LEVERAGING DIGITAL TECHNOLOGIES IN THE STEEL INDUSTRY
Introduction

The steel industry is pervasive, and its growth is reflected in the global economy. In 2020, crude steel production worldwide was around 1,864 million tons (MT)\(^1\). The global steel market is projected to reach 2,175 million tons by 2024, growing at a CAGR of 4.5% between 2020 and 2024\(^2\). This growth rate is driven by increasing urbanization, higher expenditure on construction and infrastructure projects, and increased adoption of steel in automotive, electrical, and other end use industries.

Supply and demand trends

The demand for steel products is projected to grow by 5.8 % in 2021 to reach 1,874 MT after declining by 0.2% in 2020 amid the pandemic crisis\(^1\). Steel production in Asia in 2020 was 1,374.9 MT, which is 1.5% higher compared to 2019\(^1\). China is the largest steel maker in the world, responsible for 56.5% of global steel production in 2020. China is also the largest market for consumption of steel. According to figures by Indian Brand Equity Foundation, finished steel consumption is expected to grow from 98.71 MT in 2018-19 to 230 MT by 2030-31. Figure 1 shows the annual growth trend of global crude steel production from 2013 to 2020.

Post-Covid impact on the steel industry

Global steel production during the first three months of 2020 was 1.4% lower than in the same period in 2019\(^4\). The demand for steel reduced sharply during the pandemic even though steel was declared as an essential commodity in several countries. The difference between global crude steelmaking capacity and crude steel production increased up to 700 MT in 2020 due to overall increase in capacity and decrease in production resulting from Covid-19\(^5\) as shown in Fig 2.

The automotive industry, a key steel customer, was affected as manufacturing was restricted during this time. The oil and gas sector also saw a lower demand for steel due to falling energy prices.
The steelmaking process has a complex value chain. Manufacturers are challenged to adopt efficient processes to stay competitive while at the same time saving resources. Improving asset utilization, reducing downtime, and improving product quality are also important. Figure 3 depicts key functional challenges in the steelmaking process.

Achieving a reduction in carbon emissions is a challenge in the steel industry, and breakthrough technologies are being developed worldwide to address it. Producing one ton of steel emitted around 1.83 tons of carbon dioxide in 2017. Reuse of wastewater and enhancing safety inside plant works also challenge steel enterprises.
Digital advancements and technology adoption

There are numerous digital technologies which reshape every process in the steel industry from raw material management to sales and distribution. These digital technologies help the industry to overcome current challenges by improving supply chain visibility, providing real-time capability, interoperability, and facilitate the convergence of information technology and operational technology (IT-OT).

Figure 4 shows some key themes for digital transformation in the steel industry.

Emerging digital technologies such as Industrial Internet of things (IIoT), robotic process automation are being extensively applied in the steel industry, while supply chain logistics, safety, cybersecurity, sales and marketing are undergoing a digital transformation.
Industrial Internet of Things

The Industrial Internet of Things harnesses smart devices and cloud-based infrastructure to connect plants in the steel industry and enhances process visibility. IIoT-based remote monitoring of plant, equipment, and process control applications provides operations staff with the ability to monitor multiple systems without having to physically inspect the entire shop floor. These systems also maintain data history for analysis and compliance reporting, which can be further used to predict failures and disruptions. Figure 5 shows key trends in IIOT in steelmaking.

Big Data analytics

Big Data analytics is used in pattern recognition for risk monitoring based on historical data. It is also used in complex event processing (CEP) for data stream analysis.

Asset warranty management

Digital asset warranty management is used for component health monitoring of high risk and high value items. Users can activate warranty through mobile or Web apps and avail of repairs and Other post-sale services.

Condition monitoring systems

Condition monitoring systems (CMS) are used for predictive asset maintenance by providing real-time data. For example, they can be used to analyze sensor inputs for automatic adjustment of mold width setting to reduce yield losses.

Servitization

Servitization is used to add value to steel products with improved quality and just-in-time manufacturing. It also helps in providing timely deliveries and product tracking using IoT sensors.

Infosys offers a wide range of Internet of Things (IoT) ecosystem services for 'connected' business operations. These services enable remote diagnostics, real-time factory visibility, and automated monitoring. The IoT Gateway framework connects digital devices and processes and helps in automating work through robotic processes.
Robotic process automation

Mundane and repetitive tasks such as handling tickets, KPI calculations, and security checks are prone to human error, which can be reduced by applying robotic process automation (RPA) tools. RPA helps achieve higher efficiencies, reduce human error, and identify trends for decision making. Figure 6 shows key implementation areas of RPA in the steel industry.

Gamification includes applying game mechanics to the workforce. It enables awarding achievement levels / badges for prompt completion of tasks rather than simply getting the job done.

Digitalized knowledge management
Robotic process automation helps to digitize all knowledge assets and store them in an accessible standard format.

Real time KPI Monitoring
Robotic process automation enables real-time KPI monitoring for automated data analysis and recommending production-level changes.

Digital training
Robotic process automation enables digital training for employees by cloud-based simulation tools using augmented and virtual reality.

Figure 6: Key implementation areas of RPA in the steel industry

Infosys helps in implementing RPA programs by using extensive industry knowledge to improve process efficiency. It excels in automation architecture and cloud IoT solutions to monitor KPIs and metrics in a connected environment.
Digitalizing logistics and the supply chain

The steel industry supply chain is a complex one, with challenges such as demand fluctuation, irregular raw material supply, price volatility, lack of visibility. As the demand for the steel grows globally, the pressure to procure raw materials is also increasing throughout the industry.

Most steel companies are now focusing on new digital solutions to optimize their supply chain and logistics for minimizing delivery times and increasing visibility. Advance forecasting (pricing and demand) methods together with IT infrastructure for seamless communication between stakeholders (suppliers, manufacturers, distributors, dealers, customers) along the supply chain can create competitive advantages and help in optimizing logistics costs. Some trends across the supply chain in the steel industry are shown in Figure 7.

Implementing dynamic supply chain models and IT solutions based on e-commerce to reduce the bullwhip effect and extend supply chain visibility.

Supply market intelligence couples technologies like e-sourcing, spend analysis with market and supplier intelligence for digitizing procurement. It enables tracking commodity markets and suppliers.

Blockchain digital asset platform improves transparency in tracking goods between warehouses and transferring cargo rights and other assets.

Cyber-physical logistics systems with IoT cloud-based architecture is used for real-time information and remote monitoring.

Infosys offers supply chain solutions to improve demand forecasting using AI/ML and deep learning models. Digital solutions like ‘supply chain control tower’ combined with consulting solutions like ‘what if analysis’ and ‘maturity assessment frameworks’ allow companies to manage inventory effectively, facilitate proactive action, and reduce risks due to disruptions in the supply chain. We also offer Supply Chain Buyers-Suppliers Collaboration and Communication Solution by Infosys and Pegasystems, and Infosys Supply Chain Early Warning Solution—a UI-based information modeling tool.
Enabling safe and sustainable steelmaking

Historically, steel industry has been considered as an unsafe workplace, but it is now working towards achieving zero incidents. The industry spends around €12 billion (US$14 billion) globally each year in process improvement, and research and development. As a result, the industry has today transformed to a highly automated and mechanized one with considerable reduction in injury rates. According to a report by the World Steel Association, the injury frequency rate per million hours has reduced by 82% from 2006 to 2019.

For the steel industry, the four key focus areas are safety culture and leadership, occupational safety management, occupational health management, and process safety management. Digital technologies can improve safety in these key areas. Some trends across safety in the steel industry are shown in Figure 8.

Infosys offers smart solutions to improve safety in steel plants. One of these solutions is Ambient Sense 2 which is a working prototype that demonstrates real-time capturing of critical emissions with the use of IoT devices and other sensors to measure CO2, SO2, NOX, VOC emissions in real time and provide alerts. Our Integrated HSE platform is a solution for simplified, standardized, and automated health, safety and environment data reporting.
Enhancing cybersecurity

In the asset-intensive steel industry, cybersecurity is a top priority in order to protect digital investments from external threats. Figure 9 shows key methods to strengthen cybersecurity in the steel industry.

**Identity-as-a-service (IdaaS)**

Migration from on-premise to identity-as-a-service (IDaaS) for identity and access management and to provide users proper access to online resources.

**Intrusion detection and prevention systems**

Intrusion detection and prevention systems (IDPS) can be used to monitor systems for any policy violations or malicious activities. These systems vary from antivirus software to hierarchical systems which check the traffic of the entire network.

**Intelligent log management (ILM)**

Intelligent log management (ILM), which is a security control, can address all system and network logs. It helps in tracking incidents and collecting data to improve overall security.

**File integrity monitoring & security configuration management**

Using file integrity monitoring (FIM) helps to detect changes in files that may indicate a cyberattack. Security configuration management (SCM) improves the safety settings of applications and operating systems.

Figure 9: Key methods to strengthen cybersecurity in the steel industry

Infosys provides a managed security services model that helps companies to safeguard data. This also helps organizations to improve their cybersecurity by using a worldwide network of cyber defense centers powered by an advanced security platform.
Digital sales & marketing

Steel is a capital-intensive product and the brand name and quality standards play a key role in the sales of steel products. Sales managers, or key account managers, allocate production to their different customers and perform functions such as sales forecasting and pricing. Distributors act as liaison between the steel companies and customers and create value addition. Digitalizing the work methods of sales managers and distributors can help to access a larger customer base, improve targeting, and gain a competitive advantage. Some of the trends across sales and marketing in the steel industry are listed in Figure 10.

The Infosys customer relationship management (CRM) tool helps businesses reduce IT expenditure by removing infrastructure costs. The tool also helps apply CRM in sales and marketing functions with unique processes. It enables the sales workforce to effectively interact with customers, capture real-time customer feedback, and manage campaigns.

Summary

The steel industry has been one of the biggest contributors to the growth of the global economy. However, the industry faces many challenges such as connecting remote plants working in silos, overcoming cyber threats, training an ageing workforce, and reducing machinery downtime. Steel producers seek to reduce costs and improve product quality. Digitalization can optimize the entire steelmaking process with information technology, automation, and connectivity working together. Safety, supply chain logistics, cybersecurity, and sales and marketing are some of the key areas where emerging digital technologies will be impactful. IIoT and robotic process automation are also important themes in the digital transformation of steel plants. In the future, steel manufacturers will be more connected, automated, and supported by robust enterprise systems.
Appendix

10. Infosys Knowledge Institute | AI and ML in Cybersecurity Risk Management
    Internet of Things - Offerings | Industrial Manufacturing | Infosys
    How Digital Enables Servitization (infosys.com)
    Live Supply Chains: Resilient. Future Ready (infosys.com)
12. (PDF) IoT-coordinated Logistics in Product-Service Systems (researchgate.net)
15. How do we Achieve Digital Transformation in Sales? (forcemanager.com)
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