact of production processes.

Furthermore, whilst there are three international standards on calculating product carbon footprints (ISO 14067, WRI Product Accounting Standard and PAS 2050) conducting accurate and insightful life cycle assessments can be complicated and requires the rigorous application of defined methodologies and access to consistent reliable data to be truly effective. Therefore if life cycle approaches are to be used more broadly by companies and governments further work is required to ensure the right conclusions are being drawn to deliver the goals of green growth, efficient and cost effective operational processes and lower global GHG emissions.

Circular Economy

In a circular economy there will be a greater focus on reducing the use of virgin materials and increasing the re-use and recycling rates of materials and products. Recycling and reusing steel and aluminium are both less energy and carbon intensive than making new metals creating a clear economic and environmental advantage for companies.

Steel is currently the most recycled material on the planet - the overall recycling rate reached 88 per cent in 2010[51]. Due to the longer life-cycle of many steel products (around 50 per cent of which go into the construction market), steel scrap is likely to be less available in developing countries where there is less ageing or obsolete infrastructure, vehicles and consumer goods from which to source scrap. In some developed countries however the opposite is true and steel scrap availability is forecast to grow albeit at a small rate of approximately 0.9 per cent per annum in Europe until 2050[52].

Aluminium also has very high recycling potential. Almost 75 per cent of the aluminium ever produced is currently locked in products but of the remainder, five to ten per cent of primary aluminium produced has been recycled. Maintaining high recycling rates for aluminium is a critical means for managing raw material and economic efficiency. There is around 95 percent less required to produce recycled aluminium ingot compared with producing primary aluminium ingot contributing to a strong business case for recycling aluminium[53].

For the steel sector, especially for construction customers, re-use may be the most environmentally efficient approach to reduce the need for virgin metal and energy and limit carbon emissions. The business case for re-use depends on a number of factors, in particular the price of scrap, the quality of scrap and, for steel, section price indices[54]. Better product design which accommodates steel re-use will be key, with design principles such as adaptability, ease of repair and deconstruction and traceability increasing the re-use of products and components in the future.

[51] "Steel is the World's Most Recycled Material". Steel Works. http://www.steel.org/sustainability/steel%20Recycling.aspx . 2013

[52] Steel's Contribution to a Low-Carbon Europe 2050. June 2013. The Boston Consulting Group

[53] "Aluminum is sustainable". The Aluminum Association. http://www.aluminum.org/Content/NavigationMenu/NewsStatistics/Sustainability/. 2013

[54] Allwood, J. *Conserving our metal energy*. September 2010. University of Cambridge