Competitiveness and challenges in the steel industry

OECD Steel committee
74\textsuperscript{th} session

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Contents

- Challenges in the steel industry – cyclicality and increasing competition from emerging economies
- Competitiveness of the steel industry – beyond cost optimization
- Implications for enhancing competitiveness – few actions to launch and promote
The development of the industrial production index shows fundamental differences by region

**Industrial production index – mature regions**

- **North America**
- **Europe (EU15)**

**China: 10.1% p.a.**

**Europe 1.5% p.a.**

- Years: 2008, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 2020

**Industrial production index – developing regions**

- **Latin America**
- **MENA**
- **Africa**

**Dev Asia +6% p.a.**

- Years: 2008, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 2020

- **China and Western Europe** are the dominant players in global consumers

- While projections on China are positive, mature regions suffer from no growth

- Emerging regions follow a growth trend line over the next few years

- In all of those regions next to GDP growth, some countries have clear growth stimulating drivers such as energy and resources

SOURCE: Global Insight; McKinsey
Within major steel economies macro-economic factors indicate uncertainty for demand and utilization

- Economically uncertain markets in traditional steel-consuming economies
- China's economy stabilizes while the debt to GDP ratio in the US and EU-15 has been increasing steadily since 2008 in combination with strongly declining infrastructural investments
- In addition to weak GDP growth and higher debts, infrastructural investments in EU-15 countries have declined more than 30% between 2011 and 2012

**Debt GDP ratio**
- Index (based on 2005)

**Infrastructure spending**
- Index (based on 2005)

SOURCE: Global insight; McKinsey
Current projections based on consumption forecasts indicate a global slow-down

Apparent steel demand per region
Million metric tons

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>1,306</td>
<td>1,413</td>
<td>1,500</td>
<td>1,607</td>
<td>1,702</td>
<td>1,797</td>
</tr>
<tr>
<td>North America</td>
<td>94</td>
<td>113</td>
<td>141</td>
<td>141</td>
<td>141</td>
<td>141</td>
</tr>
<tr>
<td>Developed Asia</td>
<td>134</td>
<td>141</td>
<td>143</td>
<td>141</td>
<td>141</td>
<td>141</td>
</tr>
<tr>
<td>China</td>
<td>589</td>
<td>646</td>
<td>686</td>
<td>730</td>
<td>765</td>
<td>794</td>
</tr>
<tr>
<td>India</td>
<td>270</td>
<td>293</td>
<td>318</td>
<td>354</td>
<td>394</td>
<td>439</td>
</tr>
<tr>
<td>Other(^1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regional growth
Percent p.a.
2010 - 16  | 2016 - 20
--- | ---
1 | 1
4 | 1
1 | 0
4 | 2
6 | 7
5 | 5

Share of China
Percent
--- | --- | --- | --- | --- | ---
45 | 46 | 46 | 45 | 45 | 44

\(^1\) Africa, other Asia, CIS, Oceania, MENA, Latin America

SOURCE: World Steel Association (WSA); McKinsey Steel Demand Model
The steel industry is very volatile and with depressed profitability since 2008 – mature regions are losing in profitability

<table>
<thead>
<tr>
<th>EBITDA margin</th>
<th>Percent¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Developed Asia</td>
</tr>
<tr>
<td>Europe</td>
<td>NAFTA</td>
</tr>
</tbody>
</table>

2000 - 03: price-margin squeeze
2003 - 08: margin improvement and upstream integration
2008 - 12: margin deterioration and leveraging

1 Based on a sample of 84 of the largest steel companies globally

- Margin development follows a negative trend line
- Current situation worst for a long time

SOURCE: Bloomberg; McKinsey analysis
Within the entire steel value chain, profitability is challenged and margins move to mining

HRC value chain\(^1\) profit pool split evolution since 1995, USD billions

- In the medium term, the value pool in steel will remain in favor of the raw material producers.
- There might be shifts in between years, but demand and supply for steel combined with cost for marginal producers will stabilize EBITDA distribution.

<table>
<thead>
<tr>
<th>Year</th>
<th>Iron ore</th>
<th>Coking coal</th>
<th>Steel making (HRC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>8</td>
<td>15</td>
<td>81</td>
</tr>
<tr>
<td>2000</td>
<td>11</td>
<td>11</td>
<td>78</td>
</tr>
<tr>
<td>2005</td>
<td>125</td>
<td>7</td>
<td>61</td>
</tr>
<tr>
<td>2010</td>
<td>156</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>2011</td>
<td>230</td>
<td>44</td>
<td>46</td>
</tr>
<tr>
<td>2017</td>
<td>135</td>
<td>42</td>
<td>32</td>
</tr>
</tbody>
</table>

1 HRC assumed to represent 85% of total hot-rolled flat products. Flat production assumed to use 85% of pig iron as raw materials. Assuming 1.6 t of iron ore per tonne of pig iron and 0.5 tonne of coke per tonne of pig iron.

SOURCE: McKinsey Steel Model, McKinsey Mining Value Pools Model
From a perspective on the EBITDA pool, emerging regions benefited most from the China-driven boom of the last decade.

### HRC value chain EBITDA pool

**USD billions**

<table>
<thead>
<tr>
<th>Year</th>
<th>Mining</th>
<th>Non-OECD steel</th>
<th>OECD steel</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>39</td>
</tr>
<tr>
<td>2007</td>
<td>38</td>
<td>56</td>
<td>42</td>
<td>136</td>
</tr>
<tr>
<td>2009</td>
<td>14</td>
<td>58</td>
<td>37</td>
<td>109</td>
</tr>
<tr>
<td>2012</td>
<td>28</td>
<td>121</td>
<td>15</td>
<td>164</td>
</tr>
</tbody>
</table>

**CAGR 2003 - 2012**

- **Mining**: 17%
- **Non-OECD steel**: 33%
- **OECD steel**: 9%
- **Total**: -1%

1 Based on preliminary estimates

**SOURCE:** McKinsey (BMI Value Pools Model)
Contents

- Challenges in the steel industry – cyclicality and increasing competition from emerging economies
  - Competitiveness of the steel industry – beyond cost optimization
- Implications for enhancing competitiveness – few actions to launch and promote
Margin development in steel is a major issue, driven by external factors and plant situation

**Development of industry attractiveness**
USD per ton of HRC

**Brazil**

<table>
<thead>
<tr>
<th>Year</th>
<th>Price</th>
<th>Cost</th>
<th>EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>922</td>
<td>462</td>
<td>460</td>
</tr>
<tr>
<td>2012</td>
<td>753</td>
<td>497</td>
<td>256</td>
</tr>
</tbody>
</table>

**Western Europe**

<table>
<thead>
<tr>
<th>Year</th>
<th>Price</th>
<th>Cost</th>
<th>EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>953</td>
<td>698</td>
<td>255</td>
</tr>
<tr>
<td>2012</td>
<td>657</td>
<td>622</td>
<td>35</td>
</tr>
</tbody>
</table>

**Typical factors driving/challenging competitiveness**

1. **Industry-wide factors**
   - Supply balance
   - CO₂ and technology challenges
   - ... 

2. **Intrinsic industry player actions**
   - Asset quality and actions
   - Operational performance
   - ... 

3. **Regional factors and consequences**
   - Access to raw materials/resources
   - Fx-rate and cost inflation
   - Regulation
   - ... 

4. **Regional factors and consequences**

SOURCE: SBB, MEPS, McKinsey Flat Steel database
Globally competitiveness of some regions gets challenged through erosion of cost position – example Europe/Germany

Global HRC cost curve\(^1\), ex works, USD/t

1 Operating costs excluding SG&A, considering captive raw materials, standard utilization (90%)

2 90% of capacity

SOURCE: McKinsey flat steel cost model; steel press; VDEh; WSA
Steel will remain a source of CO₂ emissions which is a consequence of the process ...

Percent, 2010e

Global CO₂e emissions

100% = 49.4 GtCO₂e per year

Steel CO₂e emissions

100% = 4.0 GtCO₂e per year

1 Includes mining and beneficiation of iron ore, coal, limestone, and ferro-alloy ores
2 Production of Ni, FeCr, FeSi, FeMn, SiMn and Al consumed during steel production

SOURCE: McKinsey (Steel CO₂ Model; Global Carbon Cost Curve 2.1)
... however, technology differences can lead to significant differences in emissions

**BF route**

- Mining and raw material processing
- Coke making
- Sintering / Pelletizing
- BF
- BOF
- Downstream

**EAF route**

- Mining and raw material processing
- Pelletizing
- DRI making
- EAF
- Downstream

1 CO₂ emissions linked to off-gas are allocated to the process step where the gas is used

SOURCE: McKinsey Steel CO₂ Model
Some raw material supplying countries get challenged by appreciation of their currencies and cost inflation

- Commodity countries exposed to external factors
- Cost base for raw materials inflating
- The rationale that inflation results in devaluation does no longer seem to hold true
- Overall economics of raw material countries will challenge markets (higher cost makes steel less attractive)

### Currency development of "commodity countries"

<table>
<thead>
<tr>
<th>Exchange rate changes (2006 - 13)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR/USD</td>
<td>2</td>
</tr>
<tr>
<td>REAL/USD</td>
<td>11</td>
</tr>
<tr>
<td>AUS/USD</td>
<td>37</td>
</tr>
</tbody>
</table>

### Price evolution

<table>
<thead>
<tr>
<th>Consumer price index growth (2006 - 13)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>15</td>
</tr>
<tr>
<td>Europe</td>
<td>15</td>
</tr>
<tr>
<td>Australia</td>
<td>19</td>
</tr>
<tr>
<td>Brazil</td>
<td>41</td>
</tr>
</tbody>
</table>

1 Eurozone countries

SOURCE: Global Insight; OANDA; McKinsey
Brasil shows how regionally attractiveness of a production base can deteriorated

Development of factor costs in Brazil

<table>
<thead>
<tr>
<th>Factor</th>
<th>2003</th>
<th>2012</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy cost USD/MWh</td>
<td>46</td>
<td>180</td>
<td>+288%</td>
</tr>
<tr>
<td>Labor cost USD/hour</td>
<td>3.2</td>
<td>12.0</td>
<td>+272%</td>
</tr>
<tr>
<td>Supply chain cost USD t coking coal</td>
<td>11</td>
<td>17</td>
<td>+52%</td>
</tr>
</tbody>
</table>

Million metric tons

SOURCE: Ministério das Minas e Energia, Aneel, Economist Intelligence Unit, James F. King
Also, import and export taxes influence competitiveness, while protecting or even taking away the need for continuous improvement.

### Examples

**Import duties for steel products**

<table>
<thead>
<tr>
<th>Import duties and taxes(^1)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>8</td>
</tr>
<tr>
<td>China</td>
<td>2</td>
</tr>
<tr>
<td>India</td>
<td>3 - 10</td>
</tr>
<tr>
<td>Turkey</td>
<td>5 - 7.5</td>
</tr>
<tr>
<td>South Africa</td>
<td>2 - 17</td>
</tr>
</tbody>
</table>

**Export barriers for raw materials**

<table>
<thead>
<tr>
<th>Export duties, iron ore India</th>
<th>Export bans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>Source: Indonesia export ban on iron, except for miners that build local processing facilities from 2014</td>
</tr>
<tr>
<td>Pre 03/2011</td>
<td>Source: Indonesia, Mongolia, Saudi Arabia, and many other countries(^2)</td>
</tr>
<tr>
<td>Post 03/2011</td>
<td></td>
</tr>
<tr>
<td>5 - 10</td>
<td></td>
</tr>
</tbody>
</table>

1 Average applied MFN tariffs
2 In addition China, Russia, Ukraine, India, Guinea, Iran, Argentina, Kazakhstan, Pakistan, UAE, and Vietnam impose export taxes.

SOURCE: WTO, OECD, European Commission
Due to low economic attractiveness new assets have been built mainly outside OECD
**Assets had been ageing over time and lose potential structural advantages**

Age comparison BOF route

<table>
<thead>
<tr>
<th>Average European steel plants, % of capacity older 25 years</th>
<th>Average US steel plants</th>
<th>Average CIS steel plants</th>
<th>Average India steel plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age comparison BOF route</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>92</td>
<td>71</td>
<td>18</td>
</tr>
<tr>
<td>2013</td>
<td>100</td>
<td>81</td>
<td>18</td>
</tr>
<tr>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>204t</td>
<td>204t</td>
<td>236t</td>
<td>93t</td>
</tr>
<tr>
<td>182t</td>
<td>217t</td>
<td>203t</td>
<td>139t</td>
</tr>
</tbody>
</table>

**SOURCE:** VDEh Plantfacts; Experts Estimate
In some regions the asset base calls for reviewing sustainability of assets and to be rebalanced.

- Majority of European blast furnaces have:
  - An average age of more than 35 years (not considering relines)
  - An average blast furnace capacity of below 2 million tonnes

- Additionally, more than 60% of European BF plants have logistical disadvantages (located inland with either river port or rail access)

SOURCE: VDEh Plantfacts; McKinsey
In contrast, greenfield plants can effectively compete against these low-positioned plants in mature regions—example Europe.

### HRC Cost USD/t

<table>
<thead>
<tr>
<th></th>
<th>MENA</th>
<th>CIS</th>
<th>Brazil</th>
<th>Europe 4th quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation²</td>
<td>28</td>
<td>51</td>
<td>50</td>
<td>59</td>
</tr>
<tr>
<td>HRC conversion</td>
<td>603</td>
<td>642</td>
<td>688</td>
<td>731</td>
</tr>
<tr>
<td>Slab cost (incl. Transport to EU)</td>
<td>551</td>
<td>530</td>
<td>569</td>
<td>672</td>
</tr>
</tbody>
</table>

### Result

- Once capacities are offshored, there will be no economies to relocate quantities back to Europe.
- Greenfield plants of new entrants will be able to compete at any price in Europe, especially from MENA.

1. Including EU exports; in HRC equivalent; includes HRC and all downstream products.
2. Based on capex of 1,200 USD/t for integrated plant, 300 USD/t for EAF slab plant; 170 USD/t for HRC mill; depreciation period 20 years.
4. Incl. CO₂ costs based on a CO₂ price of 20 USD/t.

SOURCE: McKinsey
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# EU launched a programme to support steel industry

## Programme elements

| Regulatory framework | - Assessment of impact of existing and new policies and legislation on competitiveness  
| | - Support sustainable steel production to boost demand and EU market share  
| | - Fight VAT evasion and black markets in steel |
| Boosting demand | - Promote steel end-use sectors, e.g., through simulating demand for alternative fuel vehicles and renovation of buildings by energy and resource-efficient construction |
| Level playing field | - Ensure to eliminate or reduce tariffs and non-tariff barriers on third markets for EU steel and raw materials  
| | - Update anti-dumping and anti-subsidy regulations  
| | - Monitor scrap markets and include coking coal in the list of critical raw materials |
| Energy, climate, resource policies | - Create regulatory environment conducive to sustainable growth (renewable energy, impact of the ETS on electricity prices, energy efficiency)  
| | - Support internationally binding agreements on climate change and GHG |
| Innovation | - Integrate steel industry into RDI programme for energy-efficient products  
| | - Support R&D efforts for new technologies, and shift focus to up-scaling and pilots, including steel/raw materials/recycling |
| Skills and restructuring | - Promote skills relevant to the steel industry going forward  
| | - Work with member states and industry on alleviating impact of restructuring or plant closures on local labor markets and societies |

**SOURCE:** EU Commission
Competitiveness should be promoted in a focused way

**Company specific action**

- Discover market and **customer opportunities** for steel and adjust accordingly (specialized assets, productivity focused assets, depending on market opportunities), recognize substitution risks
- Optimize **internal performance** further and do some structural adjustments

**Macro-economic initiatives to secure competitiveness**

- Monitor implications of **competitive assets outside OECD** which change the game, and reflect on unpredictable (opportunistic) tradeflows
- Promote **industrialization levels with industrial GDP contribution** and establish right incentives, permissions and timely execution
- Allow for **consolidation** in steel where possible and secure no more legacy assets remain kept up
- Secure **level playing field** to allow for sustainable production, e.g., to allow for environmental standards, avoid structural penalties and/or bottlenecks, e.g., in energy
In some applications, the profile of steel used will dramatically change and high value add grades will be increasing in importance due to lightweight concepts.

Material mix in automotive

<table>
<thead>
<tr>
<th>Percent</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon fiber</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Plastics</td>
<td>9</td>
<td>0.5</td>
</tr>
<tr>
<td>Magnesium</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Lightweight</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Steel (&lt; 550 MPa)</td>
<td>52</td>
<td>38</td>
</tr>
<tr>
<td>Other non-lightweight</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

Material demand in automotive

<table>
<thead>
<tr>
<th>mt</th>
<th>North America</th>
<th>China</th>
<th>Europe</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>46</td>
<td>14</td>
<td>11</td>
<td>40</td>
</tr>
<tr>
<td>HSS²</td>
<td>-70%</td>
<td>+273%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- In applications, the profile of steel will change
  - Need for lightweight applications due to environmental requirements
  - Need for high-strength steels for safety and power applications
  - Alternative solutions due to new power-train concepts (incl. BEV and hybrids)
  - Feasible combinations of high-strength structures and light panels

1 HSS, aluminum, magnesium, plastics, carbon fiber
2 High-strength steel (> 550 MPa)
3 Mainly other metals, glass, fluids, interior parts

A) However, competitiveness of aluminum relative to steel has dramatically increased due to falling price differential …

Steel to aluminum spreads have been shrinking

- However, current gap between 2 raw materials is over USD 1,200/tonne
... with the result that after "cost in use" calculations the aluminum disadvantage is affordable and attractive

**Body panel example, high-strength steel (HSLA) to aluminum cost bridge**

<table>
<thead>
<tr>
<th>Indexed</th>
<th>110</th>
<th>251</th>
<th>209</th>
<th>152</th>
<th>30</th>
<th>54</th>
<th>20</th>
<th>156</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per steel part (indexed to 100 for mild steel)</td>
<td>Higher per lb landed raw material cost</td>
<td>Lower density of aluminum requires fewer lbs</td>
<td>Net material cost</td>
<td>Increased scrap</td>
<td>Additional coatings/post processing</td>
<td>Increased tooling life</td>
<td>Net per part costs</td>
<td></td>
</tr>
</tbody>
</table>

Cost disadvantage in some applications has reduced to **less than 1 EUR/kg**, thus provides a real alternative

**SOURCE:** Interviews; ISIS; SRI; The Aluminum Association; FKA Weight Reduction Report
A. Ongoing innovation has been a source for enhancing competitiveness

**Specific CO₂ emission (Average BF/BOF and EAF)**
Metric ton CO₂ per t crude steel

-45%

**Specific dust emission**
Kg dust per t crude steel

-96%

**Specific energy consumption**
Metric ton coal equivalent per t crude steel

-41%

**Accident rate**
Number of accidents per million working hours

-88%

SOURCE: Wirtschaftsvereinigung Stahl, plant facts, McKinsey CO₂ model
**Capabilities of producing high value added products increase, with require producers in OECD countries to invest in more competiveness**

<table>
<thead>
<tr>
<th>High value add capacity additions 2012 - 14 and capacity evolution 2000 - 13</th>
<th>kt</th>
</tr>
</thead>
<tbody>
<tr>
<td>New CRC</td>
<td>38.0</td>
</tr>
<tr>
<td>New HDG</td>
<td>8.2</td>
</tr>
<tr>
<td>RoW CRC</td>
<td>25%</td>
</tr>
<tr>
<td>RoW HDG</td>
<td>47%</td>
</tr>
<tr>
<td>EU-27 CRC</td>
<td>8%</td>
</tr>
<tr>
<td>EU-27 HDG</td>
<td>20%</td>
</tr>
</tbody>
</table>

- **Downstream steel production is significantly built up in emerging regions, with focus on value add**
- **Relevance of producers in mature world and therefore steel production in those regions is decreasing**
- **Steel mills need to have the funds to compete in these dynamic developments**

**Loss of share EU-27**

-8.3%

**SOURCE:** VDEh Plantfacts 2012; McKinsey Analysis
B) Less predictable trade flows require monitoring and countermeasures if the conditions do not match

Major export flows 2006 and 2011
Million metric tons (origin and destination region given)

Emerging observations

- Production flows due to regional imbalances change due to
  - FX changes and cost advantages (e.g., Brazil)
  - Country development combined with local consumption trends (e.g., Russia)
  - Surplus capacity and change of addressable markets (e.g., Europe to US)

SOURCE: ISSB trade flow data base