Megatrends and their influence on the global steel industry

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World Steel Association

steelTalks, 14 December 2022
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• No discussion on contemplated trade actions or complaints about trade flows
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- Future of urban areas and the construction sector
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- Vision and agenda for a sustainable and resilient global steel industry
worldsteel’s Megatrends Evaluation Project
Megatrends Evaluation – a study by the members for the members

An 18-month study on megatrends and the resultant industry-specific consequences

Vision and strategies for sustainable growth of the global steel industry from a long-term perspective
Overview of Megatrends and their influence on global socioeconomic and geopolitical landscape
Categorising megatrends

Common characteristics:

- Sustained/long-term
- Broad scope/reach
- Major impact
Categorising megatrends

Broad outlines of a possible new vision emerging: **Sustainable & Resilient**

<table>
<thead>
<tr>
<th>Environment</th>
<th>Social</th>
<th>Economical</th>
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</thead>
<tbody>
<tr>
<td>Decarbonisation</td>
<td>Mitigate (income) inequality</td>
<td>Rebuild infrastructure</td>
</tr>
<tr>
<td>Climate change adaptation</td>
<td>A new consensus addressing political divide</td>
<td>Maintain / enhance competitiveness</td>
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<td>Restoring biodiversity loss, cutting pollution, water scarcity, reducing materials intensity</td>
<td>Education &amp; training</td>
<td>Leading the new tech &amp; economy</td>
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<td>Social transfer programmes</td>
<td>Create jobs in high-value-adding and tradable sectors</td>
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<td>Focus on green tech, strategic sectors and commodities</td>
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Major economies announcing new policy frameworks aiming to govern the rapid transformation towards green & smart era while fixing the imbalances brought about by hyper-globalization era.
Humanity’s 21\textsuperscript{st} century decarbonisation challenge requiring a rapid transformation to green and smart

IEA’s SDS trajectory for CO2 emissions, which is inline with Paris Agreement objective of “well below 2 °C warming” requires that CO2 emissions drop 30% in 2020s, 40% in 2040s and 30% in 2050s
Humanity’s 21st century decarbonisation challenge

“The SDS maps out an energy transformation of huge magnitude and scope; the changes required in the NZE2050, inside and outside the energy sector, go well beyond this.”

Source: IEA World Energy Outlook 2020
Changes in individual preferences and social norms to accelerate

- Generation Z entering their 20s in 2020s and playing an increasingly bigger role in society
- Expect accelerating changes in individual preferences and social norms towards “responsible” (e.g. secular shift in buying preference for EVs)
- Continued growth in pressure for sustainability & resilience (preparedness against safety risks)

By 2030: secular shifts in preferences & norms towards responsible alternatives, immense pressure for sustainability

Source: https://www.pewresearch.org/topic/generations-age/ via Lettink, A., 2019, “No, Millennials will NOT be 75% of the Workforce in 2025 (or ever)!”
Multi-polar geopolitical order
From globalisation to regionalisation

A continued gradual retreat from globalisation with strengthening nationalistic forces, protectionist policies & pressure for back/near-shoring

Regionalisation / bifurcation on ease of aligning interests and establishing standards with key allies or regional partners and security concerns

By 2030 “One world two systems” paradigm applying at varying degrees for many sectors, esp. strategic sectors & materials

Trade barriers likely to be relatively high
<table>
<thead>
<tr>
<th>Conclusions for the megatrends and their influence on global socioeconomic and geopolitical landscape</th>
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<tbody>
<tr>
<td><strong>Green transition and technological progress</strong> - main transformative forces of the 21st century</td>
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<tr>
<td><strong>The transformation is likely to accelerate going forward</strong> - rising volatility, uncertainty and complexity</td>
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<td>** Achieving long-term sustainability, while ensuring resilience to volatility, uncertainty, climate change during the transition**</td>
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<td><strong>The return of big governments</strong></td>
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<td><strong>Major focus on decarbonisation, enabling infrastructure, strategic sectors</strong></td>
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<td><strong>A continued gradual retreat from globalisation &amp; rising importance of regional blocs</strong></td>
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Future of urban areas and the construction sector
Urban areas at the center of global transformation

Cities represent
• ~55% of global population
• ~80% of global GDP
• ~75% of GHG emissions & energy consumption

Urban population to continue to grow
Cities & urban resource use to grow

Many major cities have ambitious climate action plans: sustainable & climate resilient

Digital age, smart city tech & transformation of urban mobility
Densification through transit-oriented development
Build extensive public transportation networks & densify around transit hubs

Paris’ Grand Paris Express project aiming to transform the city’s mobility infrastructure through establishing new neighborhoods within 800m radius of each new station

Higher Buildings: Paris’ Clichy-Batignolles development allowed 50 m height for buildings (37 m height limit for Paris)
Transform energy system
From fossil-based to green, reduce energy demand, modernise and integrate

Paris’ carbon neutrality plan targets halving energy consumption and 100% renewables by 2050

- Reduce energy demand
  - Renovation of building stock & strict energy requirements for new buildings
  - Active, shared, electric mobility
- Renewable energy in buildings
- Renewable energy from wind/solar projects, but also large bioenergy and waste-to-energy plants
- Modernisation and integration of energy systems

Source: Paris Climate Action Plan
Rapid advances in adoption of circular economy

Governments exploring circularity strategies. Materials flows for cities are being mapped out. Some cities have announced ambitious materials use reduction targets (e.g., Amsterdam to halve the use of new raw materials by 2030).

Transform mobility
Regulate and reduce car traffic, encourage public transportation & active mobility

- Traffic and car use heavily regulated, limiting road space for driving and parking, increasing car ownership costs, establishing low speed/emissions zones & car bans
- Encourage active mobility, developing cycle/walking paths, and shared bicycle programmes
- Encourage distance working

Barcelona’s superblocks reclaiming streets

Source: Barcelona Urban Mobility Plan. The why and how is explained in this new documentary by @DeutscheWelle: https://youtu.be/RYuGWOjm26E. Right hand side chart from urbanaccessregulations.eu
Transform mobility
Encourage shared, seamless multi-modal mobility

- From ownership to shared on-demand mobility, subscription services and platforms integrating multiple payment and ticketing processes
- Adoption of automated vehicles and MaaS concepts bring new opportunities for efficiency gains & densification, such as repurposing of parking lots & garages

Key figures from Bremen’s car sharing action plan that started in 2009

- 21,000+ active car sharing users (2022)
- 6,000 cars replaced - equivalent to 30 km of street space
- 400+ cars available for sharing in 135+ stations
- ~ 1/3 of car sharing users not using private car

Source: Report from eumayors.eu dated June 2022 [link]
Buildings of future – Higher and high performance

70m-high social housing with vertical forest (125 trees and 5200 plants grown by sensors)

Futuristic skyscraper design with solar walls, bladeless wind turbines and sky gardens

Bioclimatic design based on local climate and environmental conditions to minimize energy demand

Construction sector: Consolidated pressures should accelerate construction sector’s transformation in digitalisation, integration, decarbonisation & circularity

As pressures consolidate over the 2020s:

- Stagnating productivity
- Cost overruns
- Rising product & operation complexity
- Growing sustainability pressures

Construction sector to make strides in:

- **Digitalisation, automation & innovation**
- **Life-cycle impact & circular design**
- **Material efficiency and waste generation strategies**
- **High-performance durable, low carbon, recyclable materials**
- **Circularity ecosystem with establishment of standards, inventories, marketplaces**

- Integration, prefabrication and modular construction to gain further market share, but will still be far away from being mainstream
- Main construction methods and materials will not see major changes. Demand for low carbon & higher recycled content steel & concrete, high-strength steel to surge
Outlook from megatrends window suggests strong infrastructure construction activity over the next 2-3 decades

The last 3-4 decades saw persistent underinvestment in infrastructure

New development strategies in major economies show major focus on infrastructure

Climate change: requiring an economic transformation of huge magnitude and scope

Shifts in the global geopolitical landscape and supply chain structure underpinning infrastructure investment

Technological progress: building the digital infrastructure for the smart era

Demographic trends also supporting growth in global infrastructure investment
Trends in building design and construction points to increasing steel intensity

- Higher, flexible, scalable
- Energy generating / efficient / smart: fitted with energy generation capacity, various materials recycling / storage systems and sensors
- Prefabrication / modularity / digitalisation and industrialisation of construction processes
- More stringent environmental performance regulations
- Better understanding of materials flows and lifecycle impact, focus on circularity and durability, reuse and recycling characteristics might also be supporting steel intensity
Construction sector: the path to 2030

Construction expected to show relatively stronger growth in steel demand and grow its share in global total steel demand

Steel demand growth depending on construction growth and steel intensity

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Non-residential</th>
<th>Infra.</th>
<th>Plant</th>
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<tbody>
<tr>
<td><strong>Steel intensity</strong></td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Construction growth</strong></td>
<td>Low</td>
<td>Mid</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Steel demand growth</strong></td>
<td>Low</td>
<td>Mid</td>
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<td>Low</td>
</tr>
</tbody>
</table>

- Strong infrastructure investment, continued non-residential building growth
- Trends in construction, such as increasing height, durability, flexibility, modular building design, circularity, are in general pointing to increasing steel intensity

Source: worldsteel Megatrends Evaluation Study
Future of the automotive sector
Automotive sector stands at the inflection point of a once-in-a-century paradigm shift...

**Waves of disruption**

**On-demand mobility (2010 onwards)**
- Access to app-based mobility services

**Smart EV (2015 onwards)**
- New energy propulsion
- ADAS (L2 & L3)
- Embark on building ecosystem

**Autonomous mobility on demand (2025 onwards)**
- Evolution towards multi-modal, MaaS and purpose-built user-centric designs
- High utilisation of fleet-based vehicles

**Source:** Automobility analysis

**Tech enabling and disrupting.**
Digital ecosystem players penetrating mobility market

**Regulatory pressures**

**Generational shift of buyer preference in favor of EV & smart connectivity**
From mobility as a product to mobility as a service

Massive scale of cities & low motorisation in developing world, shift of preference towards MaaS, regulatory push towards shared mobility, aggressive push from digital ecosystem players

Mobility as a Product with Modern Auto
- Ownership
- Product optimisation
- Over-engineered vehicles for urban mobility

Mobility as a Service
- MoD and eventually AMOD, subscription services and multi-modal platforms
- Service optimisation (monetisation of big data)
- Purpose-built vehicles designed specifically for city use

Implications on vehicle design and bill of materials
Peak in global car demand: 91 mn units in 2017

Implications on passenger vehicle demand

Future passenger vehicle demand?

Source: Toyota Corolla and WorldAutoSteel, MOD stands for Mobility on demand and AMOD stands for autonomous mobility in demand
Future of autonomy and mobility services

Current projections suggest a wide range of possibilities for AV adoption even for 2030...

*The Society of Automotive Engineers (SAE) defines 6 levels of driving automation ranging from 0 (fully manual) to 5 (fully autonomous)
Vision and agenda for a sustainable and resilient global steel industry
Vision and agenda for a sustainable and resilient global steel industry

**Sustainable & Resilient Steel Industry**

1. **Market**
   - Growing along the market
   - Develop construct., auto, and energy steel demand along the evolving future city archetypes
   - Appeal the market with steel’s superior performance – lightness, high-strength with low-carbon footprint
   - Digitally driven customised market-oriented technology solutions
   - Meet the changing standards of the market of fair competition and innovation

2. **Products**
   - Material solution provider
   - Diverse and competitive material solutions to meet customers’ needs in the future
   - Partnering with construction, auto, energy vendors to develop products
   - Providing multi-material solutions as joining and process technology evolves
   - R&D with newly-emerging polymers industries towards future product development

3. **Smart Mfg.**
   - [Steel Making]
   - Expand smart factory capabilities - Smart safety devices, AI-based customised production, V/C integration
   - Building digital ecosystem by data sharing with business partners and applying open & transparent technology
   - Applying meta-verse tools to develop new solutions, enhance processes and measure carbon footprint

4. **Decarbonisation**
   - [Ecosystem]
   - Intra- and inter-industry open networking data platform towards green steelmaking
   - Build up green steel value chains from upstream (scrap, DRI, renewable energy, hydrogen) to downstream in a circular economy
   - Promote dialogue over decarbonisation btw. private and public sectors to cross-border over regional blocs

**Vision**

“where should we go?”

**Agenda**

“How can we get there?”

**Vision and agenda for a sustainable and resilient global steel industry**

**Sustainable & Resilient Steel Industry**