



Iron Age 2.0: The Fourth Industrial Revolution and the Steel Industry

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•Some materials are brought and modified from POSRI's presentation of worldsteel Board meeting(April '17) and OECD Steel Committee (Sept. '17) •The copyright of this presentation belongs to POSCO Research Institute (POSRI) By the start of 4th Industrial Revolution, we are facing a new era in manufacturing



The 4th industrial revolution will affect not only steel making processes but also the entire value chain of the steel industry

4th Industrial Revolution	Materials procurement	R&D	Manufacturing /Process	Product	Logistics & Service
Change	 Optimal blending of material ingredients 	• Product development & design using CPS	 Smart tech-based diagnosis & control of facilities 	 Ultra light, high strength & high performance steel 	• Rise of steel e-commerce platform (Fall of traditional SSC)
	• Enhanced recycling of resources	• Quick compliance with raw materials specification	 Agile to small Lot and small quantity batch production 	• Fusion or integration among materials (Materials solution)	• Materials Library (Physical property DB, Provision of machining tech.)
Level of impact					J

Low $\leftarrow \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \rightarrow High$

Source: '4th Industrial Revolution : Impact on and Implications for the Korean Manufacturing Industry', KIET, June 2017

POSCO RESEARCH INSTITUTE Smart production systems applied to operation, quality control, and safety lead to cost saving and improve the capacity utilization rate, i.e., helping production efficiency



[POSCO's Case] Smartization underway in various processes

Blast Furnace

Automatic Control of Blast Furnace



- From manual operation to automatic operation through deep learning
- → Furnace temperature deviation cut by 18%



Plate Mill

 Precision control of deformation during quenching through big data analysis and prediction

Precision Control of Deformation

→ Engineers' time for data analysis halved

Hot Rolling Mill

Optimal Air-Fuel Ratio Control of Reheating Furnace



- Optimization of air-fuel ratio with sensors measuring the concentration of gas in reheating furnace
- \rightarrow Fuel unit requirement cut by 5%

Galvanizing Mill



- Automatic Control of Coating Weight
- Automatic process with AI-based prediction of optimal coating weight
- → Maximum deviation of coating weight: 7g/m² → 0.5g/m²

POSCO's smart applications such as 'Smart Factory Apps' run on a common S/W platform called 'PosFrame' based on steel, engineering & construction, and energy





on PosFrame

Spreading new business platform on sales and distribution, allowing real time responses to match customers' needs, *i.e.* demand, to supply



4th industrial revolution and global climate action will bring changes to the landscape of the steel-consuming industries and the steel industry





New mobility paradigm (EVs, autonomous cars, car sharing) brings changes to automobile demand and materials



Image credit: Tesla, Bosch, Local Motors, Renault

Demand for new cars will rise less than expected

as the market gradually adopts autonomous driving technology and car sharing



Steel intensity declines as automobile materials become lighter and stronger owing to stricter standards for fuel efficiency, electrification and safety issue



Globalization will be gradually expanding despite rising global protectionism Natural gas trade will grow substantially and eco- & smart ships lead the market







Overcapacity will linger until 2025 Demand for gas tankers and containerships will grow prominently



Steel intensity will fall as vessels become larger and lighter and decline further with the rise of electric propulsion, unmanned and autonomous ships



Note: Steel intensity = Steel demand for shipbuilding/gross tonnage (GT)

* Effects of on-going trend are analyzed based on Japanese shipbuilding industry data.

Under the trend of urbanization,

cities will be transformed into Mega City, Smart and Green City in the future



Image credit: and rewprokos.com

Global construction investment will rise by 2.0% each year for the next 20 years, with varying growth rates by sector







Source: UN World Urbanization Prospects, POSRI

Source: POSRI based on IHS Markit

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Steel intensity in construction investment will continue to decrease under the on-going urbanization trend with the 4th industrial revolution



Global energy demand will grow until 2035 with transition toward renewable energy. Steel intensity will be maintained by rising investment in T&D with high steel intensity



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Source: World Energy Outlook 2016, IEA (New Policy Scenario

Under the new paradigm, global steel demand will still be on a growing path, even though growth rate moderates



Demand for other sectors is forecast using industrial production index

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Customers' needs become sophisticated and varying

Demand is rising for high strength/toughness, corrosion resistant & performance steel

Industry	Automobile Energy Construction
High strength & high toughness	 Expanded application of gigapascal AHSS for lighter cars DP, CP, HPF, TWIP, etc. High strength & low-temperature toughness steel for deep-sea & polar exploration : BCA, TMCP, etc. High strength bar, section, cable
High corrosion resistant	 Heat resistant Stainless steels for exhaust systems - 429EM, high Cr, 310S Sour(H2S) resistant steel for extream conditions - API steel for linepipe High corrosion resistant steel for high temperature, high humidity environ. PosMAC, ZAM, Super Dyma, etc
High performance	 High efficient hyper NO for EV motors, bio-shield steel for sensors, vibration damping steel Thick plate for offshore wind tower, radiation shield plate for nuclear power plant High performance steel for buildings - Thermal insulation, self-cleaning, antibacterial, sound-proof

The 4th industrial revolution will accelerate smart transformation in the steel industry



The 4th industrial revolution will have a significant impact on the steel industry and the steel demand

- ✓ Enhanced productivity and efficiency in the steel industry through smartization in steel-making process, e.g. AI, Big Data, IoT, etc, will allow to reduce production costs, affecting the entire steel value chain positively
- ✓ Global steel demand will grow by about 1% each year from 1,501 Mt in '15 to 1,857 Mt in '35
 - Steel demand growth will fall short of GDP growth owing to falling steel intensity however, steel demand will not peak in quantitative terms for the next 20 years.
 - Steel demand for construction and shipbuilding will grow modestly, while that of automobiles and energy will be maintained
- Customer needs for more advanced steel products are rising and steel industry will continuously evolve through:
 - eco-friendly steelmaking process and smart transformation

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To thrive in a challenging environment, the steel industry must seize the opportunities for new business and demand offered by smart technologies

Thank you!



If you have any comment and suggestion on this presentation, please feel free to send an e-mail to 'jgoh@posri.re.kr'.