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The Indian steel industry: Growth, challenges and digital disruption

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IndianSteel ASSOCIATION

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Foreword

Metals have been one of the core drivers of industrialisation. Among metals, steel has historically held a dominant position. As a raw material and intermediate product, production and consumption of steel are widely regarded as indicators of economic progress. Thus, it would not be an overstatement to say that the steel industry has always been at the forefront of industrial development and forms the backbone of any economy.

Post independence, India's leaders identified power and steel as the foundation for the nation's future development. True to their vision, most of India's modern infrastructure was built using steel, which cemented the industry's key position in the nation's growth story. Today, India has replaced Japan as the second largest steel-producing country, and it is on course to become the second largest consumer of steel globally.

India's domestic steel industry is especially vulnerable to cheaper imports and demand fluctuation. The slump in domestic steel consumption and decrease in investment across sectors have affected the overall growth and profitability of the steel industry. The current wave of protectionism and trade wars are further impacting the industry. However, we believe that this is a temporary phase.

The present situation calls for a quick policy boost to insulate the sector from global pressure and stimulate demand. Although corporate tax cuts are a positive step towards driving investment, they are not enough to boost demand. Measures are needed to increase consumer confidence and the credibility of the financial sector. Moreover, the steel industry needs to evaluate the digital disruption taking place in other industries and how some of its challenges can be mitigated by using emerging technologies.

In 2018, the Indian Steel Association (ISA) successfully launched its flagship event, the 'ISA Steel Conclave', as a platform for the government, senior industry leaders and consultants to gain insights into international steel trade and the related challenges. PwC India is proud to be associated as the knowledge partner for the 2019 edition of the event. This knowledge paper seeks to provide a holistic view of the steel industry, highlighting its growth in India, the challenges faced and the impact of digital disruption on the industry.

We would like to thank Arnab Kumar Hazra (Assistant Secretary General) and Zaki Hussain (Senior Executive – Trade) from the ISA for their valuable inputs and suggestions on this knowledge paper.

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1 https://www.ibtimes.co.in/india-second-largest-steelmaker-ahead-japan-behind-china-765071

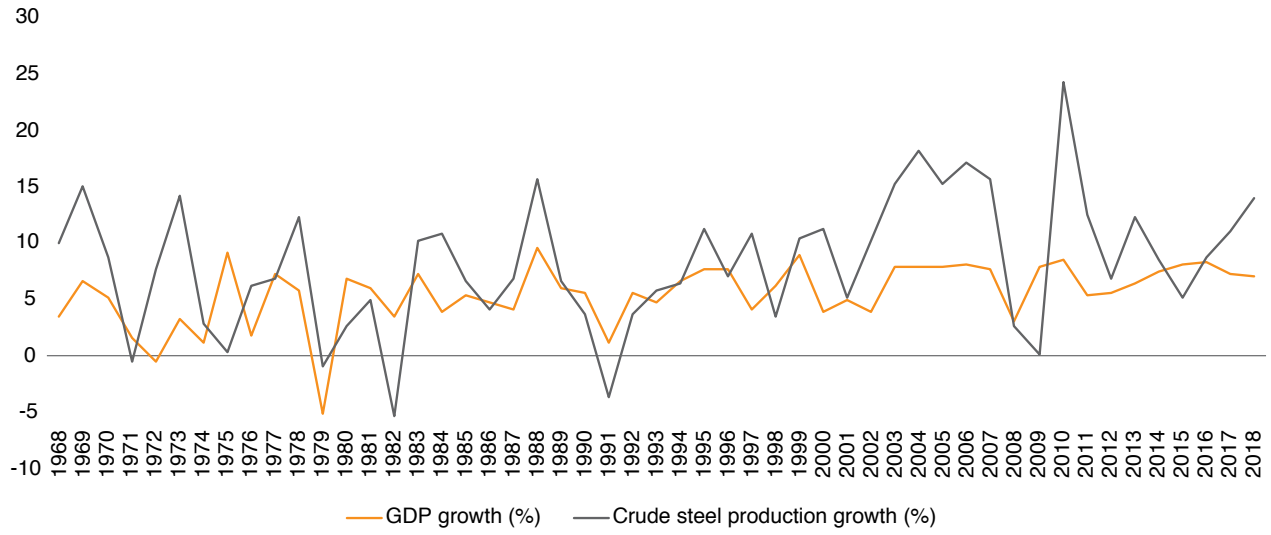
https://www.worldsteel.org/en/dam/jcr:96d7a585-e6b2-4d63-b943-4cd9ab621a91/World%2520Steel%2520in%2520Figures%25202019.pdf

Introduction

With the emergence of economies driven by industrialisation at the beginning of the twentieth century, countries with sound steel industries benefited from a first-mover advantage. India became independent in the middle of this century and looked to become self-reliant under its newly adopted model of a mixed economy. To achieve this goal, the primary (raw materials), secondary (manufacturing) and tertiary (services) sectors had to be developed simultaneously. As a raw material and intermediate product, steel was the common link between all three sectors. Apart from being a product of the primary sector, steel is probably the most extensively used input in manufacturing. Due to its high corrosion resistance, steel finds wide usage in many complex industries dealing with various reactive/non-reactive elements. Immense strength, low weight, durability and ductility at a low cost make steel the most valuable raw material of the manufacturing sector.

Steel has contributed immensely towards India's economic growth. This is evident from the similar growth patterns of India's GDP and steel production in the country, which also highlights the economy's dependence on steel. National consumption of finished steel rose from 6.5 MT in 1968 to 98.71 MT in 2018, while GDP (at constant price, 2010) grew from USD 0.25 trillion in 1968 to USD 2.7 trillion today.

Comparison of GDP growth rates and crude steel production rates (1968–2018)



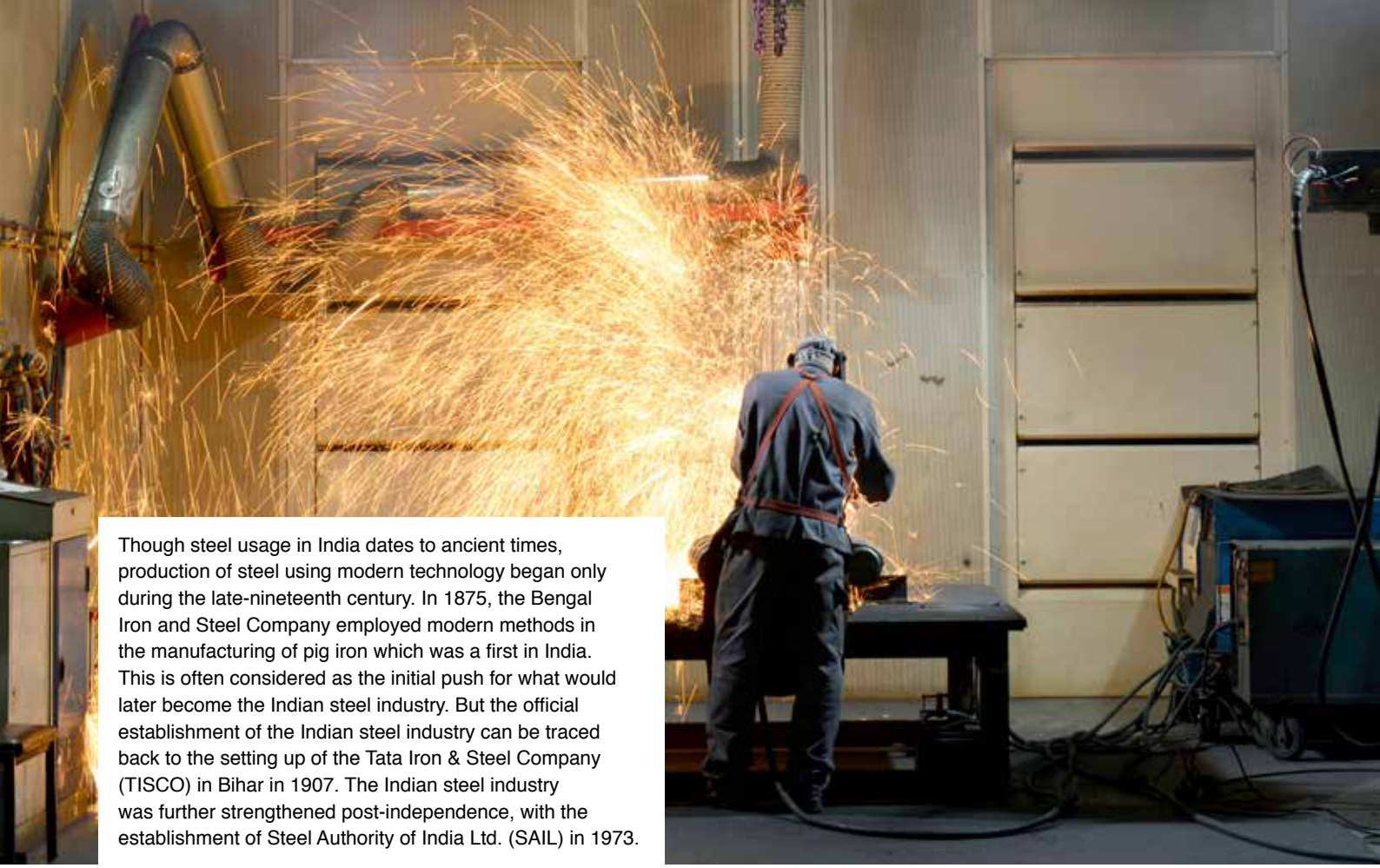
Source: GDP data: World Bank, steel production data: World Steel Association

Today, the steel industry contributes slightly more than 2% to the GDP of the country. This percentage accounts for direct contribution. The indirect contribution of steel is much larger, owing to the dependence of other sectors. The steel industry employs nearly half a million people directly and two million people indirectly. The output effect of steel on Indian economy is approximately 1.4x with an employment multiplier of 6.8x. As per the World Steel Association, globally, for every two jobs created in the steel industry, 13 more jobs are created across the supply chain.[2]

India is currently the world's second largest producer of crude steel, with 110.92 MT produced in 2018–19 (up from 103.13 MT in 2017–18). The country has strengthened its domestic steel industry considerably over the last decade. It became a net exporter in FY 2016–17, with exports of total finished steel reaching 8.24 MT vis-à-vis imports of 7.22 MT in the same year. It maintained this position with a positive trade balance of 2.138 MT in the next year too. But with rising protectionism and an ongoing trade war (among other factors), India has seen a steep decrease of 33.9% in its exports, clocking only 6.36 MT in 2018–19. In contrast, imports saw an increase of 4.7% and stood at 7.83 MT. As a result, the country once again became a net importer in the last financial year.[3] Though small in scale, a positive trade balance from finished steel production was remarkable for a country like India, which missed the opportunity to build a mature secondary sector in its hurry to strengthen the tertiary/services sector. However, the current global economic downturn and structural changes in many related industries have arrested this upward trend, at least for now.

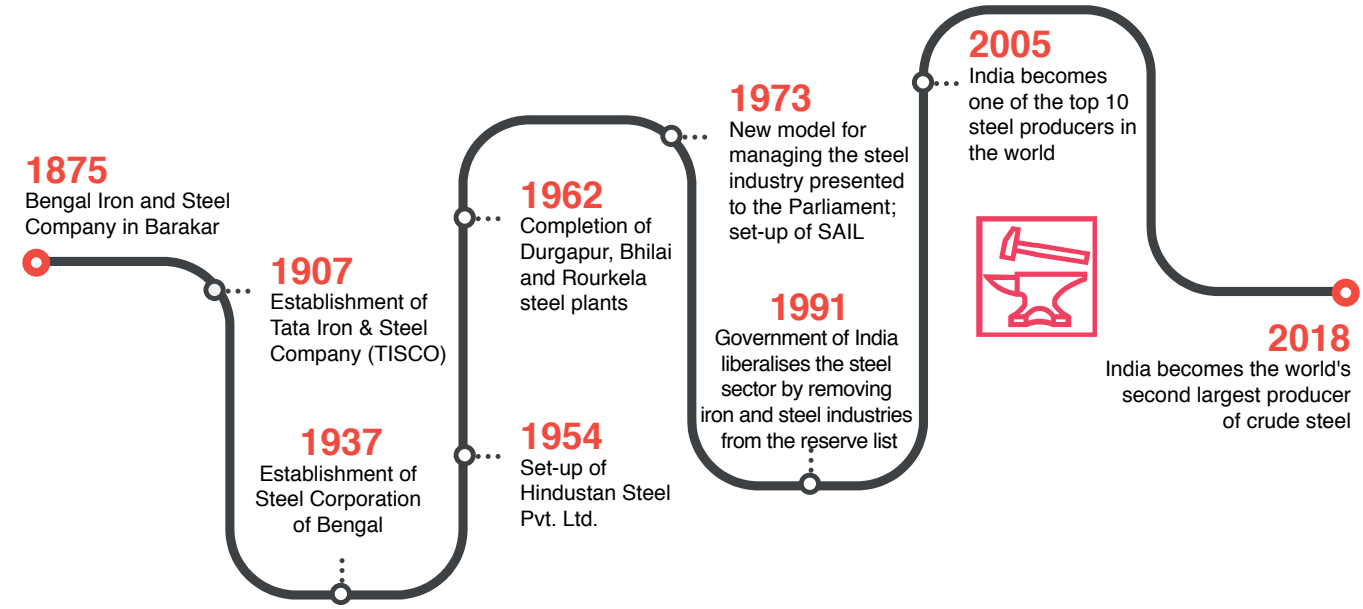
2 https://pib.gov.in/newsite/PrintRelease.aspx?relid=153661
https://steel.gov.in/make-india#skipCont

3 http://jpcindiansteel.nic.in



Though steel usage in India dates to ancient times, production of steel using modern technology began only during the late-nineteenth century. In 1875, the Bengal Iron and Steel Company employed modern methods in the manufacturing of pig iron which was a first in India. This is often considered as the initial push for what would later become the Indian steel industry. But the official establishment of the Indian steel industry can be traced back to the setting up of the Tata Iron & Steel Company (TISCO) in Bihar in 1907. The Indian steel industry was further strengthened post-independence, with the establishment of Steel Authority of India Ltd. (SAIL) in 1973.

India's steel industry: Journey so far



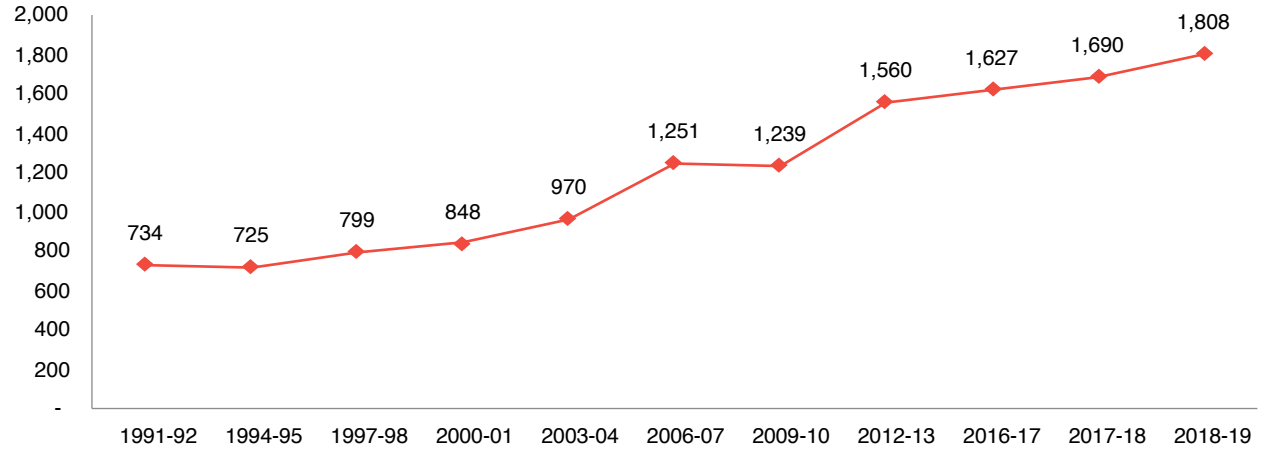
Source: https://sail.co.in/background_history#top, static.investindia.gov.in

Global collaboration

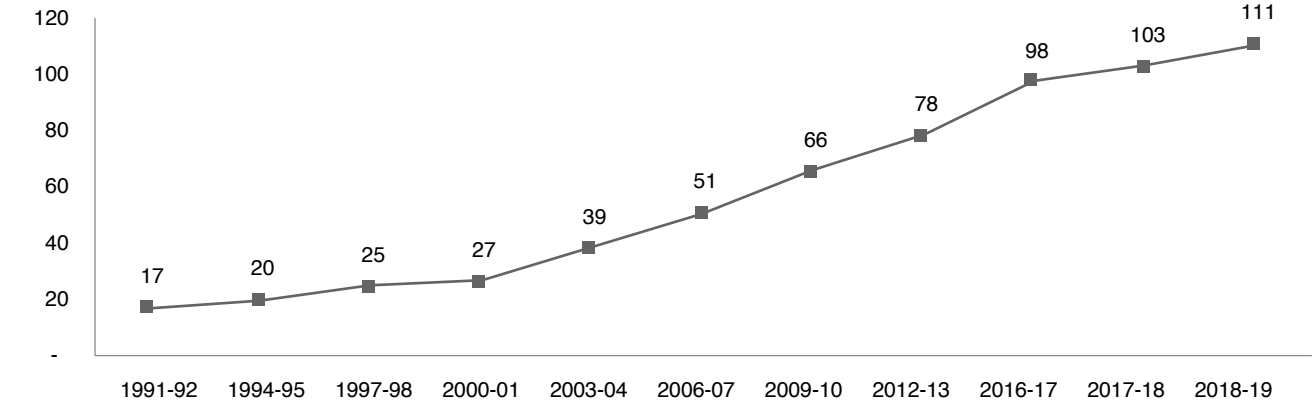
From its inception, the Indian steel industry has had business ties with foreign countries. The Durgapur, Rourkela and Bhilai steel plants were established in collaboration with Britain, Germany and Russia respectively. Indian companies have signed various MoUs with other countries over the years, especially in the area of technology, to form joint ventures (JVs) in steel production.

Globally, the steel industry has witnessed astonishing growth in the last 50 years. The World Steel Association recognises steel as the foundation for the last 100 years of progress and as equally fundamental to meet the challenges of the next 100 years. Globally, crude production of steel increased from 734 MT in 1991–92 to 1808 MT in 2018–19. In India, crude production of steel increased from 17 MT in 1991–92 to 111 MT in 2018–19.[4]

World crude steel production (MT)



Indian crude steel production (MT)



Source: GDP data: World Bank , steel production data: World Steel Association, JPC data

At 51.3%, China is the world's largest producer of steel. With a total contribution of 5.9%, India has overtaken Japan to become the second largest producer of steel.[5] Production of steel has kept pace with its global usage. In 2018, the global usage of steel stood at 1712.1 MT, up from 1632.5 MT in 2017. Per capita consumption of steel increased to 224.5 kg in 2018 from 216.3 kg in 2017.[6]

India allows for 100% foreign direct investment (FDI) under the automatic route. This has paved the way for huge investments in the India's steel sector by foreign countries. FDI in steel stood at 0.34% of the GDP last year, and the key reasons for investment were technology and state-of-the-art machinery.

The private sector has also played a significant role in strengthening the Indian steel industry, and Indian steel companies have acquired foreign ones in order to expand.

4 GDP data: World Bank, steel production data: World Steel Association, http://jpcindiansteel.nic.in

5 https://www.business-standard.com/article/economy-policy/india-pips-japan-to-be-second-largest-global-steel-producer-119012100723_1.html

6 https://www.worldsteel.org/en/dam/jcr:96d7a585-e6b2-4d63-b943-4cd9ab621a91/World%2520Steel%2520in%2520Figures%25202019.pdf

Growth prospects of the Indian steel industry

On the back of sustained domestic demand, India's steel industry witnessed robust growth in the last 10–12 years. Since 2008, production has gone up by 75% while domestic steel demand has grown by around 80%. Steel-making capacity has also increased in tandem, and the growth has been fairly organic.[7]

The Indian government has always supported the steel industry and introduced the National Steel Policy in 2017, which envisions the growth trajectory of the Indian steel industry till 2030–31. The broad contours of the policy are as follows:

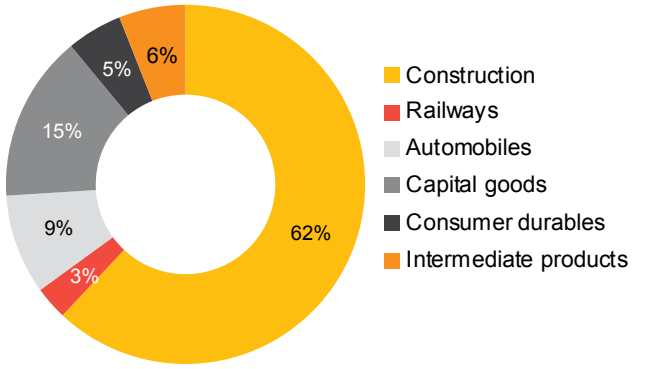
- Steel-making capacity is expected to reach 300 million tonnes per annum by 2030–31.
- Crude steel production is expected to reach 255 million tonnes by 2030–31, at 85% capacity utilisation.
- Production of finished steel to reach 230 million tonnes, assuming a yield loss of 10% for conversion of crude steel to finished steel – that is, a conversion ratio of 90%.
- With 24 million tonnes of net exports, consumption is expected to reach 206 million tonnes by 2030–31.
- As a result, per capita steel consumption is anticipated to rise to 160 kg.
- An additional investment of INR 10 lakh crore is envisaged.[8]

While the National Steel Policy, 2017, is a vision document of the Indian government, it nevertheless emphasises the growth potential of the Indian steel industry.

As per data from the Joint Plant Committee, at the end of 2018–19, India produced 110.9 million tonnes of crude steel.[9]
In order to reach 255 million tonnes of crude steel production by 2030–31, production needs to grow at a CAGR of about 7.2%.[10] This is easily achievable given that in 2018–19, crude steel production grew by 7.6%. Therefore, the growth potential that the government has charted out in the National Steel Policy, 2017, is in sync with the industry's growth trajectory.

Naturally, the next question that arises is where the demand that can sustain the production levels envisaged in the policy will come from. This requires a sectoral approach. The approximate sector-wise demand for steel is shown below:[11]

Sector-wise demand for steel



7 http://jpcindiansteel.nic.in/

8 https://steel.gov.in/sites/default/files/draft-national-steel-policy-2017.pdf

9 http://jpcindiansteel.nic.in/writereaddata/files/ANNUAL%20PERFORMANCE%202018-19.pdf

10 CAGR computation

11 ISA analysis

Construction sector: The sector includes physical infrastructure (excluding railways) and real estate, and contributes roughly 62% of India's steel use or steel demand. The sector grew by 8.6% in 2018. Although growth is expected to slow down to 5.4% in 2019, the sector is again expected to pick up in 2020 and beyond, growing by around 7% till 2024.[12]

The construction sector was estimated to be worth around USD 500 billion in 2018. India will become the world's third largest construction market by 2025. The infrastructure sector, currently a huge focus area of the government, will drive growth in this sector as well as overall steel demand. The real estate sector is growing at a CAGR of over 4% and the affordable housing and smart cities initiatives will drive growth in this sub-segment. A few of the major government initiatives, both ongoing or planned, are as follows:

- Road connectivity through the Bharatmala programme envisages the development of 34,800 km of road under the National Highways Development Project. Moreover, under the Bharatmala programme, 24 logistics parks have been identified along the national corridors that will cater to key production and consumption centres accounting for 45% of total road freight.
- Port connectivity through the Sagarmala programme envisages port-led industrial development covering all major maritime zones in India.
- In the oil and gas sector, the Urja Ganga Gas Pipeline Project aims to develop a 15,000-km gas pipeline network.
- Under urban infrastructure, 100 smart cities will be developed further. Besides the on-going metro railway projects in cities like Delhi, Mumbai, Kochi and Bengaluru, 10 more cities will be covered. Under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), basic facilities are being upgraded.
- National Investment and Manufacturing Zones (NIMZs) are being developed across the country, with 14 NIMZs already receiving in-principle approval. In addition, eight investment regions along the Delhi–Mumbai Industrial Corridor Project (DMIC)have also been announced as NIMZs.[13]

India's total construction investment is likely to increase by 50% over the next 5 years. Overall, the infrastructure segment is likely to grow by 9–10% per year, mainly driven by road projects and urban infrastructure. All these are expected to significantly boost steel demand directly and indirectly. For example, enhanced road construction leads to enhanced demand for steel crash barriers.

Further, the real estate sector, which has been suffering from inventory overhang in the last few years, is expected to pick up pace in the coming years, especially from the affordable housing segment. The urbanisation rate in India is currently around 33% and is expected to rise to 40% by 2030–31. This translates to 90 million people (or twice the population of Argentina) moving from rural to urban areas. Consequently, the demand for housing and, therefore, growth in real estate in urban and semi-urban areas is expected to rise in the medium to long term.

Railways: This sector, which contributes 3% of steel demand, is growing at a fast pace. It grew by 13.4% in 2018[14] and is expected to grow by more than 20% in 2019.[15] Projects like 100% track electrification (electrification of 16,540 track km by 2021–22), dedicated freight corridors (of over 3350 km)

12 https://www.globaldata.com/store/report/gdcn0460mr--construction-in-india-key-trends-and-opportunities-to-2023/

13 https://www.globaldata.com/store/report/gdcn0460mr--construction-in-india-key-trends-and-opportunities-to-2023/

14 Centre for Monitoring Indian Economy (CMIE) Database

15 ISA analysis

connecting industrial hubs in western and eastern India and high-speed rail corridors are expected to boost steel demand significantly.

Automobiles: The Indian automotive industry is the fourth largest in the world. It contributes to around 9% of steel demand in India. India is the largest manufacturer of two-wheelers, three-wheelers and tractors, the fourth largest producer of passenger vehicles, and the seventh largest in commercial vehicles in the world. Two-wheelers occupy a dominant position with an 81% market share and overall passenger vehicles compose 13% of the market. India's automobile sector is domestic market oriented, with domestic sales accounting for over 80% of sales.[16]

After rapid growth in the last few years, the sector is currently undergoing a slowdown. All the sub-segments have witnessed de-growth in 2019. However, growth normalisation is expected in 2020. The automobile sector, including component parts, is expected to cross USD 250 billion by 2026. India's auto and auto component export markets are also expected to grow at a CAGR of 3% until 2026.[17]

The Government of India announced the Automotive Mission Plan 2016-26 (AMP 2026) in 2015. The plan outlines the vision for all sub-segments in terms of size, global footprint and technological maturity, etc. It aims at sustained automotive growth and bringing India at par with the global auto giants.

Therefore, steel demand from the automotive sector is expected to be sustained, despite the temporary blip in growth this year. However, the Indian government is putting a significant thrust on electric vehicles, which will require less steel as these vehicles have fewer auto components.

Capital goods: The sector contributes about 15% of steel demand. It has several sub-segments, of which machinery and equipment are the most prominent. The machinery and equipment segment can be further divided into construction and earth-moving machinery, plant machinery, heavy electrical machinery and machine tools.

Therefore, the sector is obviously dependent on construction, mining, and heavy and light industries. In other words, the capital goods sector is dependent on economic growth in general and the secondary sector's performance in particular.

Machinery and equipment, a subset of the capital goods sector, accounts for roughly 23% of total manufacturing and about 4% of India's total gross value added (GVA).[18] However, the sector's growth has been uneven in the past and it is hugely dependent on imports, especially for the large machinery segment. Significant gaps exist in technology capabilities due to low acceptance of domestically manufactured products, leading to a lower capacity utilisation ratio, weak support infrastructure and inadequate R&D spending.

Since the beginning of 2018, both economic growth and industrial growth in India have consistently slowed down. As a result, the capital goods sector growth was strong in 2018 at 6.4%, but is expected to fall below 1.5% in 2019. Since late 2018, manufacturing growth fell significantly due to liquidity concerns, especially in the SME segment, coupled with slowing new investments. Falling tariffs in solar and wind energy have impacted the implementation of announced projects. However, the sector is expected to recover in 2020.

16 https://www.ibef.org/industry/india-automobiles.aspx

17 https://www.ibef.org/industry/india-automobiles.aspx

18 CMIE

Historically, the sector has seen wide fluctuations. For example, in 2016, growth was 3.8%, which fell to 0.5% in 2017 and again rose to 6.4% in 2018. Sectoral growth is again expected to remain below 1.5% in 2019.

Overall, the long-term growth forecast for this sector is difficult, given the wide fluctuations it has witnessed and due to the fact that several segments of the economy affect its growth prospects. However, there are government initiatives to encourage technology providers and OEMs to set up base in India. The government is also focusing on R&D to revive the sector. Moreover, given India's thrust on the Make in India programme, the outlook for the sector remains positive.

Consumer durables: The sector contributes about 5% of India's steel demand. India is a consumption-driven economy and traditionally this sector has witnessed robust growth. In 2018, for example, the sector grew by 21.7%. However, in line with declining GDP growth, there was a slowdown in this sector's growth performance in 2019. The liquidity crisis in the shadow banking sector, high interest rates and uncertainty during the general elections led to a significant decline in consumer durables.

However, the sector is quite broad and growth prospects have not always been even. For example, in 2019, although sections like air conditioners saw growth, frost-free refrigerators and washing machines did not. In urban areas, household demand

has consistently exceeded personal disposable income and was being funded through falling household savings and higher leverage, constraining potential growth. Tightening in financial conditions (led by NBFCs) has also hurt consumption. As a result, in the near term, growth prospects are expected to be modest, but normalisation of the growth trajectory is expected in the latter half of 2020 and beyond.

Intermediate products: The sector contributes the remaining 6% of India's steel demand. This segment is closely linked to the auto sector as well as the oil and gas sector, besides industrial activity. So, on the one hand, a weaker automotive sector has negatively impacted the demand for gear boxes, bearings, etc., on the other hand, demand for pipes, especially large diameter pipes, continues to grow with ongoing pipeline projects. However, with economic growth slowing down, demand in the packaging segment (drums and barrels) has witnessed a slowdown, while exports have also seen muted growth.

The outlook for the sector is positive in the medium term as a revival is expected in the auto sector and the oil and gas sector will continue to grow with government-led spending.

Overall, the demand prospects of steel-using sectors remain positive, with steel demand set to grow. Nevertheless, it is pertinent that India returns to a 7% plus GDP growth rate for steel demand to grow at more than 7%, which in turn would enable market-led conditions to increase steel-making capacity and production.

Challenges before the Indian steel industry

The growth trajectory of the steel industry has its own set of challenges. We outline the five major challenges to the growth prospects discussed in the previous section.

The Indian steel industry is often regarded as uncompetitive globally.

In 2016, World Steel Dynamics ranked India second in terms of cost of conversion of iron ore to steel, after Ukraine. Indian mills were found to be more cost efficient in converting iron ore to steel than their counterparts in China, Japan or Korea. Most Indian integrated steel producers ranked within the top 35 steel mills globally.

The answer to the dichotomy can be found in a report by the National Institution for Transforming India (NITI Aayog).[19] The report explains a USD 80–100 cost difference in the table below:

(USD/tonne)	
Logistics and infrastructure	25–30
Power	8–12
Import duty on coal	5–7
Clean Energy Cess	2–4
Taxes and duties on iron ore	8–12
Finance	30–35
Total cost disadvantage	80–100

Source: NITI Aayog

Finance: Steel is a capital-intensive sector. Nearly INR 7,000 crore is required to set up 1 tonne of steel-making capacity through the greenfield route. Naturally, the cost of financing any expansion or new steel capacity is usually through borrowed capital. And in India the cost of finance is extremely high compared to the cost of finance in developed countries such as China, Japan and Korea. This adds about USD 30–35 USD to the final cost of steel.

Moreover, steel demand is cyclical. So, during a downturn, the return on investments gets eroded. From 2004–2011, steel demand increased at a fast pace. This prompted most steel makers to expand existing capacities. However, the Indian steel industry faced a severe downturn between 2014 and 2016. This eventually resulted in many steel makers facing bankruptcy proceedings in 2018. The industry, in fact, is yet to resolve all the bankruptcy cases. Today, financial institutions have become wary of lending to the sector.

In conclusion, therefore, a large share of the challenges that the steel industry has faced since 2014 can be traced to the extremely high finance costs or cost of borrowed capital. Although India's Reserve Bank has lowered the policy repo rate five times and by 135 basis points in 2019 alone, the cost of capital in India still remains significantly high and Indian steel makers continue to face a relative disadvantage vis-à-vis their competitors from the developed world.

19 https://niti.gov.in/sites/default/files/2019-07/Need%20for%20a%20new%20Steel%20Policy_NITI%20Website%20Final.pdf

If the Indian steel industry is to fulfil the vision outlined in the National Steel Policy, 2017, financing capacity addition of 100–150 million tonnes will be the biggest challenge. The policy document acknowledges that additional investment of INR 10 lakh crore will be required and financing it is the primary challenge.

Logistics: For most Indian steel makers, managing logistics requirements is arduous, challenging and costly. The primary raw material for steel making is iron ore, besides coal or coking coal. Both are bulk minerals, and steel is also a bulk commodity. So, whether it is physical transportation of raw materials for steel making to the steel mills or physical transportation of finished steel to demand centres, transportation of bulk materials is always arduous.

Moreover, most Indian steel plants are located inland, unlike in China, Japan or Korea, where they are located close to the sea. This increases the challenge of managing logistics requirements for most steel plants in India.

Railways are naturally the preferred mode of transportation for steel makers. More than 80% of the total logistics requirements of the steel industry are met through the railway network, as the sea route can be partially leveraged for only three steel plants. Moreover, transportation through roadways for bulk materials is economically unviable.

The railways face huge infrastructure constraints, which makes managing logistics challenging for Indian steel makers. Moreover, for a long time now, the overwhelming dependence of the Indian Railways on revenue from freight traffic, especially from bulk commodities, is well documented. In other words, the freight cost of moving materials through the railways, both raw materials and finished steel, is artificially much higher as passenger traffic is subsidised from freight earnings by the Indian Railways. NITI Aayog estimates a relative cost disadvantage for Indian steelmakers at USD 20–25 per tonne of finished steel. The study estimates that the freight cost from Jamshedpur to Mumbai can be as high as USD 50/tonne in comparison with USD 34/tonne from Rotterdam to Mumbai.[20]

For every 1 tonne of steel produced, roughly 3 tonnes of raw material needs to be transported. So, as India doubles its steel production in the next 10 years, the logistics requirement of the domestic steel industry will become unmanageable unless steps are taken to increase and improve the physical infrastructure, especially by the Indian Railways, and on an urgent basis. Shortage of railway rakes has already started plaguing the steel industry.

The National Steel Policy, 2017, envisages that by 2030–31, India will export 24 million tonnes of steel annually and imports will be nil. These objectives will remain on paper unless there is freight cost rationalisation, which reduces the cost or price of steel and makes Indian steel more competitive globally. The following steps can help in this direction:

- lowering the freight class for iron ore to 145, uniform with the freight class for coal and limestone
- inclusion of iron ore, coal and coke in Long Term Tariff Contract (LTTC) Policy
- no long-term policy on freight structure for short lead traffic to a distance of 100 km
- removal of route rationalisation policy (Charging of iron ore and Limestone by a longer route)
- abolition of long-term policy on freight structure for short lead traffic up to a distance of 100 km.

In conclusion, infrastructure bottlenecks, especially in railway connectivity, are another external challenge that can outweigh future growth considerations. Unless there is a significant effort by the Indian Railways to rationalise costs as well as to improve railway connectivity, capacity additions will remain limited.

Tax, duties and cess: While the government has recently lowered corporate tax rates to 25%, there are certain non-creditable taxes, duties and cesses, specifically paid by the steel sector, which reduce the competitiveness of Indian steel products in the global market.

20 https://niti.gov.in/sites/default/files/2019-07/Need%20for%20a%20new%20Steel%20Policy_NITI%20Website%20Final.pdf

NITI Aayog estimates that Indian steel makers pay an additional amount, varying between USD 15 and 23 by way of taxes, duties and cesses compared to their global peers. Our own calculations estimate the figure to be around USD 35–40, as elaborated below.

Non-creditable taxes, duties and cesses paid by steel makers

Input	Type of tax	Amount (INR per MT)
Iron ore	Royalty, Clean Energy Cess, District Mineral Foundation, National Mineral Exploration Trust and a few others	1,100
Electricity	Electricity duty	500
Freight	Taxes on fuel	500
Customs duty	Customs duty on imports of raw materials	650
Total	2,750	

Source: ISA analysis

Abolition of these taxes, cesses and duties or making them creditable would only increase India's competitiveness and, in turn, add value to both upstream and downstream steel-producing and steel-using units.

The National Steel Policy has laid down certain goals. For these to be realised, Indian steel needs to be globally competitive. Otherwise, India will never be able to increase steel exports beyond a certain limit and will continue to be threatened by cheaper imports. To prevent his, the government needs to ensure that the additional burden of USD 80–100 that Indian steel makers are saddled with is removed. Removal of non-creditable taxes, duties and cesses is the easiest to achieve. Otherwise, we foresee this to be a big challenge going forward.

Raw materials: Although India has abundant reserves of iron ore and coal, it has negligible reserves of coking coal. The National Steel Policy envisages that India will reach 300 million tonnes of steel-making capacity, and 68% of that will be through the blast furnace route, which requires coking coal. This translates to about 200 million tonnes of steel being produced using coking coal, which means an annual consumption of about 180 million tonnes of coking coal.[21]

India largely fulfils its coking coal requirements through imports from Australia. But due to vagaries of weather, there has been huge fluctuations in coking coal supply as well as coking coal prices.

Jharia fields in eastern India are amongst the world's largest coal fields in terms of reserves, with an estimated coal reserve of 19.4 billion tonnes.[22] Jharia coal fields are the only source of coking coal in India, with an estimated reserve of approximately 12 billion tonnes. The coal mines in Jharia have had to deal with fires and issues related to subsistence right from the time mining operations commenced in early 1900. Moreover, the entire town of Jharia is located on coal fields and close to 100,000 people reside there. The development of the Jharia coal fields will not only secure the coal requirement of the steel industry, acting as a major incentive for investment, but will also lead to the overall development of the region.

The National Steel Policy, 2017, envisages that only 65% of India's coking coal requirements will be met through imports by 2030–31. If India is to consume 180 million tonnes of coking coal annually, this means that around 60–65 million tons will be provided by domestic sources. This poses a serious challenge to the growth aspirations of the Indian steel industry, unless the Jharia fields are developed.[23]

Environment and energy consumption: Increasingly, environmental concerns are taking centre stage and the Indian steel industry is not immune to this trend. The steel industry is energy-intensive and is the second biggest consumer of energy globally. This leads to a higher carbon footprint and also affects the immediate environment. Using energy-efficient methods to produce steel will not only reduce production costs but also improve competitiveness. This can be achieved through highly developed energy management systems and usage of the latest technologies in steel production.

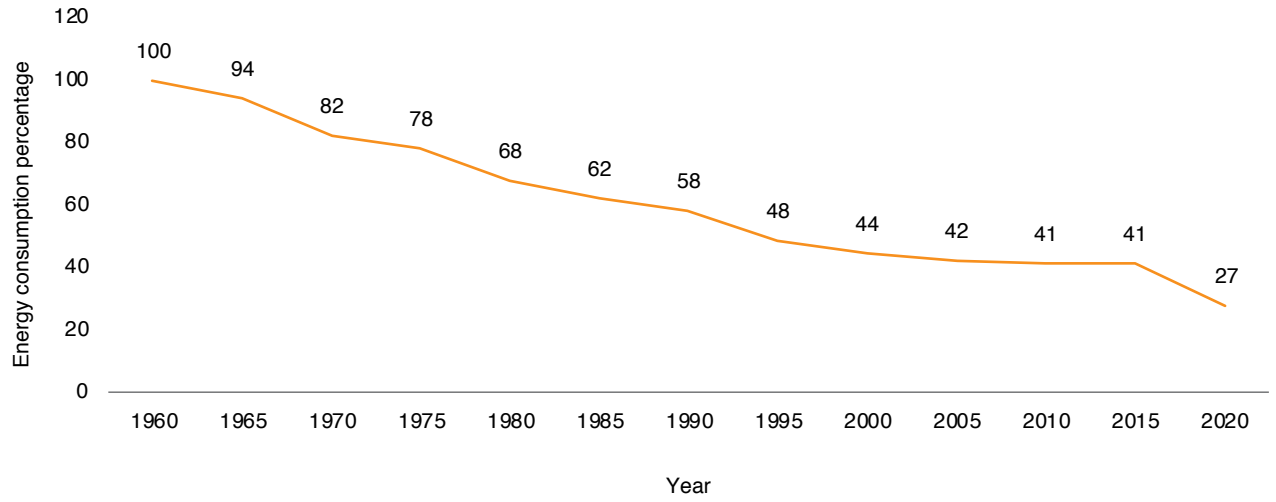
21 https://www.thehindubusinessline.com/news/national/india-can-produce-300-mt-of-steel-by-2030-experts/article9783300.ece# http://ficci.in/spdocument/20782/ficci-steel-report.pdf

22 Indian mineral yearbook 2011, India bureau of mines, Ministry of mines Government of India Oct 2012

23 https://www.mjunction.in/blog/taking-stock-indias-met-coal-coke-outlook/

As per the World Steel Association, improvements in energy efficiency have led to a reduction of about 60% in the energy required to produce a tonne of crude steel since 1960, as highlighted in the figure below.[24]

Energy consumption per tonne of crude steel production



Source: Worldsteel.org

Slurry and other solid wastes and emissions like GHGs are byproducts of the steel manufacturing process and result in environmental pollution. As per the World Steel Association, on an average, in 2017, 1.83 tonnes of CO2 were emitted for every tonne of steel produced, which is equivalent to around 7–9% of direct emissions from the global use of fossil fuel. In India, the figures are marginally higher.[25]

Water management is a crucial step and challenge in steel manufacturing, especially in areas where availability of pure water is decreasing. Thus, reusage becomes important, necessitating desalination and cooling of water to avoid damaging vital equipment like rolling mills. Desalination requires large amounts of energy (for crystallisation), which produces a low-quality salt that has no commercial use and is costly to dispose of.

Going forward, if the Indian steel industry is to fulfil its growth aspirations, it will have to continuously upgrade to energy-efficient technologies and invest in processes that help reduce the carbon footprint. The Indian government has already released draft environment guidelines which are quite stringent and may become stricter in future.

This means that many inefficient and small steel producers will find it unviable to produce steel while complying with increasingly strict environment norms. This may jeopardise the goals laid out in the National Steel Policy, 2017.

Besides these challenges, we would like to highlight two threats that can turn into potential challenges and hamper the growth aspirations of the Indian steel industry. The first arises from global steel trade and the second is digital disruption.

An understanding of the global steel industry and developments in the last few years is important. China is the world's largest steel producer, accounting for 51.3% of global production and an output that is nearly eight to nine times higher than that of the second largest producer, which is India. Clearly, exports from China have the potential to disrupt global trade and international steel prices. Moreover, in the last couple of years, protectionist barriers are being put up by various nations against steel imports. With a growing market, India is a potential destination for all the displaced exports from countries like China, Japan and Korea, who all have a substantial export basket in steel products.

We perceive this as a threat rather than a challenge. However, if the areas outlined above are not addressed vis-à-vis improving India's competitiveness in terms of costs, this threat can become a challenge to the growth aspirations outlined in the National Steel Policy, 2017.

The other potential challenge that the Indian steel industry will soon start facing in a significant way is digital disruption; however, this also represents an opportunity in terms of staying globally competitive. The next section focuses on this aspect.

24 https://www.worldsteel.org/en/dam/jcr:f07b864c-908e-4229-9f92-669f1c3abf4c/fact_energy_2019.pdf

25 https://www.worldsteel.org/publications/position-papers/steel-s-contribution-to-a-low-carbon-future.html

Digital disruption and application of emerging technologies

When we consider the impact of digital disruption on organisations, steel companies tend to be overlooked. However, the fact is that entire industry needs an upgrade to achieve its true potential moving forward, especially considering the various challenges the industry is facing.

Continuous trade wars between the world's major economies and the steel vs aluminium debate in auto manufacturing are some of the many well-known threats that the steel industry needs to develop strategies for. Likewise, unexpected threats, the surprises that arise through digital technologies and changing customer expectations also merit consideration.

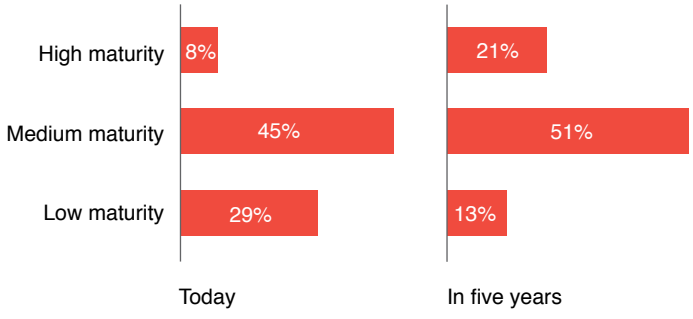
These new and possibly more disruptive improvements can challenge the traditional steel company's business models. Digital disruption will enable the steel industry to prepare itself for unexpected challenges and become more competitive.

The advantages of the digitised value chain include seamless client interaction and higher service levels, a 2–4% improvement in EBITDA, and reductions in inventory of 10 days or more.[26]

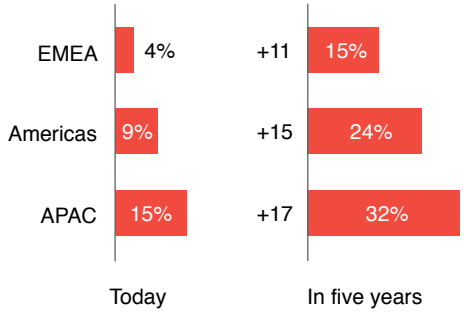
Companies can benefit from emerging technologies like predictive analytics, IOT and data lakes through agile pilot tests and get positive results within a few weeks or months. What's more, most organisations can start gaining positive ROI in the first few years. As per the Global Digital Operations Study by PwC and Strategy&,[27] companies all over world are expecting to increase their digital ecosystem maturity over next five years.

Progress towards facilitating digital ecosystem

To what extent have you made progress toward the implementation of digital ecosystems? And five years from now?



Current digital ecosystem maturity and future development by geographic region



Source: PwC and Strategy& Global Digital Operations Study 2018

26 https://www.weforum.org/agenda/2019/06/the-digital-revolution-will-transform-steel-and-metals-companies/

27 https://www.strategyand.pwc.com/gx/en/insights/industry4-0.html

Some of the challenges faced by steel companies which can be solved by emerging digital technologies are:

First, complex value chains pose a serious challenge to the metal and steel industry. Organisations must take steps to deal with the vast amount of interconnected assets, a varied client base, a large number of items with changing quality requirements and services, and complicated distribution channels with various margin implications.

Though utilisation of resources is recognised as a priority to determine incentives, it is not the sole factor influencing the business drivers that impact overall revenue, profit margin, working capital, or service levels. Plants and resources usually work in silos, instead of working together to meet a larger strategic goal. Inventory network administrators either lack or have little access to real-time data, rendering them incapable of foreseeing changes in the market. As a result, companies end up acting defensively, without having the capacity installed to minimise risk and leverage short-term opportunities, which ultimately leads to significant value losses.

Metal and steel organisations have been struggling to overcome these challenges; however, conventional operational improvement techniques have their own limitations. Digitisation can help in breaking through the human capacity bottleneck and developing extensive real-time performance systems in the overall supply chain of the steel industry, thereby resolving some of the challenges.

Variability across the steel Industry—chiefly in processes, production and supply chain, and labour costs—decreases as digital connectivity is embedded vertically and horizontally throughout companies, streamlining their processes and yielding efficiencies. Also, as demand for customised services and products rises, digital manufacturing (including real-time data analytics, self-monitoring and remote control of equipment) will enable faster tailoring of processes and operations that are less dependent on human labour, thus cutting the costs of variability in conventional manufacturing.

Of course, not all digital technologies will result in cost cutting and revenue generation for all manufacturers to the same degree. Steel companies are digitalising operations incrementally and looking to grab the low-hanging fruit with the highest RoI. One of the leading American vehicle manufacturing companies has connected all of its industrial robots to a centralised cloud, which can back up programs and monitor performance and signals when there is an imminent need for repairs, preventing or reducing the idle time of any of the company's thousands of robots. Preventing downtime could lead to massive savings, given that a study by Nielsen Research, estimated that any disruption to production at automotive factories costs an average of USD 22,000 a minute.[28]

28 https://news.thomasnet.com/companystory/downtime-costs-auto-industry-22k-minute-survey-481017

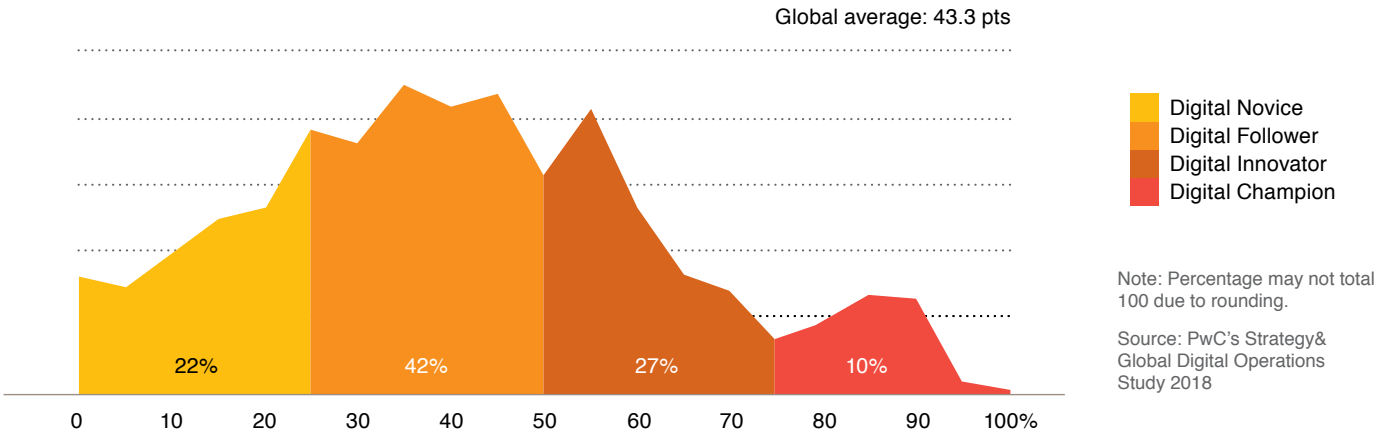
Harnessing the power of digital through emerging technologies across business

Distinct from Industry 3.0, which involved the automation of single machines and processes, Industry 4.0 encompasses end-to-end digitisation and data integration of the value chain: offering digital products and services, operating connected physical and virtual assets, transforming and integrating all operations and internal activities, building partnerships, and optimising customer-facing activities

Mastering Industry 4.0 requires a deep understanding of collaboration, the commitment of top management and a clear strategy. Companies that fail to embrace this radical change will likely struggle to survive. Yet, only a few companies are poised to benefit from Industry 4.0 at this moment. We call this select group digital champions.

Global Digital Operations Study 2018 categorises firms into digital novices, followers, innovators and champions based on their digital maturity levels.

Distribution of digital maturity levels

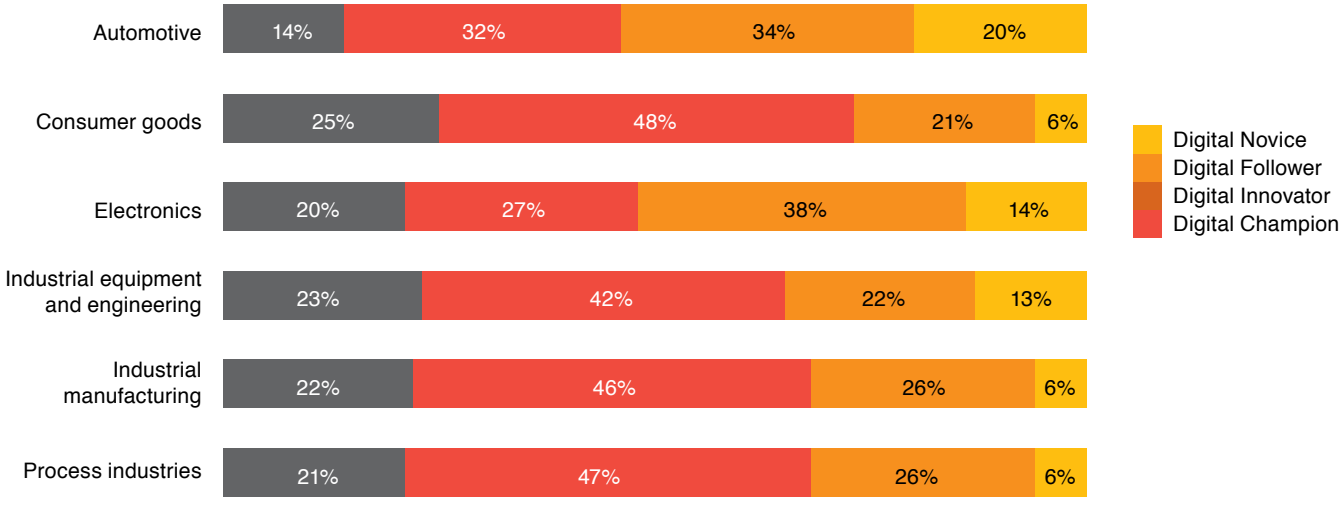


Note: Percentage may not total 100 due to rounding.

Source: PwC's Strategy& Global Digital Operations Study 2018

Among industries, automotive and electronics have the largest share of digital champions, at 20% and 14% respectively. Operations in auto companies have been optimised, automated, and connected for decades, and electronics manufacturers have been at the forefront of outsourced manufacturing, which requires connecting and managing disparate systems and partners across an extended value chain. Consumer goods, industrial manufacturing and process industries lag significantly behind

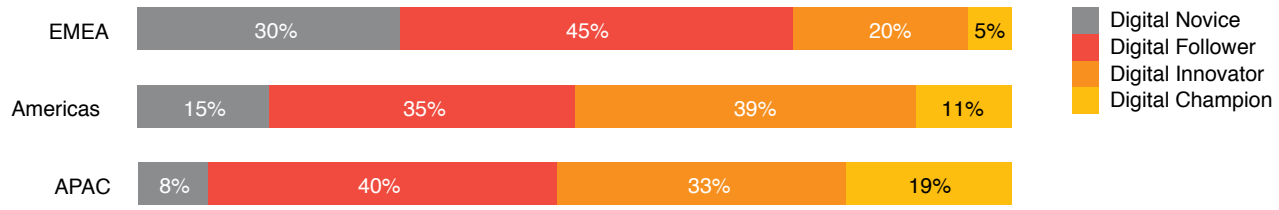
Level of digital maturity by industry



Source: PwC's Strategy& Global Digital Operations Study 2018

From a regional perspective, Asian (APAC) companies are clearly the most advanced, with 19% of the companies from that region in the digital champion category, followed by America, with 11%. European companies lag behind, with just 5% of companies in the digital champion segment. Asian companies have the advantage of setting up robust digital operations from essentially a blank slate in terms of factory automation, workforce, and even organisational IT networks as a whole – that is, without having numerous complex legacy systems and facilities to upgrade, integrate or discard. In addition, Asian companies appear to be keener to try new business models and develop innovative products and services.

Level of digital maturity by geographic region

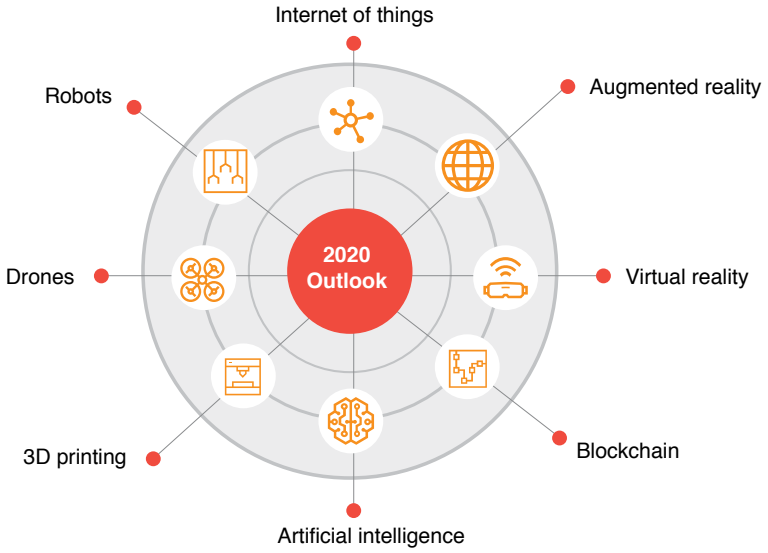


Source: PwC's Strategy& Global Digital Operations Study 2018

Organisations can conduct a small-scale pilot test that focuses on a single business unit, geographic market or asset. The pilot can begin with a few advanced use cases, demonstrating the benefits of the digital methodology and serving as a roadmap for setting up in-house arrangements.

Applications of emerging technologies in the steel industry

The eight emerging technologies, collectively and commonly referred to as Industry 4.0, are depicted below:

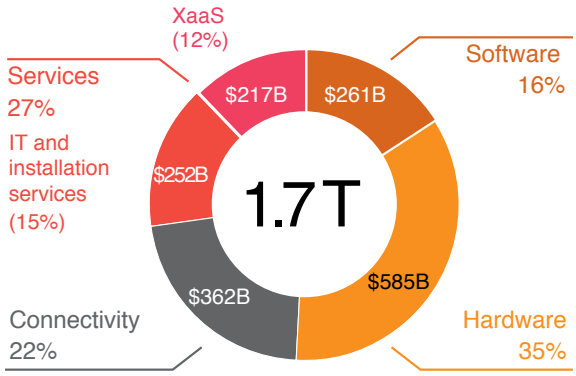


Source: PwC analysis

Industry 4.0 makes it feasible to collect and analyse data across machines, allowing faster, more flexible, compliant and more efficient business processes to produce superior quality goods at reduced costs. This in turn will increase productivity and promote economies of scale, encouraging industrial growth and transforming the workforce in manufacturing industry – ultimately increasing the competitiveness of companies across regions. Some of the emerging technologies that are relevant to the manufacturing and steel industry are discussed below.

Internet of things (IoT)

According to International Data Corporation (IDC), a total of USD 6 trillion will be spent on IoT solutions between 2015 and 2020. IoT investments by businesses will grow from USD 215 billion in 2015 to USD 832 billion in 2020, while consumer spending on IoT solutions will rise from USD 72 billion to USD 236 billion. The IoT marketplace will be worth USD 1.7 trillion in 2020, with the biggest portion being hardware, followed by services, connectivity and software.[29]



Sources: "IDC's Worldwide Internet of Things Taxonomy, 2015," IDC, May 2015;

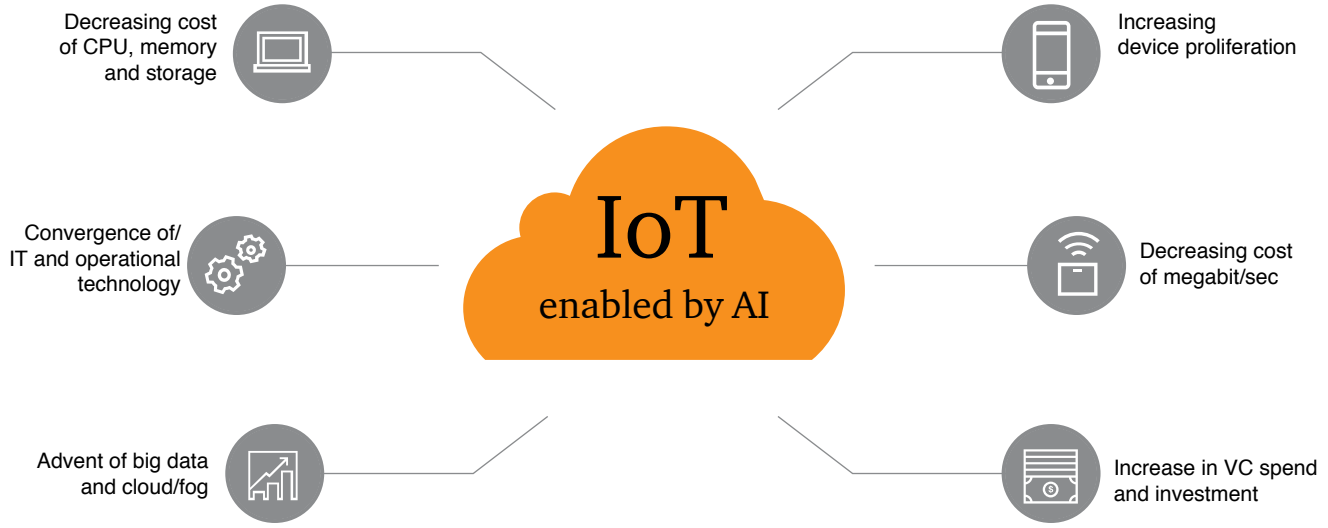
"Worldwide Internet of Things Forecast, 2015 – 2020," IDC, May 2015.

29 PwC report - Leveraging the upcoming disruptions from AI and IoT
IDC's Worldwide Internet of Things Taxonomy, 2015, IDC, May 2015;
Worldwide Internet of Things Forecast, 2015 – 2020, IDC, May 2015

The utilisation of IoT sensors in steel-producing equipment enables condition-based maintenance alerts/cautions. There are numerous critical machine tools that are designed to work inside certain temperature and vibration ranges. IoT sensors can effectively monitor machines and send an alert when the equipment deviates from its standardised parameters. By guaranteeing the working environment for machinery, producers can conserve energy, reduce costs, eliminate machine downtime and increase operational effectiveness.

As per a study by PwC, the following are the drivers of IoT growth:

Drivers of IoT growth



Source: PwC

Maintenance costs in the steel industry constitute a significant percentage of the total production cost.[30] If maintenance is scheduled too early, it could be a waste of money, but if one waits for too long, it might result in a huge cost. Corrective measures can prevent breakdown and can be done through IoT-enabled asset monitoring by creating work orders for the maintenance of machinery based on the current status of the machinery, as tracked by sensors. This will help in reducing the impact on output as any kind of breakdown is prevented. On the other hand, IoT-empowered machinery can transmit operational data to various entities like original equipment manufacturers. This will allow operation supervisors and industrial facility heads to remotely deal with the production line units and exploit process automation and optimisation. In addition, a digitally connected unit will set up a better line of command and help distinguish key result areas for managers.

An Indian steel manufacturing company in India has implemented an IoT framework at one of its plants, using a network of machines, advanced analytics and highly skilled IT professionals. With this, the health and status of machines can be monitored remotely by registering mobile devices on the IoT cloud. According to the company, the IoT framework has improved the efficiency and productivity of the plant.[31]

Robots

Use of robots in the steel industry is not a new trend. Today, robots come with artificial intelligence embedded with machine learning that in turn power cognitive competences. Equipped with computer vision, these robots can inspect items in bulk for errors, automate the transportation of work-in-progress or finished goods, and avoid safety risks using predictive intelligence.

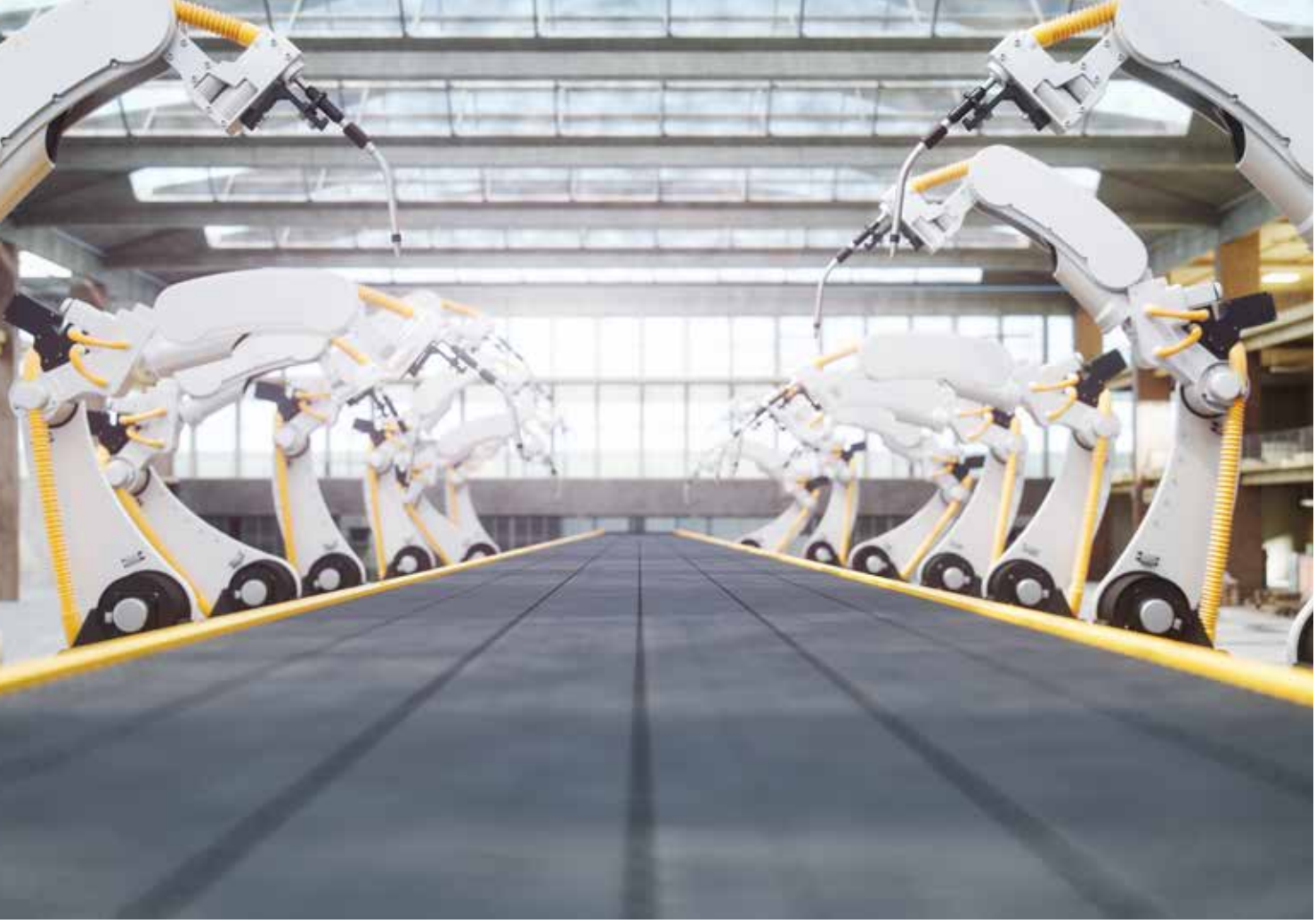
In particular, with regard to Industry 4.0, the demands on material composition of steel have increased in terms of precision and accuracy. Bringing autonomous robots into the picture will allow precision and consistency. With such robots, labour costs will be reduced, and productivity can increase as the robots can work continuously around the clock without fatigue. Further, employee safety can be improved in highly hazardous environments, and insurance and injury leave costs can be reduced significantly. In addition, drones can be utilised in different warehouse operations – inbound logistics in time-critical circumstances, transporting materials from storage to production line, efficiently scanning stock – thus reducing overall labour costs.

However, as technology progresses, prices are dropping. As per research by ARK, the cost of industrial robots is likely to reduce by 50–60% in the next 5 years.[32]

30 https://www.ndt.net/article/wcndt00/papers/idn135/idn135.htm

31 https://www.cioandleader.com/article/2017/06/05/how-jindal-steel-and-power-using-iot-future-proof-its-business

32 https://ark-invest.com/research/industrial-robot-cost-declines



A hi-tech robotic welding line is being used by an Indian steel company at its automotive service centre to increase capacity. As the biggest, fastest and most efficient robotic welding line, it can weld more than a thousand car parts in an hour. As a result, the site can produce more sheets of special steel without any impact on the employment levels.[33]

Drones

Commercial drones are being used in steel manufacturing. These are extremely useful to inspect materials and devices without disturbing production. Such inspections will reduce downtime drastically and also reduce the time taken to detect a specific issue in more inaccessible environments like finishing mills and furnaces. Drones are also being employed to collect better quality data due to their ability to take images at close range.

The drone market will grow steadily in the consumer, commercial and military sectors. In a 2016 report, Goldman Sachs estimated that drone technologies will reach a total market size of USD 100 billion between 2016 and 2020. Though 70% of this figure would be linked to military activities, commercial business represents the fastest growth opportunity, projected to reach USD 13 billion between 2016 and 2020. It is estimated that currently, commercial applications have a total addressable market of USD 127 billion globally.[34] The numbers clearly indicate the huge potential of autonomous technology. Delivery of products to customers using autonomous drones and robots is also becoming increasingly common.

An Indian steel manufacturing company is deploying drones to report compliance issues and monitor the volumetric production.[35]

3D printing

Until now, 3D printing has been utilised by product designers and specialists, apart from a few manufacturing applications. However, prototyping of additive manufacturing machinery is improving, the number of substitutes for steel is increasing, and costs (for both printers and materials) are declining quickly. Thus, 3D printing is slowly reaching a point where it could see fast adoption by buyers and more applications in the steel industry. 3D printed steel is a material obtained by superimposing fine layers of steel, for which the base material is steel powder. The technology used in producing 3D printed steel is indirect metal printing.

33 https://economictimes.indiatimes.com/industry/indl-goods/svs/steel/tata-steel-unveils-uks-biggest-robotic-welding-line/articleshow/57171709.cms

34 https://www.toptal.com/finance/market-research-analysts/drone-market

35 https://www.livemint.com/technology/gadgets/flying-high-how-commercial-drones-are-taking-flight-in-india-through-enterprise-1551640246185.html

Some applications of 3D printing include:

- 3D models of steel structures can be printed. With this, design of objects can be easily improved without undertaking the complex manufacturing process.
- The supply chain of the industry can be drastically optimised as parts can be produced on demand with the availability of printers and base material.
- 3D printers can be installed in steel industries to produce steel and related parts.

A Swedish multinational which produces metal powders owns a production hall where metal products are 3D printed.[36]

Artificial intelligence

Applications of artificial intelligence involving predictive and preventive analytics can be used to avoid costs connected with supply chain failures. Steel companies need a better way to manage raw materials procurement. One way can be to use the supplier's route details as well as traffic and weather data provided by trustworthy external sources to identify the probability of delivery delays. A big data tool which uses predictive analytics can be used to calculate raw material shortages and possible delays in delivery. Based on these calculations, the company can work out a supply-related emergency plan that allows it to avoid interruptions in production and excessive downtime costs. Data on unplanned downtime with respect to steel production can be tracked. Machine learning agents can monitor the health of assets using analytical techniques such as logistic regression and neural networks. These techniques keep track of variables such as condition of the asset, frequency, weather and failure. Equipment breakdown is common in the operations of the metal and steel industry. Predictive maintenance use cases can help organisations optimise overall maintenance frequency.

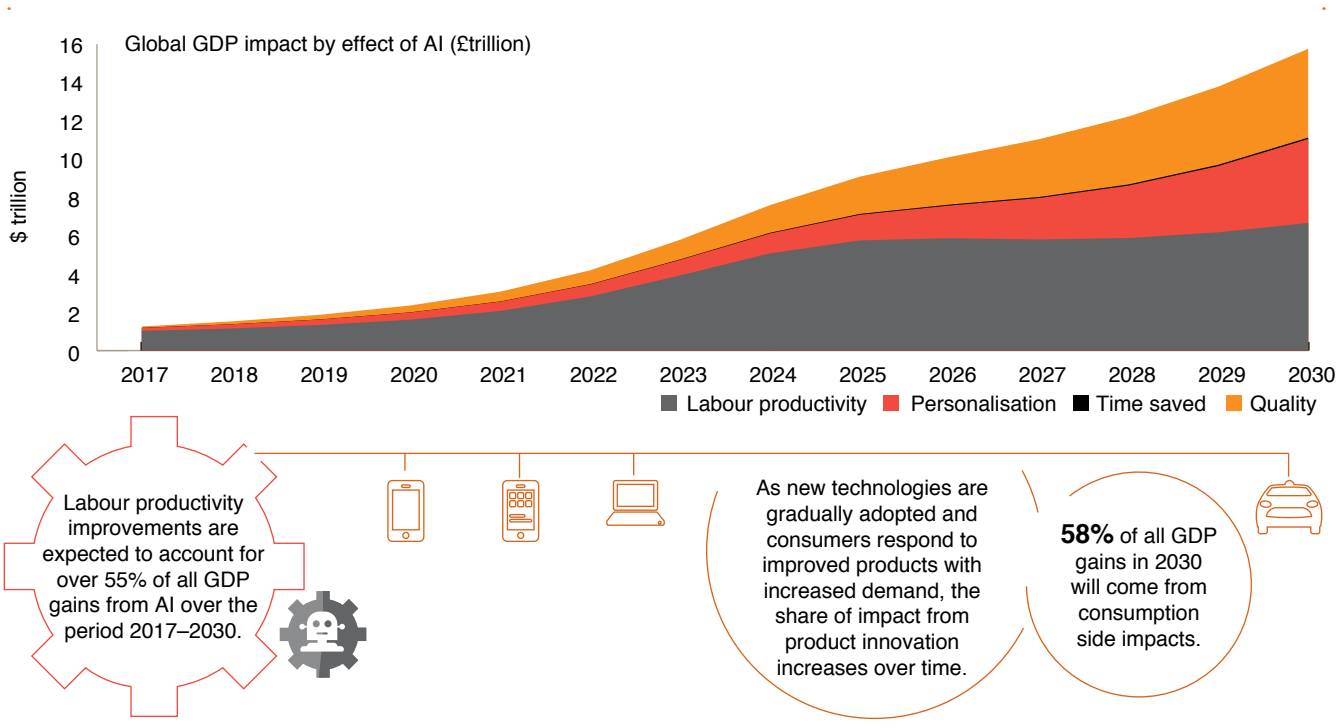
An American steel manufacturing company has started using artificial intelligence for demand prediction, to manage sourcing and inventory, and to optimise production and outbound transportation. The company is also planning to optimise end-to-end performance and profitability by integrating and interconnecting different business operations and plans.[37]

36 https://www.hoganas.com/en/services/digital-metal/

37 https://www.forbes.com/sites/tomdavenport/2018/02/08/shining-up-a-rusty-industry-with-artificial-intelligence/#e30913c61c43

As per a study by PwC, the following are the value gains from artificial intelligence:

Where will the value gains come from with AI?



Source: PwC Analysis

Road ahead

As India works towards becoming a manufacturing powerhouse through policy initiatives like Make in India, the steel industry has emerged as a major focus area given the dependence of a plethora of sectors on its output. India is currently the world's second largest producer of steel and is set to become the second largest consumer of steel, with the industry contributing about 2% of the country's GDP. The industry has the potential to help India regain its positive trade balance in steel as well as to drive the country's export manufacturing capabilities. The decline in exports is a concern and calls for efforts from both the public as well as the private sector. There is an urgent need to boost the competitiveness of the country's steel industry. In order to achieve this, cost reduction across the supply chain, development of efficient logistics and reduction in financing costs are some of the measures required. A sound credit sector, better investment environment and boost to infrastructure development will go a long way towards strengthening the industry.

Steel and metal manufacturing units are considered to be asset intensive. The steel industry is going through an exciting transformation with the evolution of various emerging technologies such as robots, drones and IoT that provide business with valuable solutions. In addition to automating processes, these technologies connect all units in a plant, allowing them to interact in real time and enhancing the efficiency of the whole system. Sound asset performance and technology integration will also boost labour productivity. This will help in reducing costs and increasing profitability across the industry. However, the introduction of new technologies will entail the development of a new talent pool with the requisite skills and the upskilling of the existing workforce. Investment in education and training will be a key enabler in these areas. The digital disruption has just begun and is set to increase exponentially in the next 10 years. The right adoption of the emerging technologies is a critical factor for success in times to come.

Though the steel industry in India and the rest of the world is grappling with certain challenges, a push from the government and the adoption of emerging technologies will enable India to become a USD 5 trillion economy in 5 years and to achieve the goals outlined in National Steel Policy, 2017.

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