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Industry Research Report on Specialty Cables, Train Control System and Interconnect Products

November 2024

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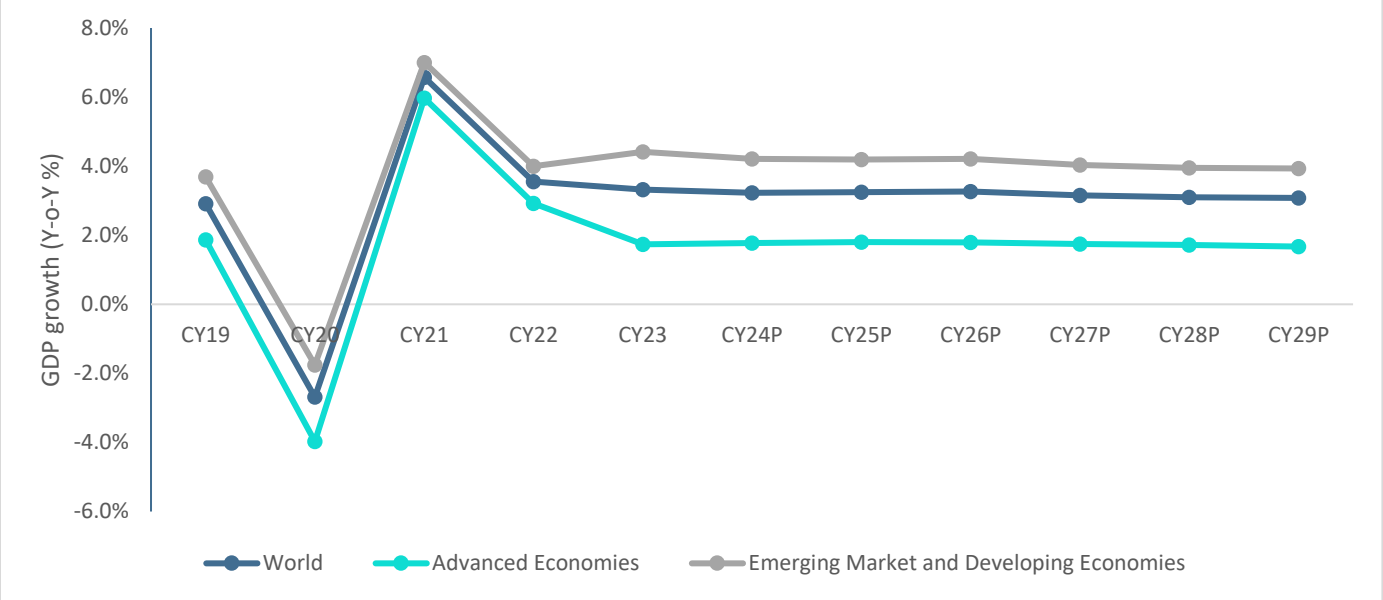
1. Economy Outlook

1.1 Global Economy

Global growth, which stood at 3.3% in CY23, is anticipated to fall and remain at 3.2% in both CY24 and CY25. The global real GDP growth outlook shows signs of improvement as cyclical imbalances ease, aligning economic activity with potential output in major economies. While global disinflation progresses, risks remain, particularly from financial market volatility and geopolitical tensions that could disrupt trade and increase commodity prices. Nonetheless, stronger public investment in advanced economies aimed at infrastructure and the green transition may stimulate private sector investment and bolster global demand. Additionally, accelerating structural reforms in both advanced and emerging markets could enhance productivity and support medium-term growth.

Chart 1: Global Growth Outlook Projections (Real GDP, Y-o-Y change in %)



Notes: P-Projection; Source: IMF – World Economic Outlook, October 2024

Table 1: GDP growth trend comparison - India v/s Other Economies (Real GDP, Y-o-Y change in %)

	Real GDP (Y-o-Y change in %)									
	CY20	CY21	CY22	CY23	CY24P	CY25P	CY26P	CY27P	CY28P	CY29P
India	-5.8	9.7	7.0	8.2	7.0	6.5	6.5	6.5	6.5	6.5
China	2.2	8.4	3.0	5.3	4.8	4.5	4.1	3.6	3.4	3.3
Indonesia	-2.1	3.7	5.3	5.0	5.0	5.1	5.1	5.1	5.1	5.1
Saudi Arabia	-3.6	5.1	7.5	-0.8	1.5	4.6	4.4	3.6	3.5	3.5

Brazil	-3.3	4.8	3.0	2.9	3.0	2.2	2.3	2.4	2.5	2.5
Euro Area	-6.1	6.2	3.3	0.4	0.8	1.2	1.5	1.4	1.3	1.2
United States	-2.2	6.1	2.5	2.9	2.8	2.2	2.0	2.1	2.1	2.1

P- Projections; Source: IMF- World Economic Outlook Database (October 2024)

Advanced Economies Group

Advanced economies are expected to experience a gradual increase in growth, increasing to 1.8% in CY24 and staying same for next 2 years.

The United States is expected to grow to 2.8% in CY24, followed by a slight slowdown to 2.2% in CY25. Growth outlook for the United States has improved due to strong consumption and non-residential investment, driven by rising real wages and wealth effects. However, growth is expected to decelerate as fiscal policies tighten and the labour market cools, leading to a gradual closure of the output gap.

The Euro Area's growth is anticipated to rebound from its sluggish growth in CY23 to 0.8% in CY24 and further to 1.2% in CY25. This recovery is driven by better export performance, as well as, a stronger domestic demand. The gradual loosening of the monetary policy is expected to boost investment and the rise of real wages is anticipated to improve the consumption patterns.

Emerging Market and Developing Economies Group

Emerging market and developing economies are forecasted to maintain stable growth at 4.2% in both CY24 and CY25. The economic forecast for emerging and developing Asia reveals a modest deceleration in growth, with projections indicating a decline from 5.3% in CY24 to 5% in CY25. China's trajectory reflects a gradual slowdown, transitioning from 4.8% in CY24 to 4.5% in CY25 due to low consumer confidence and ongoing real estate sector challenges. However, better than expected net exports have ensured that the slowdown in growth is marginal. In contrast, India's growth remains robust, with anticipated rates of 7% in CY24 and 6.5% in CY25. This moderation in GDP growth is expected as the surge in pent-up demand from the pandemic wanes. The economy is transitioning towards its potential, reflecting a more sustainable pace of growth as it adjusts to post-pandemic realities.

The Indonesian economy is expected to register growth of 5.0% in CY24 and 5.1% in CY25, an important concern for Indonesia is the trade fragmentation. **Saudi Arabia's** growth in CY24 is predicted to see a revamp in the growth rate to 1.5% on account of the extension of oil production cuts taking place in the country. Going forward, GDP is expected to grow at 4.6% in CY25. On the other hand, Brazil's growth is projected to be 3% in CY24 due to robust private consumption and investment driven by a strong labour market and effective government transfers. However, due to the anticipated tightening of the labour market and ongoing restrictive monetary policy, growth is expected to slowdown in CY25 to 2.2%.

Despite the turmoil in the last 2-3 years, India bears good tidings to become a USD 5 trillion economy by CY27. According to the IMF dataset on Gross Domestic Product (GDP) at current prices, the nominal GDP has been at USD 3.6 trillion for CY23 and is projected to reach USD 5.2

trillion by CY27 and USD 6.3 trillion by CY29. India's expected GDP growth rate for coming years is almost double compared to the world economy. The Indian economy shows resilience amid global inflation, supported by a stable financial sector, strong service exports, and robust investment driven by government spending and high-income consumer consumption, positioning it for better growth than other economies.

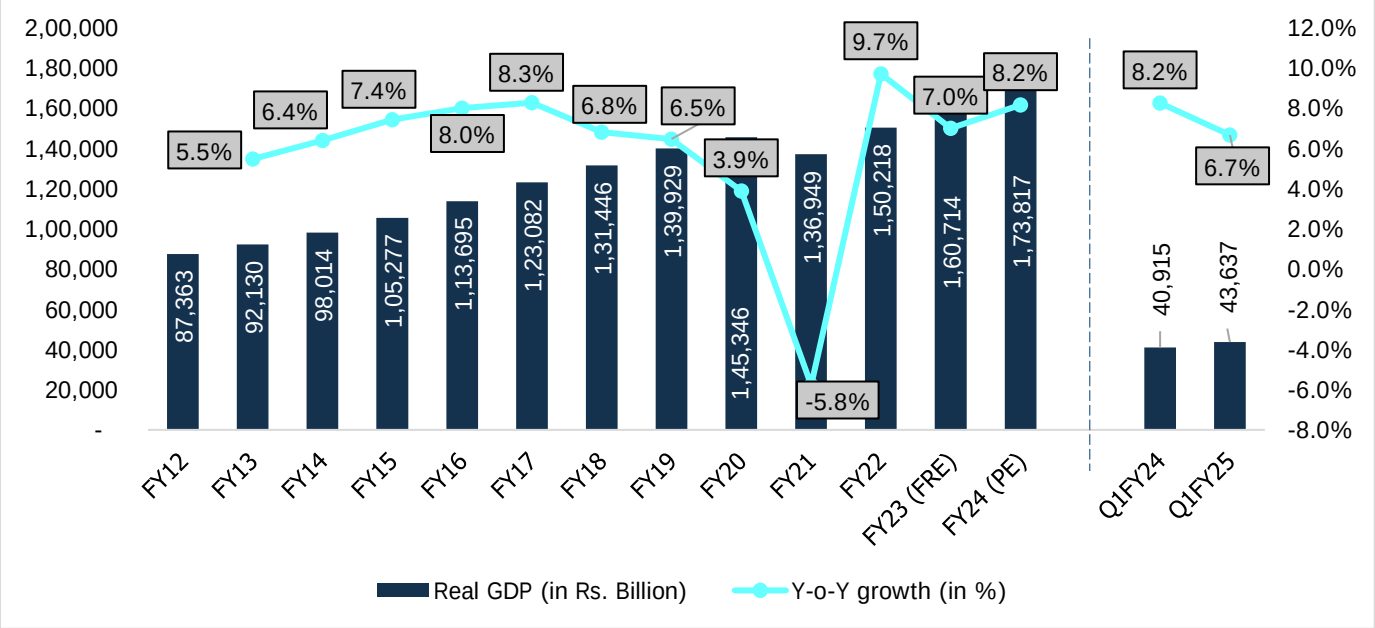
Besides, India stands out as the fastest-growing economy among the major economies. The country is expected to grow at more than 6.5% in the period of CY24-CY29, outshining China's growth rate. By CY27, the Indian economy is estimated to emerge as the third-largest economy globally, hopping over Japan and Germany. Currently, it is the third largest economy globally in terms of Purchasing Power Parity (PPP) with a ~7.9% share in the global economy, with China (~18.7%) on the top followed by the United States (~15.1%).

1.2 Indian Economic Outlook

1.2.1 GDP Growth and Outlook

Resilience to External Shocks remains Critical for Near-Term Outlook

Chart 2: Trend in Real Indian GDP growth rate



Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

India's real GDP grew by 7.0% in FY23 and stood at ~Rs. 161 trillion, as per the First Revised Estimate, despite the pandemic in previous years and geopolitical Russia-Ukraine spillovers. Real GDP in the year FY24 is estimated to grow at 8.2% at Rs. 173.82 trillion as per provisional estimate of the Ministry of Statistics and Programme Implementation. It is expected that domestic demand, especially investment, to be the main driver of growth in India, amid sustained levels of business and consumer confidence.

In Q1FY25, real GDP grew by 6.7% y-o-y, hitting a 15-month low, as compared to 8.2% y-o-y in the previous quarter. Private consumption, a key driver of the GDP, showed resilience increasing by 7.45% while government spending contracted by 0.24%. This growth was largely driven by elections and extreme summer conditions, which impacted economic activities across several sectors.

GDP Growth Outlook

- Driven by fixed investment and improving global environment, domestic economic activity continues to expand. The provisional estimates (PE) placed real GDP growth at 8.2% for FY24.

- Industrial activity led by manufacturing continues its momentum on the back of strengthening domestic demand, lower input costs, and a supportive policy environment. The purchasing managers' index for both manufacturing and services sector remained elevated in September 2024, indicating a robust expansion.

- Domestic economic activity continues to remain steady. On the supply side, advancing monsoon has boosted kharif sowing and improved agricultural production prospects, while higher reservoir levels and good soil moisture conditions are favorable for the upcoming rabi crop. Additionally, growth in GVA for major non-agricultural sectors like manufacturing, construction, and utilities has stayed above 5% for Q1FY25, indicating expansion. On the demand side, household consumption is bolstered by an upward trend in rural demand while urban demand continues to hold firm. Additionally, improvement in government consumption can also be observed. Moreover, on the global trade front, services exports are supporting overall growth.

- Fixed investment activity is robust, supported by the government's ongoing focus on capital expenditure, healthy balance sheets of banks and corporates, and other policy measures. Private investment is picking up, driven by an increase in non-food bank credit, higher capacity utilization, and rising investment intentions.

Persistent geopolitical tensions, volatility in international financial markets and geo-economic fragmentation do pose risk to this outlook. Based on these considerations, the RBI, in its October 2024 monetary policy, has projected real GDP growth at 7.2% y-o-y for FY25.

Table 2: RBI's GDP Growth Outlook (Y-o-Y %)

FY25P (complete year)	Q2FY25P	Q3FY25P	Q4FY25P	Q1FY26P
7.2%	7.0%	7.4%	7.4%	7.3%

Note: P-Projected; Source: Reserve Bank of India

1.2.2 Gross Value Added (GVA)

Gross Value Added (GVA) is the measure of the value of goods and services produced in an economy. GVA gives a picture of the supply side whereas GDP represents consumption.

Industry and Services sector leading the recovery charge

• The gap between GDP and GVA growth turned positive in FY22 (after a gap of two years) due to robust tax collections. Of the three major sector heads, the service sector has been the fastest-growing sector in the last 5 years.

• In FY23, the agriculture sector performed well despite weather-related disruptions, such as uneven monsoon and unseasonal rainfall, impacting yields of some major crops and clocked a growth of 4% y-o-y, garnering Rs. 22.3 trillion. The agriculture sector's growth slowed in FY24 to an estimated 1.4% rise for the year, down from 4.7% in FY23. The sector reached to Rs. 23.1 trillion for FY24 as per provisional estimate. In Q1FY25, the agriculture sector grew by only 2% y-o-y as compared to 3.7% in Q1FY24. Better monsoon conditions are expected to brighten outlook for the agriculture sector. Going forward, rising bank credit and increased exports will be the drivers for the agriculture sector.

• The industrial sector output in FY23 grew by only 2.1% with estimated value Rs. 44.74 trillion owing to decline in manufacturing activities. India's industrial sector experienced robust growth in FY24 supported by positive business sentiment, falling commodity prices, and government policies like production-linked incentives. The sector grew by 9.5% on y-o-y basis, reaching Rs. 48.9 trillion for FY24. In Q1FY25, the industrial sector grew by 8.3% y-o-y as compared to 6% in Q1FY24. This growth was driven mainly by sales growth in manufacturing companies, construction, and utility services. Construction grew at the highest rate of 10.5% as compared to a growth rate of 8.3% in the same quarter in previous year.

• In FY23, benefitting from the pent-up demand, the services sector was valued at Rs. 80.6 trillion and registered growth of 10.0% y-o-y. In FY24, India's services sector growth was driven by steady growth in various service sector indicators like air passenger traffic, port cargo traffic, GST collections, and retail credit. With this, the growth of service sector is estimated at Rs. 86.7 trillion registering 7.6% growth in FY24 overall. In Q1FY25, the services sector grew by only 7.2% y-o-y as compared to 10.7% in Q1FY24.

Table 3: Sectoral Growth (Y-o-Y % Growth) - at Constant Prices

At constant Prices	FY19	FY20	FY21	FY22	FY23 (FRE)	FY24 (PE)	Q1FY24	Q1FY25
Agriculture, Forestry & Fishing	2.1	6.2	4.1	3.5	4.7	1.4	3.7	2.0
Industry	5.3	-1.4	-0.9	11.6	2.1	9.5	6	8.3
Mining & Quarrying	-0.9	-3.0	-8.6	7.1	1.9	7.1	7.0	7.2
Manufacturing	5.4	-3.0	2.9	11.1	-2.2	9.9	5.0	7.0
Electricity, Gas, Water Supply & Other Utility Services	7.9	2.3	-4.3	9.9	9.4	7.5	3.2	10.4
Construction	6.5	1.6	-5.7	14.8	9.4	9.9	8.6	10.5
Services	7.2	6.4	-8.2	8.8	10.0	7.6	10.7	7.2
Trade, Hotels, Transport, Communication & Broadcasting	7.2	6.0	-19.7	13.8	12.0	6.4	9.7	5.7
Financial, Real Estate & Professional Services	7.0	6.8	2.1	4.7	9.1	8.4	12.6	7.1
Public Administration, Defence and Other Services	7.5	6.6	-7.6	9.7	8.9	7.8	8.3	9.5

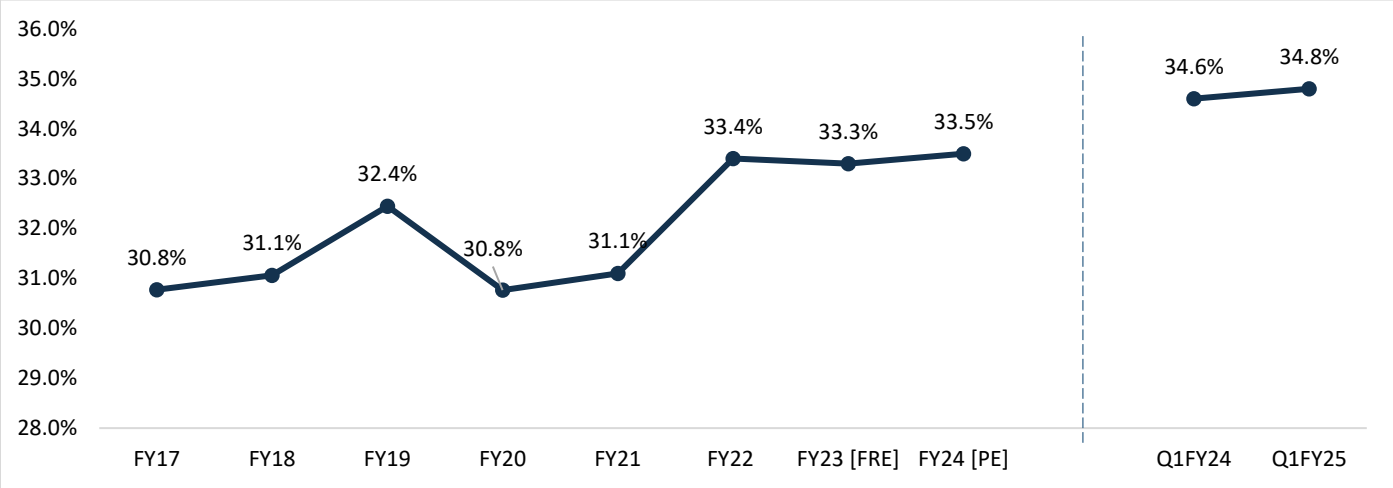
At constant Prices	FY19	FY20	FY21	FY22	FY23 (FRE)	FY24 (PE)	Q1FY24	Q1FY25
GVA at Basic Price	5.8	3.9	-4.2	8.8	6.7	7.2	8.3	6.8

Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

1.2.3 Investment Trend in Infrastructure

Gross Fixed Capital Formation (GFCF) is a measure of the net increase in physical assets. In FY23, the ratio of investment (GFCF) to GDP remained flat, as compared to FY22, at 33.3%. Continuing in its growth trend, this ratio has reached 33.5% in FY24. In Q1FY25, GFCF as a proportion in GDP, reached 34.8% as compared to 34.6% in Q1FY24 mainly reflecting growth in private investment.

Chart 3: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices)



Note: 3RE – Third Revised Estimate, 2RE – Second Revised Estimates, 1RE – First Revised Estimates, PE – Provisional Estimate, FAE-First Advance Estimate; Source: MOSPI

Overall, the support of public investment in infrastructure is likely to gain traction due to initiatives such as Atmanirbhar Bharat, Make in India, and Production-linked Incentive (PLI) scheme announced across various sectors.

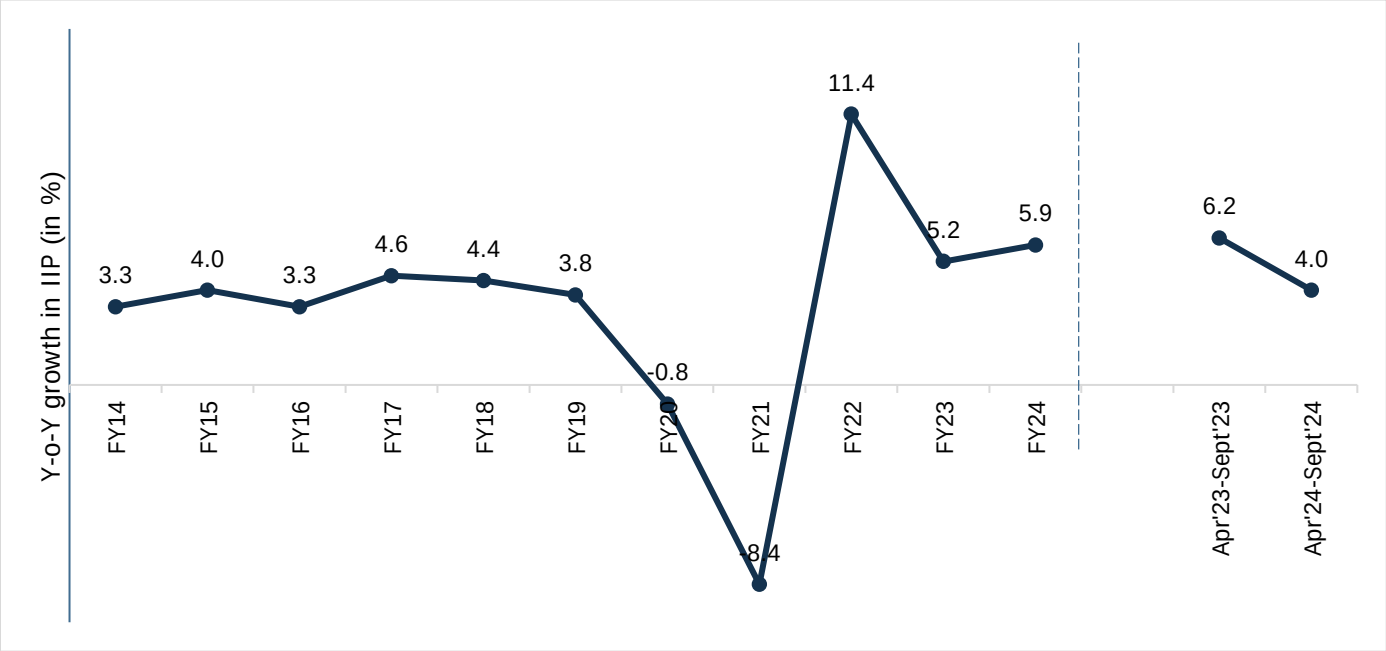
1.2.4 Industrial Growth

Improved Core and Capital Goods Sectors helped IIP Growth Momentum

The Index of Industrial Production (IIP) is an index to track manufacturing activity in an economy. During FY23, the industrial output recorded a growth of 5.2% y-o-y supported by a favorable base and a rebound in economic activities. During FY24, the industrial output recorded a growth of 5.9% y-o-y supported by growth in manufacturing and power generation sectors. The period April 2024 – September 2024, industrial output grew by 4.0% compared to the 6.2% growth in the corresponding period last year. For the month of September 2024, the IIP growth increased by 3.1% as compared to the last year's IIP growth of 6.4%. This increase was on account of all

the used based segments witnessing a growth in their Y-o-Y growth in September 2024 compared to August 2023. The manufacturing sector also grew modestly in September 2024 by 3.9% as compared to a growth of 5.1% in September 2023. Within the growth in manufacturing, the top three positive contributors were Manufacture of basic metals, Manufacture of electrical equipment, and Manufacture of coke and refined petroleum products. So far in the current fiscal, the government's strong infrastructure spending and rising private investment are evident, though consumer non-durables production has declined. Urban demand drives consumption, while rural demand improves, highlighting the importance of sustained consumption and investment for industrial performance.

Chart 4: Y-o-Y growth in IIP (in %)



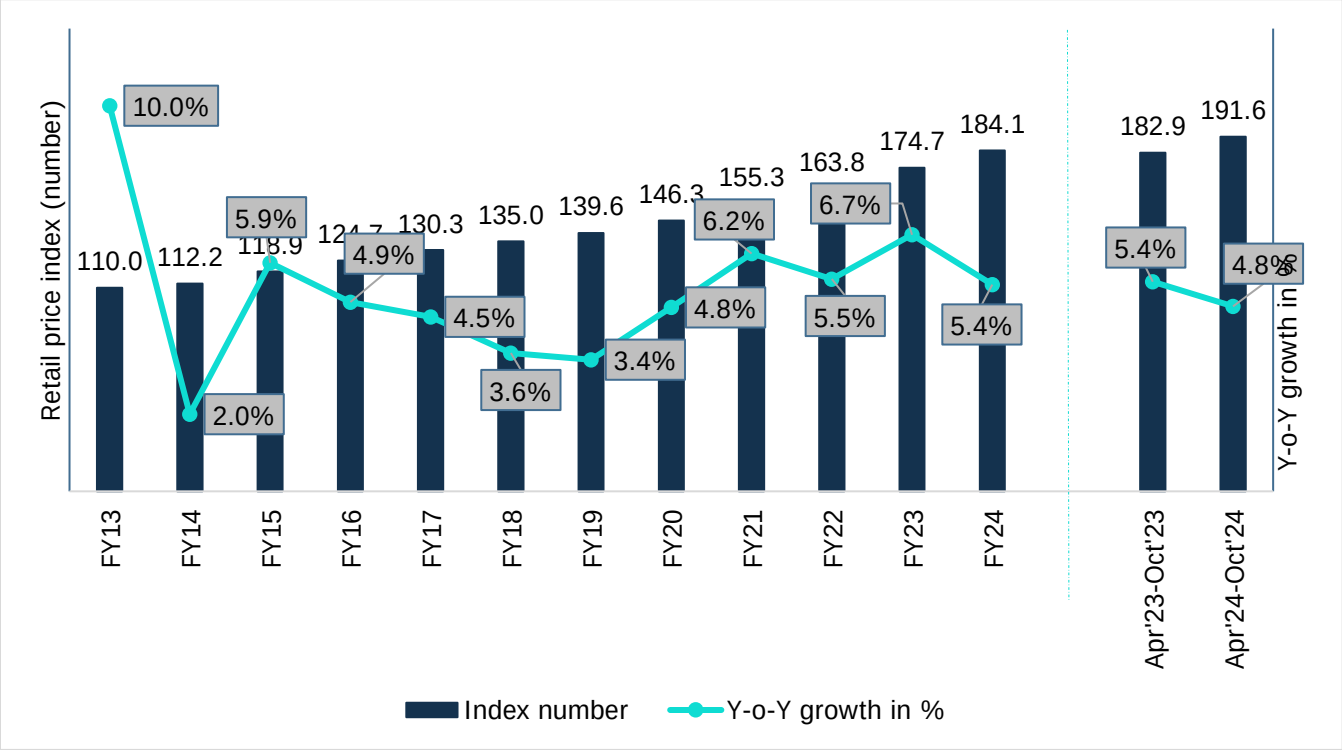
Source: MOSPI

1.2.5 Consumer Price Index

India's consumer price index (CPI) tracks retail price inflation in the economy. During FY23, CPI remained elevated at an average of 6.7%, above the RBI's tolerance level. In FY24, the Consumer Price Index (CPI) showed fluctuations, starting with a moderation to 4.3% in May 2023, followed by a spike to 7.4% in July 2023 due to rising food prices. Overall, inflation moderated to 5.4% for the year, remaining within the RBI's target range of 2% to 6%, despite volatility in food prices throughout the months. High inflation in specific food items poses inflation risk, even though an improvement in south-west monsoon and better kharif sowing are improving the food inflation outlook. The numbers for April 2024-October 2024 show a decline in inflation growth y-o-y to 4.8% as compared to inflation growth y-o-y of 5.4% in April 2023-October 2023 period. For October 2024, CPI inflation stood at 6.2% which has been the highest retail inflation since December 2023. There

was a decline in inflation observed among the subgroups pulses & products, eggs, sugar & confectionery and spices subgroup.

Chart 5: Retail Price Inflation in terms of index and Y-o-Y Growth in % (Base: 2011-12=100)

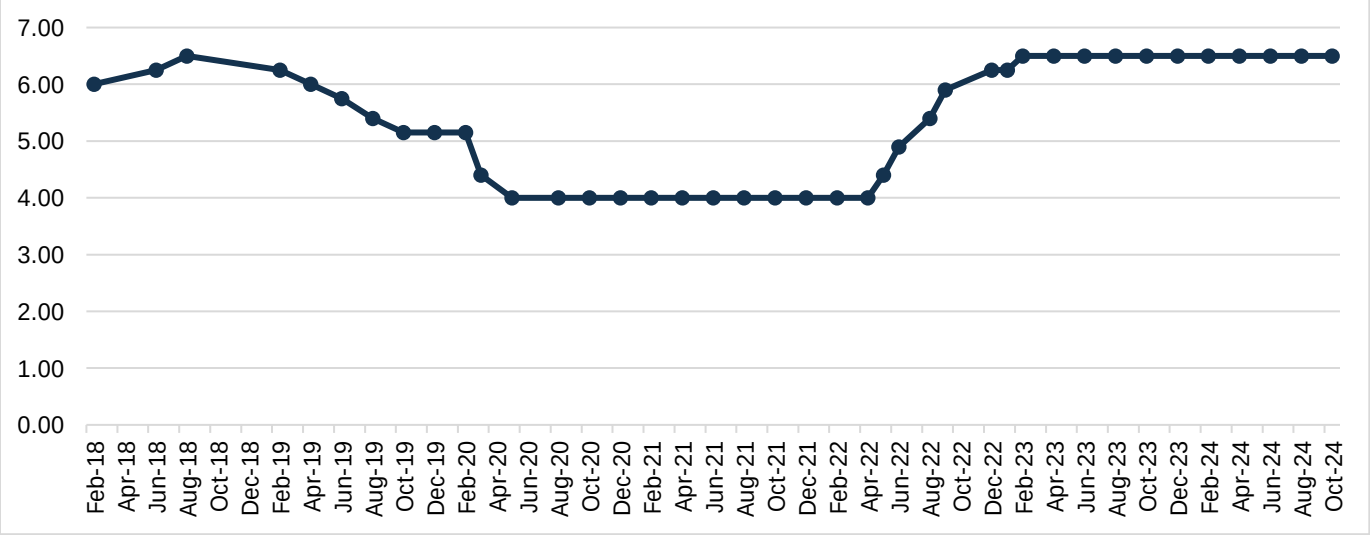


Source: MOSPI

The CPI is primarily factored in by RBI while preparing their bi-monthly monetory policy. At the bi-monthly meeting held in October 2024, RBI projected inflation at 4.5% for FY25 with inflation during Q2FY25 at 4.1%, Q3FY25 at 4.8%, Q4FY25 at 4.2%, and Q1FY26 at 4.3%.

Considering the current inflation situation, RBI has kept the repo rate unchanged at 6.5% again in the October 2024 meeting of the Monetary Policy Committee.

Chart 6: RBI historical Repo Rate



Source: RBI

Further, the central bank changed its stance to neutral. While headline inflation has started easing due to softening in core component and economic activity has been resilient supported by domestic and investment demand, volatility in food prices due to adverse weather conditions pose a risk to the path of disinflation. Core inflation has likely reached its lowest point, and fuel prices are contracting. Domestic growth remains strong, driven by private consumption and investment, allowing the MPC to focus on bringing inflation down to the 4% target. As a result, the MPC decided to adopt a 'neutral' stance, monitoring inflation while supporting growth.

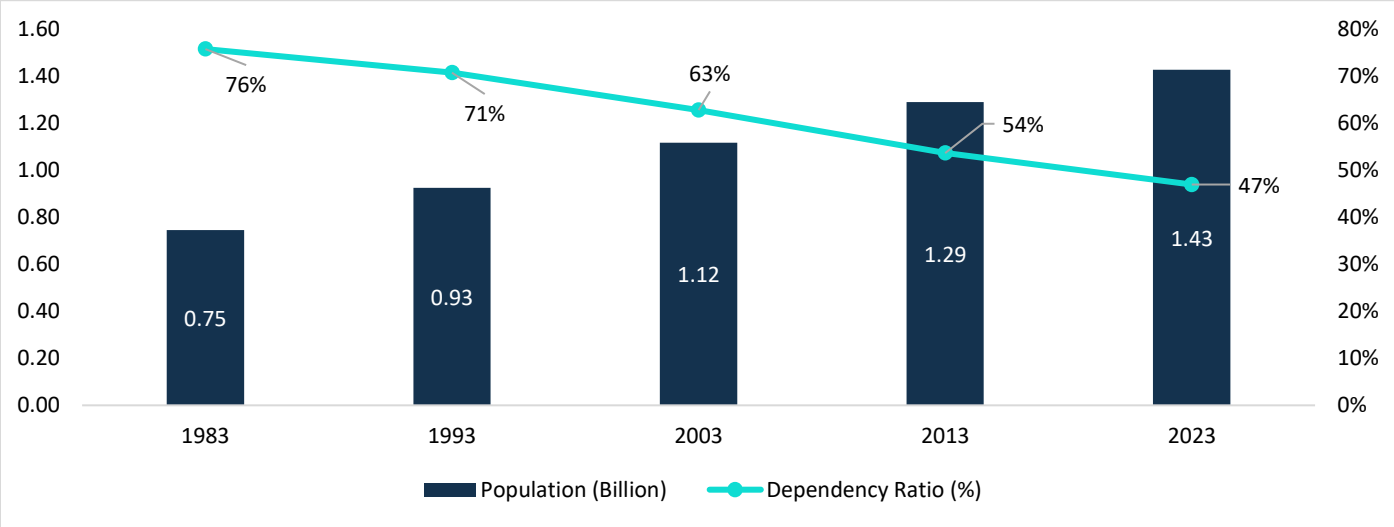
1.2.6 Overview on Key Demographic Parameters

- Population growth and Urbanization

The trajectory of economic growth of India and private consumption is driven by socio-economic factors such as demographics and urbanization. According to the world bank, India's population in 2022 surpassed 1.42 billion slightly higher than China's population 1.41 billion and became the most populous country in the world.

Age Dependency Ratio is the ratio of dependents to the working age population, i.e., 15 to 64 years, wherein dependents are population younger than 15 and older than 64. This ratio has been on a declining trend. It was as high as 76% in 1983, which has reduced to 47% in 2023. Declining dependency means the country has an improving share of working-age population generating income, which is a good sign for the economy.

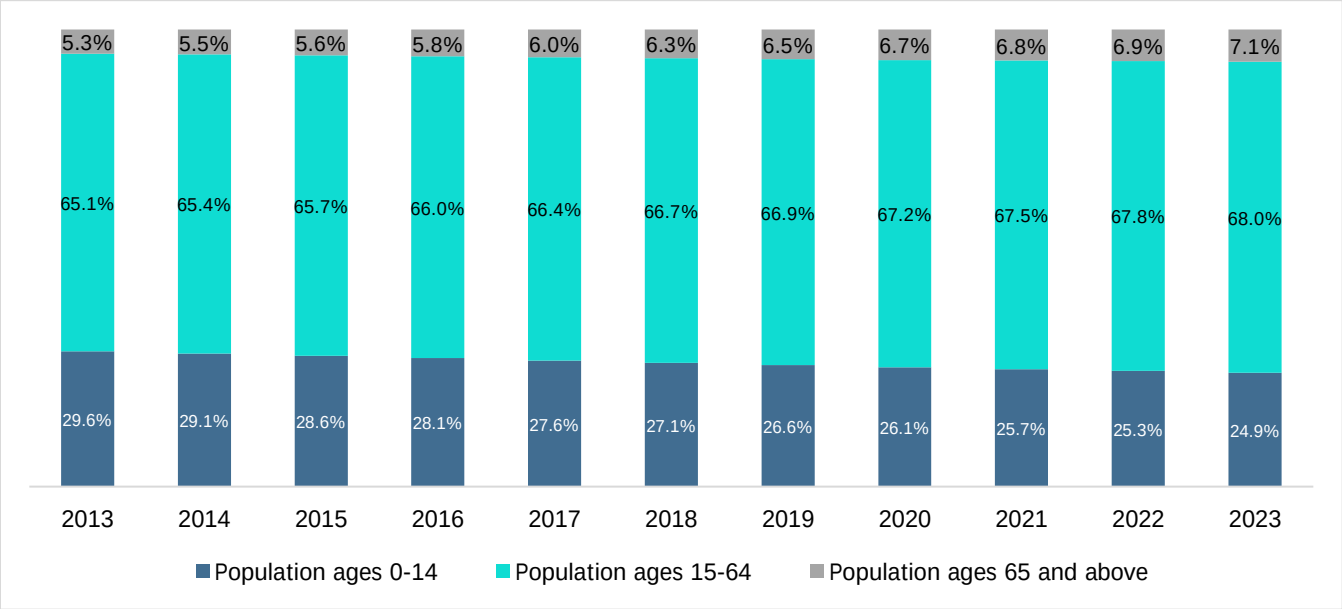
Chart 7: Trend of India Population vis-à-vis dependency ratio



Source: World Bank Database

With an average age of 29, India has one of the youngest populations globally. With vast resources of young citizens entering the workforce every year, it is expected to create a 'demographic dividend'. India is home to a fifth of the world's youth demographic and this population advantage will play a critical role in economic growth.

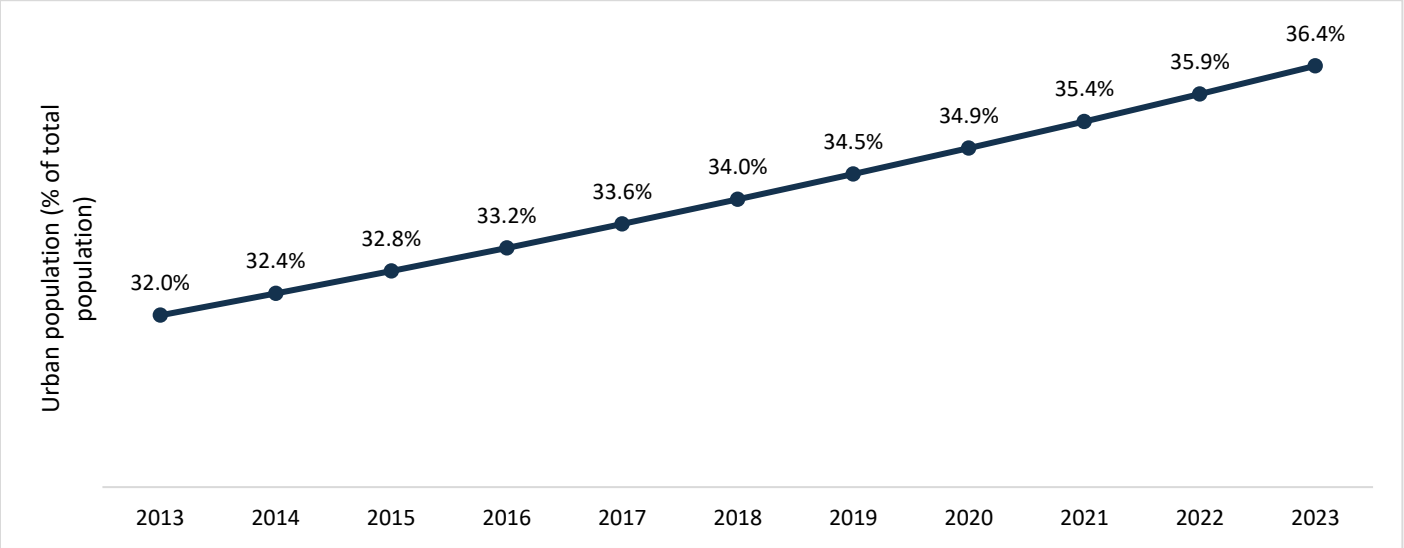
Chart 8: Age-Wise Break Up of Indian population



Source: World Bank Database

The urban population is significantly growing in India. The urban population in India is estimated to have increased from 413 million (32% of total population) in 2013 to 519.5 million (36.4% of total population) in the year 2023.

Chart 9: Urbanization Trend in India



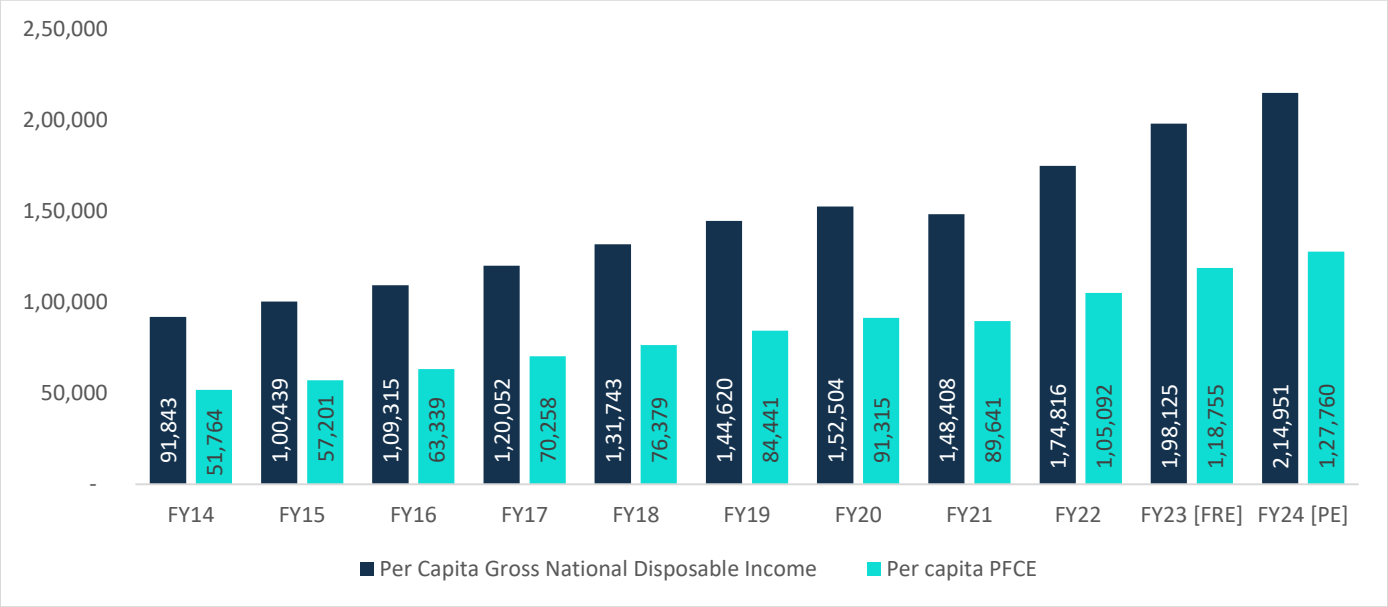
Source: World Bank Database

- Increasing Disposable Income and Consumer Spending

Gross National Disposable Income (GNDI) is a measure of the income available to the nation for final consumption and gross savings. Between the period FY14 to FY24, per capita GNDI at current prices registered a CAGR of 8.88%. More disposable income drives more consumption, thereby driving economic growth.

With increase in disposable income, there has been a gradual change in consumer spending behaviour as well. Private Final Consumption Expenditure (PFCE) which is measure of consumer spending has also showcased significant growth in the past decade at a CAGR of 9.46%.

Chart 10: Trend of Per Capita GNDI and Per Capita PFCE (Current Price)



Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

1.2.7 Concluding Remarks

The major headwinds to global economic growth are escalating geopolitical tensions, volatile global commodity prices, high interest rates, inflation woes, volatility in international financial markets, climate change, rising public debt, and new technologies. Despite the global economic growth uncertainties, the Indian economy is relatively better placed in terms of GDP growth compared to other emerging economies. According to IMF's forecast, it is expected to be 7% in CY24 compared to the world GDP growth projection of 3.2%. The bright spots for the economy are continued healthy domestic demand, support from the government towards capital expenditure, moderating inflation, investments in technology and improving business confidence.

India's strategic positioning as a manufacturing hub, bolstered by government initiatives, a skilled workforce, and a burgeoning startup ecosystem, enhances this outlook. Ongoing reforms and a focus on innovation position the country to capitalize on emerging opportunities, strengthening its role in the global manufacturing landscape. Likewise, several high-frequency growth indicators including the purchasing managers index, E-way bills, bank credit, toll collections and GST collections have shown improvement in FY24. Moreover, normalizing the employment situation after the opening up of the economy is expected to improve and provide support to consumption expenditure.

At the same time, public investment is expected to exhibit healthy growth as the government has allocated a strong capital expenditure of about Rs. 11.11 lakh crores for FY25. The private sector's intent to invest is also showing improvement as per the data announced on new project investments and resilience shown by the import of capital goods. Additionally, improvement in rural demand owing to healthy sowing, improving reservoir levels, and progress in south-west monsoon along with government's thrust on capex and other policy support will aid the investment cycle in gaining further traction.

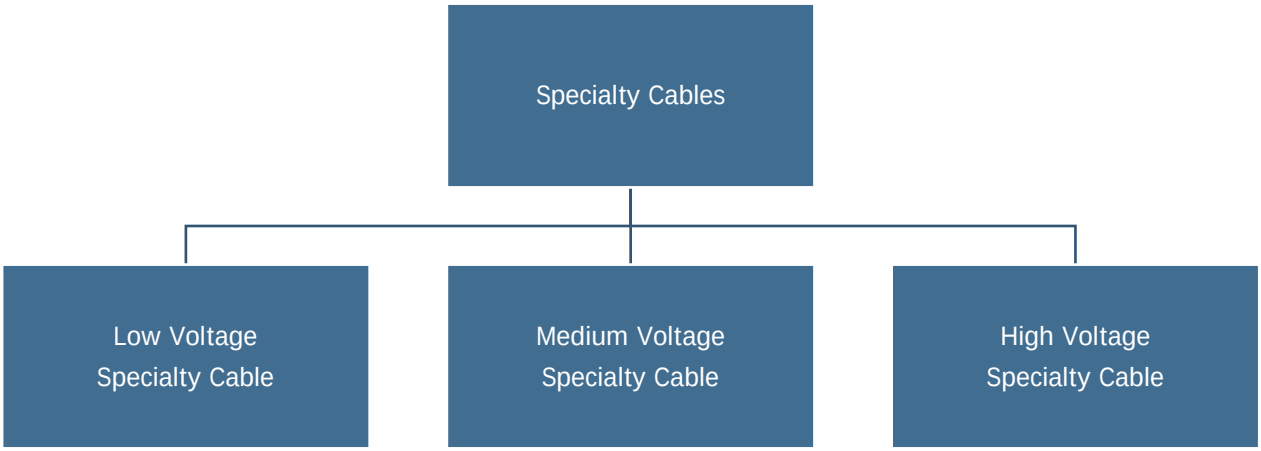
2. Indian Specialty Power Cables Industry

2.1 Overview

Cable is a conductor used for transmitting electric power or telecommunication signals from one place to another. A regular power cable can be used for standard applications which are compatible with most equipment and setups. Sometimes, these regular power cables cannot quite fit the requirements of special applications. Engineers and Designers often need to meet the specific requirements which are well suited by specialty power cables. Specialty cables have unique properties and special structures which are specifically designed for more industrial applications like railways, defence, automobiles etc.

Evidently, with technology expanding rapidly worldwide, connectivity is a priority. Also, there is a growing demand for a wide range of cables given the increasing traffic on communication and power networks. Such rising network traffic needs specialty cables with cutting-edge coatings and cabling materials, resistant to radiation, chemicals, abrasion, high temperature, vibration, and shock.

Based on voltages, specialty cables can be classified into three categories. The same is depicted in figure below:



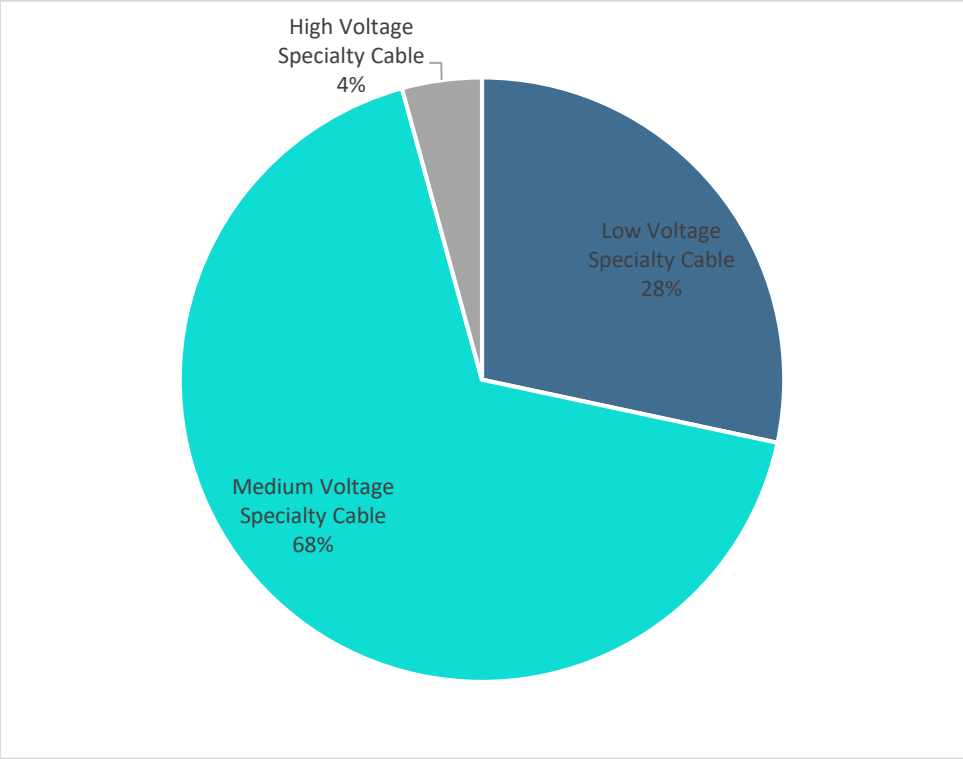
- Low Voltage Specialty Cable - Low Voltage Specialty Cable refers to power cables with voltage levels below 6kV, used in low-voltage power distribution systems or industrial installations.

- Medium Voltage Specialty Cable - Medium Voltage Specialty Cable refers to power cables of rated voltage between 6kV and 30kV, usually used to transmit medium voltage power. Medium voltage cables usually consist of one or more copper or aluminium conductors, insulation, sheathing, and other accessories. Medium voltage cables have vast applications, covering many fields such as urban power distribution, rural power grids, mining power systems, and rail transit systems.

- High Voltage Specialty Cable - High Voltage Specialty Cable refers to power cables with a rated voltage greater than 30kV. High-voltage cables are mainly used for burial, which can resist high-intensity pressure on the ground and prevent damage caused by other external forces.

In terms of market share, with wide application field, medium voltage speciality cable held a major share of about 68% in CY24EE, followed by low voltage speciality cable (28%) and high voltage speciality cable (4%).

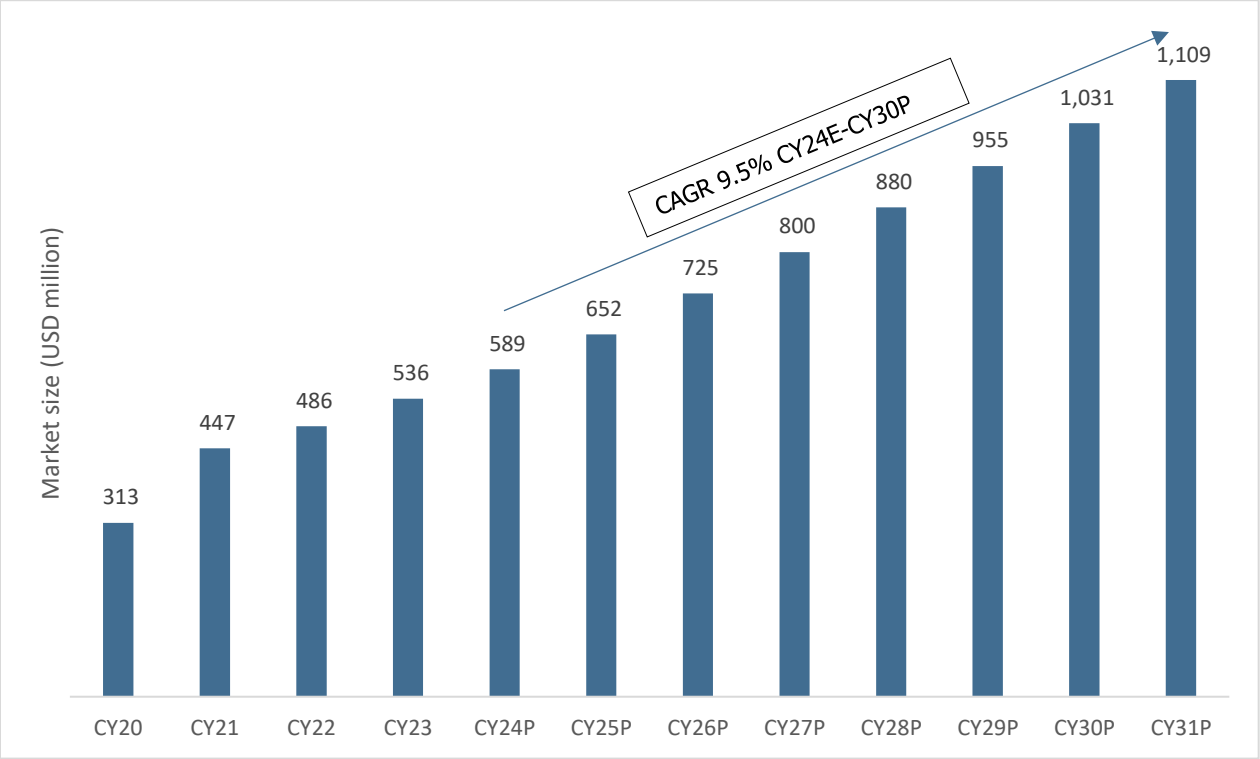
Chart 11: India Specialty Power Cables Market Share by Types in CY24EE



Source: Maia Research; CareEdge Research

The domestic market size of specialty cables was valued at USD 589 million in CY24EE which is expected to reach USD 599 million in CY24E. For the projected period CY24E-CY30, the market is forecasted to register a CAGR of 9.8%. This is attributed to infrastructural developments in the country. Accordingly, the projected growth drivers include renewable power generation, expansion and revamping of transmission & distribution infrastructure, expansion & improvement in the railway network, and increasing investments in metro projects.

Chart 12: Indian Specialty Cables Market Size (USD million)



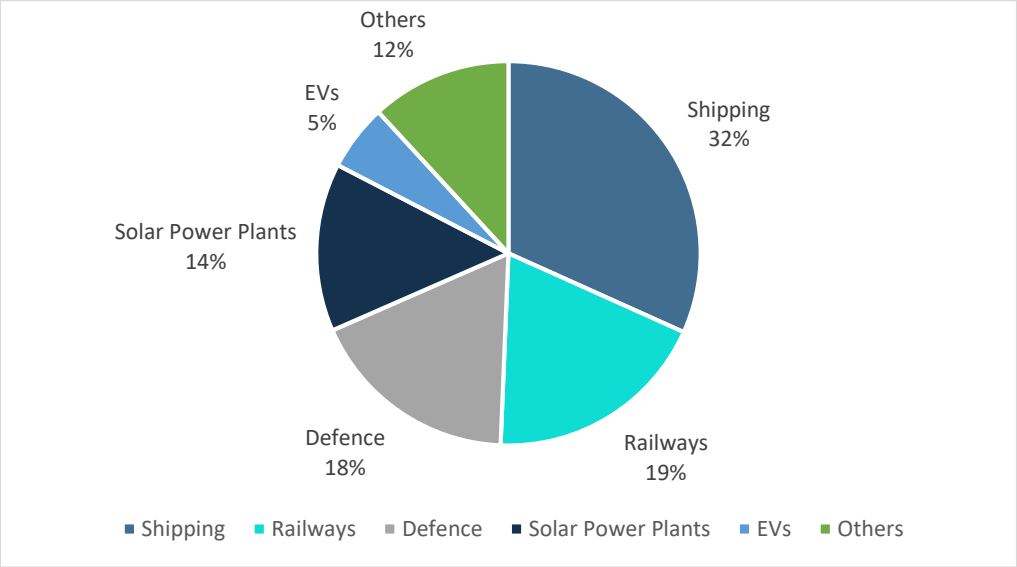
Source: Maia Research; CareEdge Research

Specialty cables are used across an extensive range of applications like railway, defence, shipping, electric vehicle, solar and others. Growing inclination towards the expansion and developments in these segments bodes well for specialty cables industry. Moreover, increasing investment in metro railways and smart grid projects, increasing awareness about the potential of renewable power and significant increase in adoption of renewable energy are also estimated to propel growth of specialty power cable market.

2.2 Market Analysis by Industry Application

Specialty cables have applications in areas where safety concerns are imperative, critical circuits are required, and special capabilities are needed in engineering and configuration. In this regard, shipbuilding, railways, defence, renewable energy, and electric vehicles are some of the key segments where specialty cables are used. The Projected market share in terms of application in CY24E included a major share from the shipping industry (32%), followed by railways (19%), defence (18%), solar (14%), electric vehicles (EVs) (6%), and remaining segments (12%).

Chart 13: Market Share by Industry in CY24E



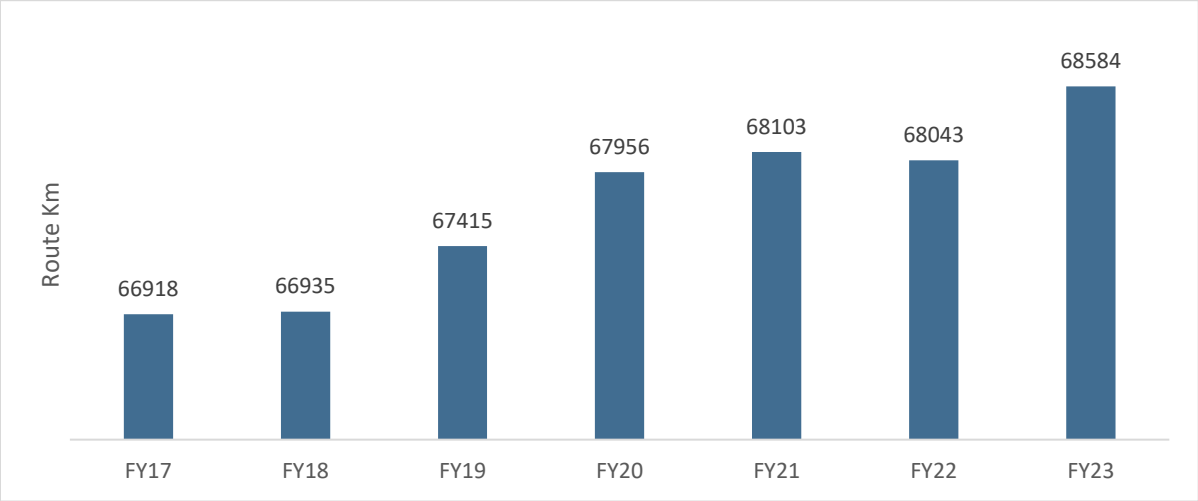
Source: Maia Research; CareEdge Research

2.2.1 Railways

The railway sector is consistently evolving. Railways is one of the key consumer segments in the specialty cable industry. Wherein, specialty cables are used in signalling and control system, power supply and communication system. Among the rail transit cables, specialty cables with DC tractions, flame-retardant, fire-resistance, green environment friendly and self-temperature control cables are used in railway construction. The rail transit construction has an extensive impact on the specialty cable industry. Moreover, the railway sector has been the recipient of more than Rs. 1 lakh crore investment allocation in the previous three budgets, with the government focusing on improving connectivity across the country.

Further, Indian Railways has set out massive network expansion and decongestion targets. It had planned to undertake 17,000 track km of new lines, doubling and gauge conversion work by FY24. Of this, 5,243 km was achieved during FY23 compared to 2,909 km during FY22.

Chart 14: Indian Railway Route Length



Source: Indian Rail Yearbook

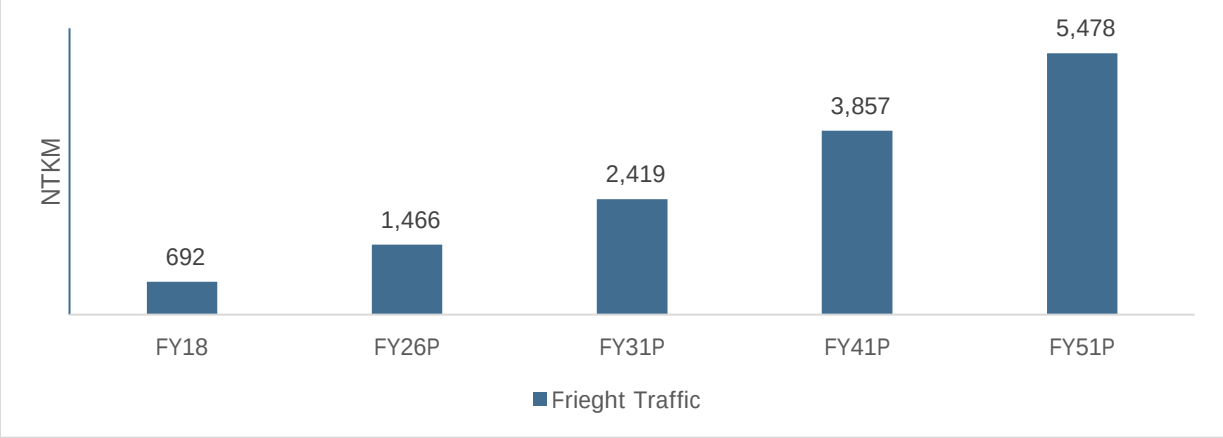
Further, as of April 2022, across the Indian Railways, 452 railway projects (183 New Lines, 42 Gauge Conversion and 227 Doubling) of total length 49,323 Km, costing approx. Rs 7.33 lakh crore are in different stages of planning/sanction/execution, of this, 11,518 Km length have been commissioned and an expenditure of approx. 2.35 lakh crore has been incurred up to March, 2022.

Moreover, it is essential to strengthen the rail network and build efficient warehouses to improve the share of freight traffic by rail. In CY20, the Indian Railways established a 'National Rail Plan (NRP) for India **– 2030'.** This plan is aimed at formulating strategies based on both operational capacities and commercial policy initiatives to increase the modal share of the railways in freight to 45% by CY30. This is anticipated to support fright traffic increase in the coming years.

Accordingly, a pipeline of capacity enhancement work was envisaged for easing the bottleneck/constrains and augmenting the network to make it capable of moving 3600 MT of cargo by 2030. For which, **'Mission 3000MT'** has been formulated as an intermediate milestone toward achieving the aforesaid ambitious target of NRP.

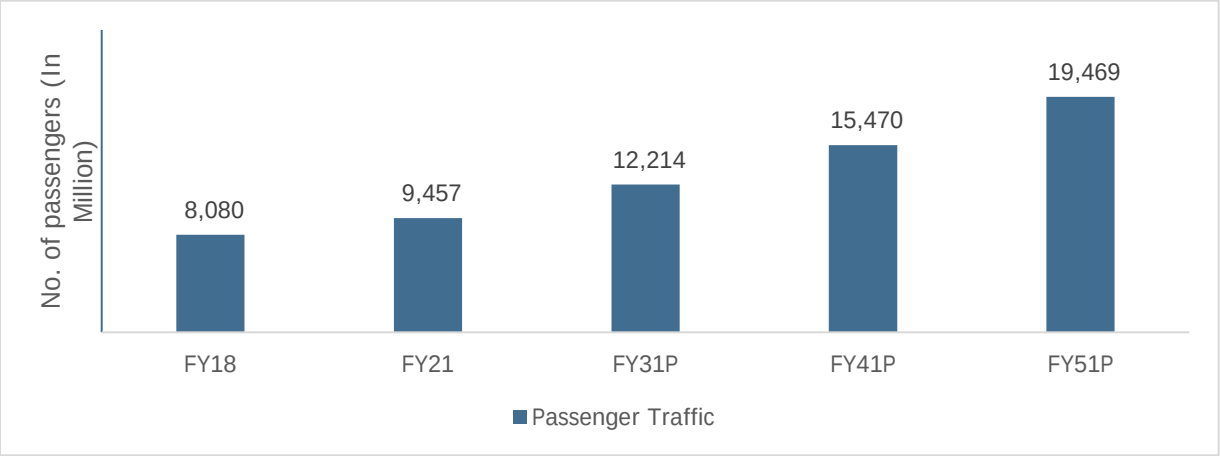
Similarly, the passenger traffic is expected to grow at a CAGR of 2.6% between FY21 and FY31, driven by population growth and a growing workforce.

Chart 15: Projected Growth in Freight Traffic



Note: P-Projected; Source: Indian Railways, National Railway Plan

Chart 16: Projected Growth in Passenger Traffic



Note: P-Projected; Source: Indian Railways, National Railway Plan

Such growing demand from freight traffic and passenger traffic is expected to source additional rolling stock to cater to the rising volume. The requirement for locomotive is projected to increase from 12.63 thousand in FY18 to 47.02 in FY51 and the requirement for wagons is anticipated to grow from 2.8 lakhs in FY18 to 10.62 lakhs in FY51.

Table 4: Projected Growth in Locomotive and Wagons Requirement

Particulars	FY18	FY26P	FY31P	FY41P	FY51P
No. of Locomotive Required (in thousands)	12.63	17.8	21.74	32.58	47.02
No. of Wagons Required (in lakhs)	2.8	4.07	5.44	7.77	10.62

Source: Indian Railways, National Railway Plan

Indian Railways is rapidly progressing to accomplish Mission 100 Percent Electrification and become the largest green railway network in the world. A historic 6,542 RKMs have been achieved during FY23, registering an increase of 2.76% from FY22. The previous highest electrification was 6,366 RKMs during FY22. It also plans to become a net zero carbon emitter by CY30 as part of the country's strategy to combat climate change. Whereas it plans to source 1,000 MW of solar power and 200 MW of wind power across zonal railway and production units.

Further, Automatic Block Signalling is a cost-effective solution to increase the line capacity to run more trains on the existing High-Density Routes of Indian Railways. During FY24, Indian Railways have upgraded 582 Kms with automatic signalling as compared to 530 Kms during FY23, registering an increase of 10%. It is also the best figure achieved in automatic signalling in the history of Indian Railways.

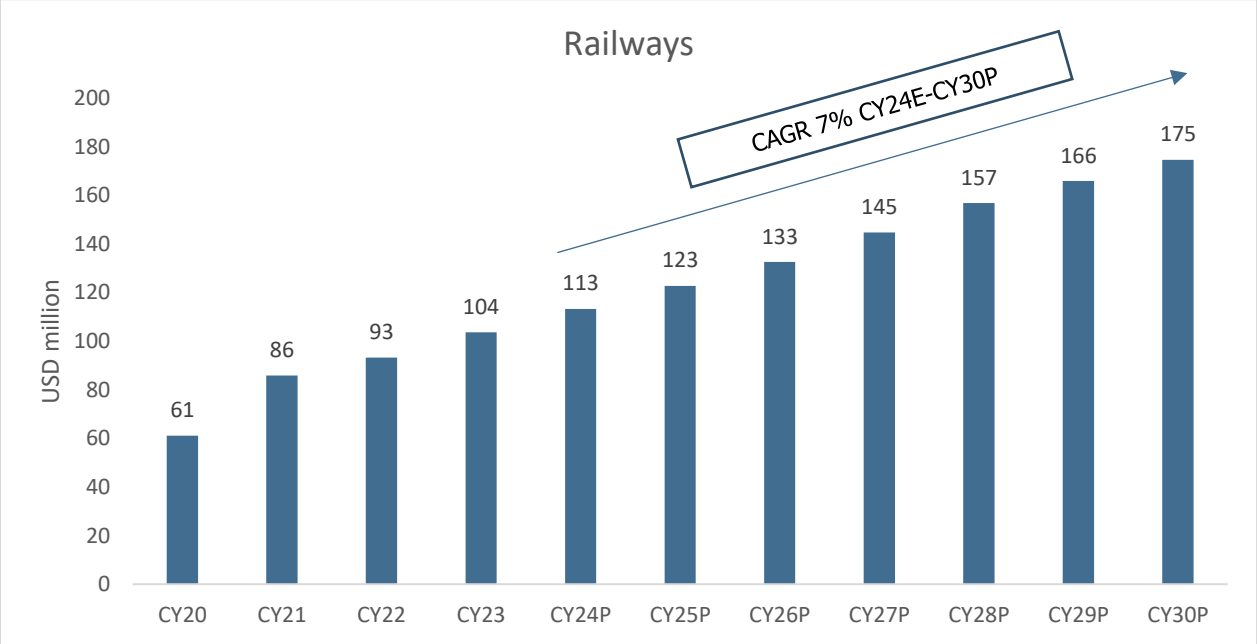
Similarly, Electronic Interlocking is being adopted on a large scale to derive benefits of digital technologies in train operation and to enhance safety. During FY24, 551 stations were provided with Electronic Interlocking as compared to 538 stations during FY23, an increase of 2%.

Furthermore, the Indian government is focusing on operating more semi-high-speed trains. The production plans of trains like Vande Bharat are already on the rise. There are about 34 Vande Bharat trains serving passengers across the states and union territories. Out of which, 9 trains were added recently in September 2023. India's first-ever indigenously designed and manufactured semi-high speed Vande Bharat trains have

provided a modern and comfortable rail travel experience to passengers. High Speed, enhanced Safety standards, and world-class service are the hallmarks of this train.

Moreover, as of August 2023, Rs. 1,343.7 crore fund has been utilised for manufacturing Vande Bharat trains. The introduction of trains, including Vande Bharat services, is an ongoing process on Indian Railways subject to operational feasibility and traffic justification. This bodes well for the specialty cable industry in the coming years.

Chart 17: Demand trend from Railways for Specialty Cables (USD Million)



Source: Maia Research; CareEdge Research

The contribution from the railway segment in the specialty cable market was valued at USD 104 million in CY23 which is expected to reach USD 113 million registering a 9% y-o-y growth in CY24E. For the forecast period CY24E-CY30, the segment contribution is anticipated to grow at 7% CAGR. The Government of India has identified railways as a key focus area to boost GDP and make India more export competitive by reducing freight costs. This augurs well for the specialty cables industry overall.

KAVACH – Automated Train Protection (ATP) System

1. Material Updates for Kavach

The Union Ministry of Railways is set to accelerate the deployment of Kavach 4.0, an indigenous anti-collision system, by issuing tenders for its installation in 20,000 locomotives. Two bulk tenders for 10,000 locomotives each are expected soon, with one closing by October 2024. The goal is to cover all geographical areas and locomotive types within four years, with new locomotives already coming equipped with Kavach 4.0.

Tenders have also been issued for Kavach installation on major railway sections, including the Delhi-Chennai and Mumbai-Chennai routes (3,300 Rkm), as well as 5,000 Rkm of automatic sections. Additionally,

a plan is in place to implement Kavach at 8,000 stations to enhance communication between trains and stations, further improving safety.

Kavach, India's National Automatic Train Protection (ATP) system, gained renewed focus after recent train accidents, such as the Kanchenjunga incident in June 2024 and the Odisha triple-train crash in 2023, which highlighted its absence on certain routes. Currently, Kavach covers only 2% of the railway network, with deployment slow due to industrial capacity constraints. However, improvements have been made, with five domestic companies now ready to meet the growing demand.

The Kavach system includes five subsystems designed to monitor train speed and braking, enhancing safety in various conditions, such as poor weather or signaling issues. Three Indian manufacturers — HBL Power Systems, Kernex, and Medha — are currently approved to produce Kavach, with additional manufacturers in development.

2. Multiple Floated Tenders for Loco Kavach

Indian Railways has launched tenders worth over ₹2,200 crore for the deployment of Kavach, its indigenous automatic train protection system, covering nearly 7,228 route kilometers (rkm) across multiple states, including West Bengal, Tamil Nadu, Chhattisgarh, Karnataka, Kerala, and Uttar Pradesh. The tenders include components like towers, optical fibers, dashboards, and system integrators.

Kavach consists of key components such as RFID technology integrated into tracks, RFID readers in the locomotive's cabin, radio infrastructure with towers and modems, and cabin panels that display signals and speed limits. The system automatically applies brakes and alerts the pilot to red signals, enhancing safety in low visibility conditions.

The tenders, with values ranging from ₹100 crore to ₹340 crore, have deadlines between September and November 2024. This phase of Kavach installation will cover high-density routes, adding to the 3,000 rkm already under installation. Kavach is currently operational on 1,465 rkm, and its coverage is expected to expand to 10,000 locomotives, with work already underway.

In 2024, a total of 635 Kavach-related tenders have been published. Notable open tenders include installations on the Kharagpur–Chakradharpur division (₹200 crore) and the Dholpur–Bina section (₹207 crore).

The next phase of the Kavach implementation is planned as follows:

- The project to equip 10,000 locomotives has been finalized.
- Bids have been invited for track-side works of Kavach covering approximately 15,000 rkm, with bids for around 9,000 rkm already opened. This includes all GQ, GD, HDN, and identified sections of Indian Railways.

3. Indian Railways target to Implement Kavach across 44,000 km by year 2029

In her interim budget for fiscal 2024-25, Finance Minister Nirmala Sitharaman allocated ₹2.55 lakh crore to Indian Railways, a 5.8% increase from the ₹2.41 lakh crore for fiscal 2023-24. The revised estimates for 2023-24 stood at ₹2.43 lakh crore, highlighting a strong commitment to strengthening railway infrastructure. As part of these efforts, Sitharaman announced the conversion of 40,000 regular rail bogies to Vande Bharat standards to enhance passenger experience, improve speeds, and reduce travel time.

In addition to this, the introduction of the Kavach system, an automatic train protection (ATP) technology developed by the Research Design and Standards Organisation (RDSO) with Indian firms, aims to improve railway safety. Currently operational on 1,445 km of routes, Kavach is set to expand to 4,500 km in the upcoming fiscal year, with plans to extend coverage to 44,000 km over the next five years. Tenders for an additional 6,000 km are expected by year-end.

Moreover, Indian Railways has ambitious plans to develop three economic corridors spanning over 40,000 km, supported by investments of more than ₹10 lakh crore. This initiative aims to enhance connectivity between major economic hubs, streamline freight movement, and boost logistical efficiency, playing a crucial role in the country's economic growth.

2.2.2 Defence

Military strength plays a decisive role in national development. The development of military power is inseparable from high-tech equipment, requiring a large number of high-temperature-resistant, lightweight fluorine containing plastic products which is supporting the rapid demand growth for special cables. Military and defence wires and cables are divided into coaxial cables, optical fiber cables, power cables, marine cables, multi-core cables, shielded cables, etc.

Military special cables also play an important role in the scientific research of military equipment. Therefore, specialty power cables are a key component in the defence field. For instance, in Navy, the applicability of specialty cables is largely for pressure-tight underwater applications and shore supplies.

For FY25, the Ministry of Defence has been allocated a total Budget (Revenue + Capital) of Rs. 6.21 lakh crore, from which, capital outlay pertaining to capital acquisition is 1.72 lakh crore roughly.

Table 5: Budgetary Outlay toward Defence (Rs. In Crore)

Particulars	FY20 (A)	FY21 (A)	FY22 (A)	FY23 (R)	FY24 (B)
Total Capital Outlay	1,11,092	1,34,305	1,37,987	1,50,000	1,62,600
Army	29,001	26,285	25,131	32,597	37,242
Of which towards:					
Aircrafts and Aeroengines-Army	4,478	3,582	2,113	3,565	5,500
Heavy and Medium Vehicles	840	1,359	1,508	2,385	3,000
Other equipment-Army	17,863	17,426	16,532	20,885	21,300
Rolling Stock	7	106	49	120	163
Navy	27,447	41,667	45,029	47,727	52,805
Of which towards:					
Aircrafts and Aeroengines	1,071	9,074	7,331	7,500	7,000
Heavy and Medium Vehicles	19	25	10	50	90
Other equipment-Navy	4,012	7,354	6,692	8,200	9,500
Naval Fleet	16,002	20,198	24,928	24,187	24,200
Naval Dockyard/projects	4,337	3,433	4,047	4,500	6,725
Airforce	45,056	58,138	51,827	53,749	57,137
Of which towards:					
Aircrafts and Aeroengines-Air Force	23,449	35,681	29,930	23,713	15,722
Heavy and Medium Vehicles-Air Force	110	21	98	163	948
Other equipment-Air Force	18,435	20,370	18,947	26,624	36,223

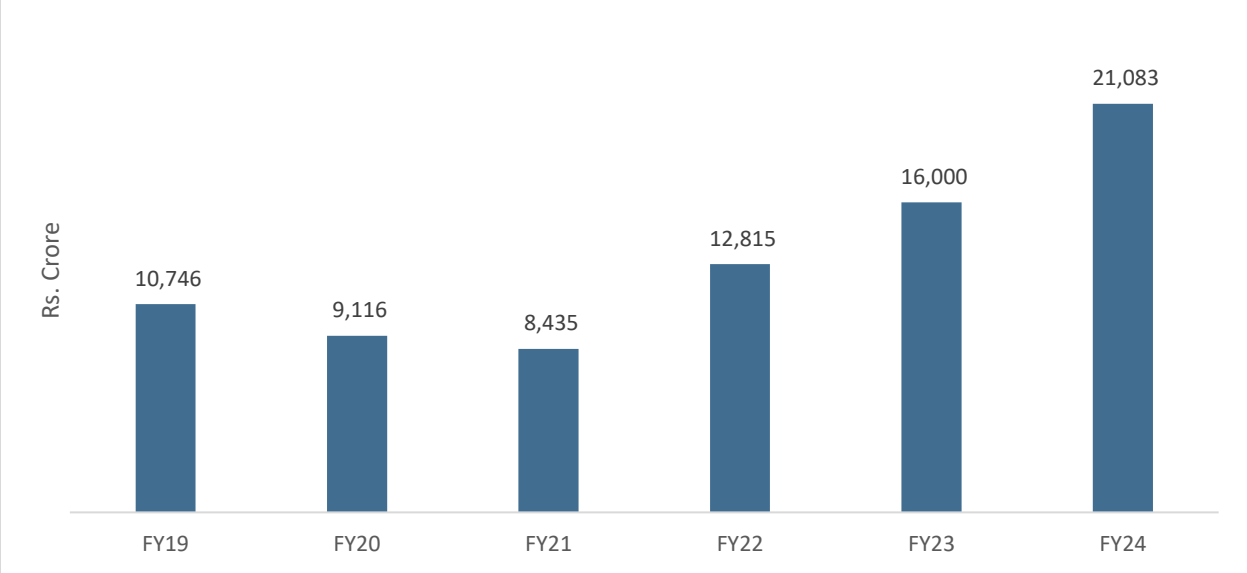
Towards Others/ Schemes/ Projects/ Eneterprise	9,589	8,215	16,001	15,926	15,417

Source: Budget Documents; Note: B – Budgeted, A – Actual, R – Revised

Furthermore, to provide impetus to self-reliance in defence manufacturing, the government is striving to develop a robust eco-system and provide supportive policies. Accordingly, the Ministry of Defence has formulated a draft Defence Production and Export Promotion Policy 2020 (DPEPP) as a guiding document to provide a focused, structured, and significant thrust to the defence production capabilities of the country for self-reliance and exports.

Moreover, to give a push to defence exports, the government has taken a number of policy initiatives and brought reforms over the last 9 years. Export procedures have been simplified and made industry-friendly with end-to-end online export authorisation curtailing delays and bringing the Ease of Doing Business. India's defence exports have reached an all-time high, surging from Rs. 686 crores in FY14 to nearly Rs. 21,083 crores in FY24. This remarkable 30-fold increase reflects India's progress in the global defence manufacturing sector. With exports reaching more than 85 countries, India's defence industry has shown its capability of design and development to the world, with 100 firms exporting defence products at present.

Chart 18**: India's** Defence Export Trend



Source: Ministry of Defence

With the boost of defence exports in the country, the number of authorizations has also seen a quantum jump. Whereas the market size of defence production in India is estimated to increase by CY25 to 25 billion US dollars, given the growing concerns about national security. Further, aerospace & defence is estimated to be a Rs. 80,000 crore industry, to which the private sector's contribution has steadily grown to Rs. 17,000 crores. The Indian government has also been encouraging participation from the private sector to cater for the growing demand. Additionally, India is taking a proactive approach toward foreign mutual trade with countries such as the UAE, Kazakhstan, and the US for strengthening the country's defence. The other sub-sector which is likely to make parallel leads is the maintenance repair and overhaul sector.

Recent Developments

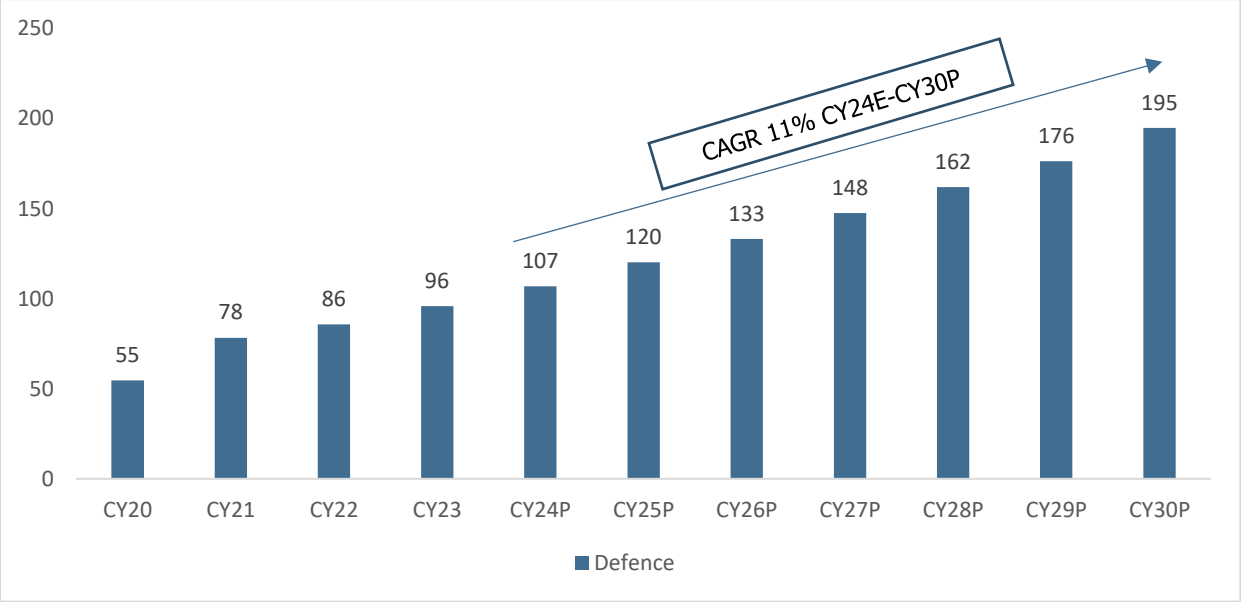
• The defence exhibition DefExpo 2022, marked the emergence of India's defence industry as a sunrise sector for investment on the global scale, in line with the theme 'Path to Pride' which was organised exclusively for Indian companies.

• India's defence production crossed the Rs. 1 lakh crore mark in FY23, an increase of 12% over Rs. 95,000 crores production in FY22. The total production in FY24 was nearly Rs. 74,739 crores

• The government has taken several policy initiatives in the past few years and brought in reforms to encourage indigenous design, development, and manufacture of defence equipment, thereby promoting self-reliance in defence manufacturing & technology in the country. Due to these policies, the industries, including MSMEs and start-ups, are forthcoming in defence design, development, and manufacturing. There is almost a 200% increase in the number of defence licenses issued to industries in the last 7-8 years by the Government.

The contribution from the defence sector in the specialty cable industry was valued at USD 96 million in CY23. Which is forecasted to grow at a CAGR of 11% during CY24E-CY30.

Chart 19: Demand Trend from Defence for Specialty Cables (USD Million)



Source: Maia Research; CareEdge Research

Overall, the increasing government investment has boosted the defence industrial manufacturing ecosystem in the country and generated tremendous employment opportunities, which supports the specialty cables market growth in India.

2.2.3 Shipping

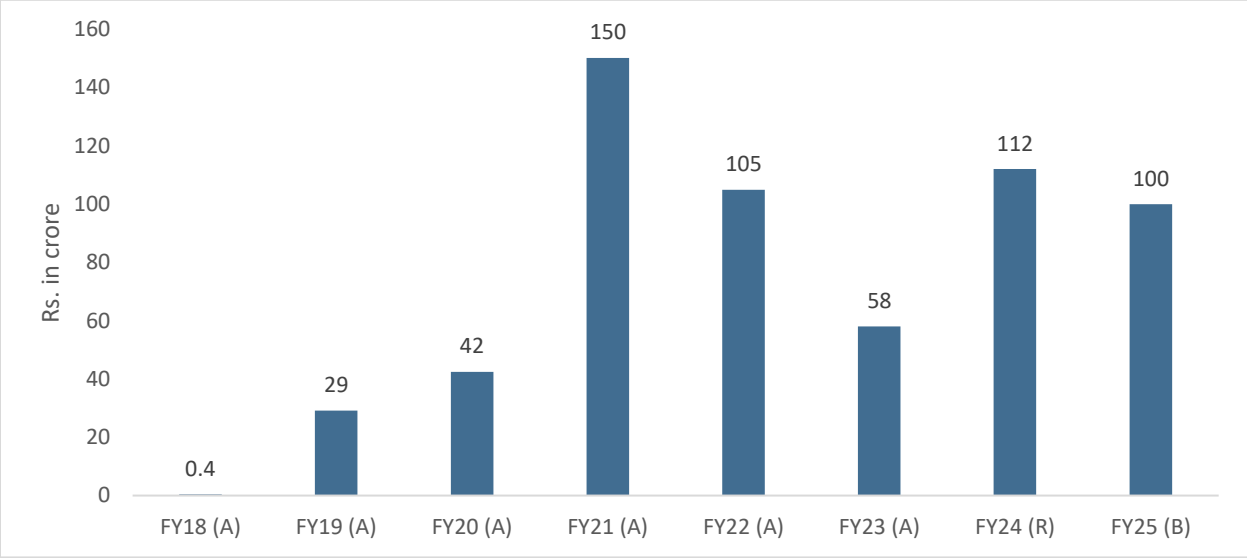
The Indian shipping industry is integral to the global freight transportation system. Given the large volume of goods that vessels can carry over long distances, shipping is the most convenient way of transporting goods from one country to another.

For manufacturing ships and containers, special marine cables are used. It is used for power, lighting, and general control of various ships in rivers, seas, offshore oil platforms, and other water structures. Shipping is one of the major consumer segments of specialty cables.

Further, India has one of the largest coastlines of about 7,517 km, 12 major ports, and 205 notified minor & intermediate ports. India's competitiveness in global trade is expected to increase with initiatives such as Make in India, Atmanirbhar Bharat, PLI Schemes for key sectors, etc. The government is focusing on increasing the domestic manufacturing of shipping containers to eliminate the dependence on imported containers.

Moreover, in the Union Budget 2023-24, the government announced 100 transport infrastructure projects for end-to-end connectivity for ports, coal, steel, and fertilizer sectors. The budgetary allocation of Rs 6,858 crores was announced for the Ministry of Ports, Shipping and Waterways compared to Rs 5,542 crores in the previous budget, implying a growth of 24% year-on-year basis. This includes the yearly budgetary allocation for assistance to shipbuilding, research, and development. During the Union Budget 2024-25, Rs. 100 crores have been allocated to shipbuilding industry.

Chart 20: Budgetary Outlay Towards Ship Building

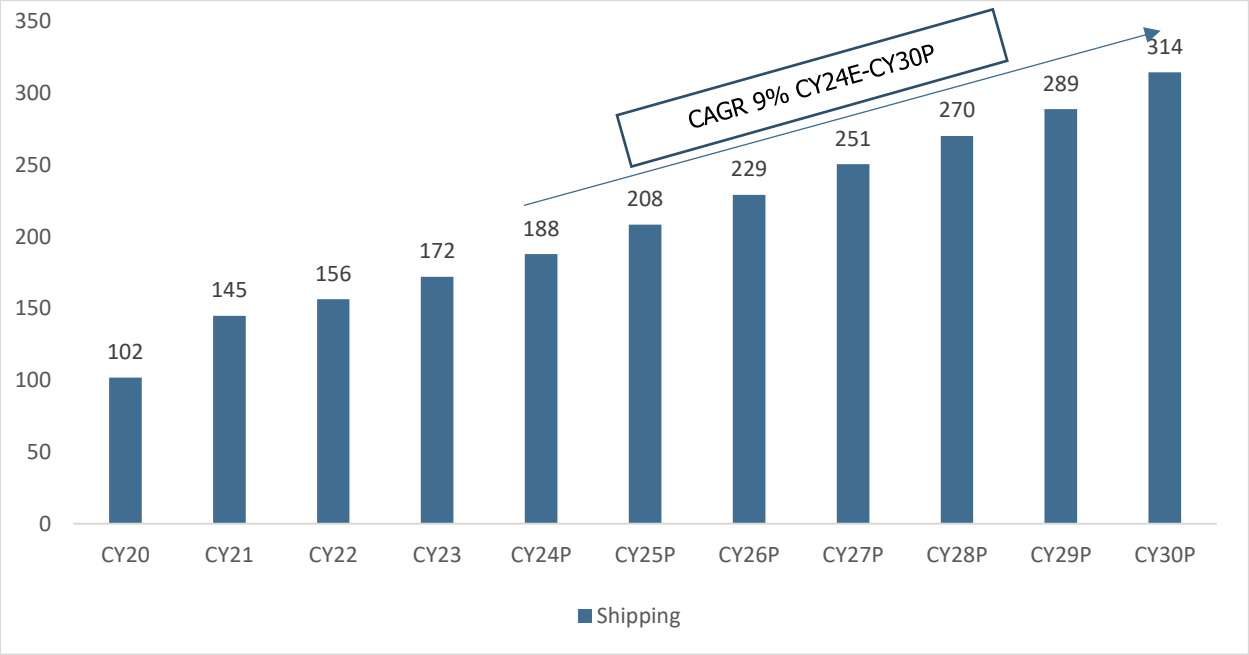


Source: Budget Documents; Note: B – Budgeted, A – Actual, R – Revised

Unlike other manufacturing industries, the shipbuilding industry usually follows a 'make to stock inventory model,' i.e., an order-driven industry in which each vessel is custom-built on receiving a shipbuilding order. Hence, a healthy order book is essential to this industry's growth. The shipbuilding industry growth is likely to foster the growth of its sub-sectors, including the specialty cables industry.

In CY23, the contribution from the shipping industry was valued at USD 172 million, making the shipping segment a major consumer of specialty cables. This value is expected to reach USD 188 million in CY24E registering 9% y-o-y growth. For the forecast period CY24E-CY30, this segment is projected to register a 9% CAGR.

Chart 21: Demand Trend from Shipping for Specialty Cables (USD Million)



Source: Maia Research; CareEdge Research

Accordingly, the outlook for the shipbuilding industry is expected to be stable, driven by the container shipment segment. Besides, the ship repair market has the potential to contribute to the sector. The government's initiatives to promote Indian-made ships under the Atmanirbhar Bharat policy will also help boost the demand for ships manufactured in India. These key growth drivers of shipping and shipbuilding segment bodes well for specialty cables market.

2.2.4 Electric Vehicles

There is a growing thrust on adopting electric vehicles (EVs) across the globe amid increasing carbon emissions which have serious repercussions including global warming. As India is significantly dependent on crude oil imports and various cities in India are facing pollution menace, the Indian government has also acknowledged the need to promote EVs.

The EV market in India has been witnessing steady growth. The sales of electric cars, two-wheelers, and three-wheelers have been increasing in recent years, driven by government incentives, decreasing battery costs, and the introduction of new EV models by domestic and international manufacturers. The following table depicts total EV sales:

Table 6: Total EV Sales

EV Sales (in Units)	FY19	FY20	FY21	FY22	FY23	FY24
Two-wheeler	28005	26827	44782	252568	728069	944907
Three-wheeler	115189	142342	90073	182604	404427	632520
Four-wheeler	1823	2339	5132	18567	47486	90696
Buses	78	447	374	1195	2008	3607

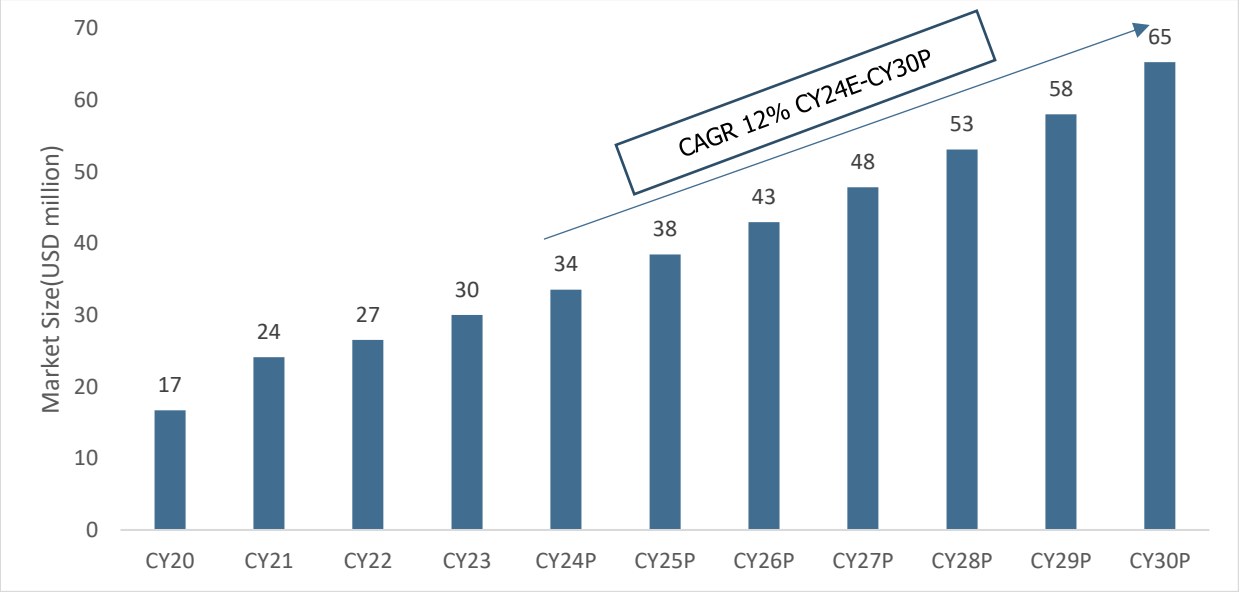
EV Sales (in Units)	FY19	FY20	FY21	FY22	FY23	FY24
Goods vehicle	769	80	81	1258	1182	5078
Total EV sales units	145864	172035	140442	456192	1183172	1676808

Source: Centre of Energy Finance, CareEdge Research

Since new energy vehicles use a large amount of electronic equipment, especially high-voltage electrical equipment, they have higher requirements for power cables. Specialty power cables play an important role in the safety of new energy vehicles. For instance, high-quality specialty power cables can ensure that the electrical system can work properly and ensure a low failure rate, thereby reducing the risk of accidents such as fires and explosions.

In CY23, the contribution from the electric vehicle segment in the specialty cables market was valued at USD 30 million, which is expected to reach USD 34 million in CY24E. The electric vehicle segment's growth is forecasted to register a CAGR of 12% during CY24E-CY30. As the EV market is growing exponentially in India, vehicle manufacturers are gradually inclined to manufacture more electric-run vehicles. This further supplement the specialty cables market growth

Chart 22: Demand Trend from Electric Vehicle for Specialty Cables (USD Million)



Source: Maia Research; CareEdge Research

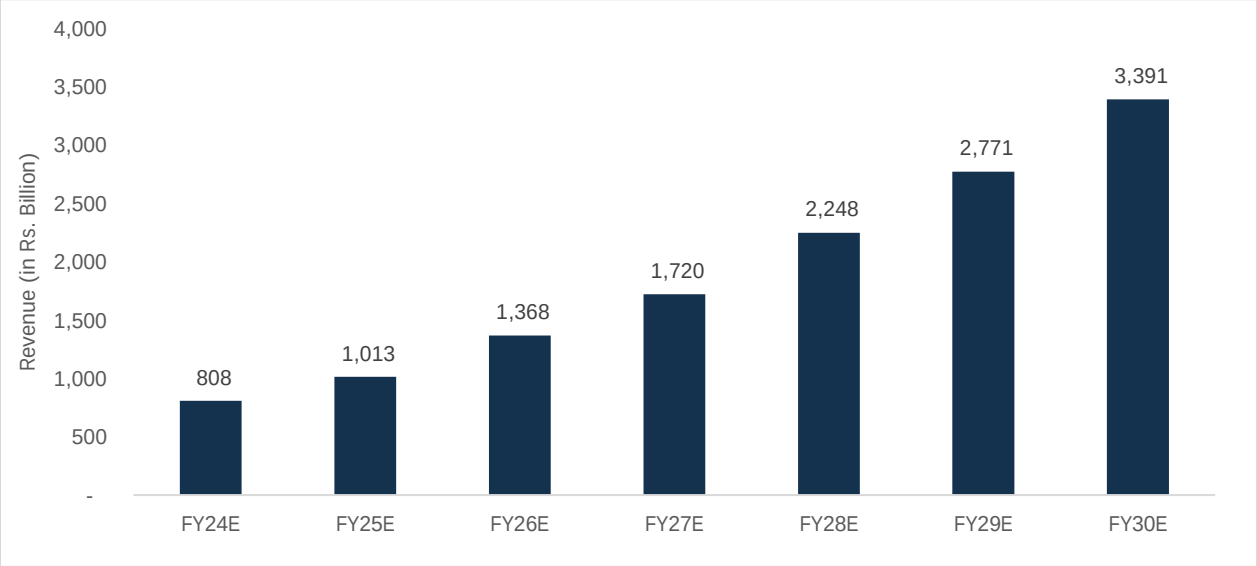
Furthermore, as per the Economic Survey 2023, India's domestic electric vehicle market will see a 49% compound annual growth rate between 2022 and 2030, with 10 million annual sales by 2030. India's adoption of electric vehicles is hampered by the lack of significant charging infrastructure. However, the government is looking forward to developing a nationwide charging infrastructure network.

Also, the industry received good government backing over the last few years to increase EV penetration in India. For instance, the Smart City Mission, is an urban renewal and retrofitting program by the Government of India with the mission to develop 100 cities across the country alongside making them citizen friendly and sustainable. EVs are the solution for both better quality of life and reduction in environmental footprint

and hence EVs will be integrated as part of smart city transportation. Additionally, the government has set a target to achieve 100% electric mobility for public transport and 40% electrification of private vehicles by CY30.

The expected revenue generation from overall EV sales is estimated to reach approximately ~ Rs. 4,000 Billion around CY30 in India. The sales across each EV vehicle segment is expected to clock strong growth going forward owing to governments push towards green mobility.

Chart 23: Annual Revenue forecast from EV sales



Source: Centre of Energy Finance, CareEdge Research

With this, measures taken by the government and the state government to accelerate EV transition, development of local manufacturing of batteries, and increasing affordability of the vehicles, augur well for the sector, which is anticipated to see long-term growth in the future. Overall, the country is well on its way to achieving a sustainable and eco-friendly transportation ecosystem. Therefore, the overall outlook for EVs in India is positive, which can be foreseen as a growth driver for specialty cable market.

2.2.5 Solar Power

Cables are necessary elements for transmitting solar power. Such (specialized) cables are designed to connect solar panels to the electrical grid, enabling the widespread adoption of solar power. They are manufactured to withstand extreme weather conditions, resist UV rays, and handle high electrical loads, making them an essential component in the development of solar power systems. Also, these cables are designed to provide higher flexibility, durability, and reliability.

Further, the cables used in solar power stations are mostly laid outdoors. The environment where they are used is very harsh. The material of the cable is selected based on the degree of ultraviolet rays, ozone, severe temperature changes, and chemical corrosion such as acid and alkali in the environment. If ordinary cables are used, working in harsh environments for a long time will cause damage to the cable sheath and even decomposition of the cable insulation layer, resulting in cable short circuits and fire accidents. Therefore, it is imperative to use photovoltaic cables in solar power stations.

Photovoltaic cables and ordinary cables undergo different radiation steps. Radiation significantly improves the thermal properties, mechanical properties, and chemical properties of the cable insulation material.

They can withstand more ultraviolet rays, radiation, severe temperature differences, and chemical corrosion.

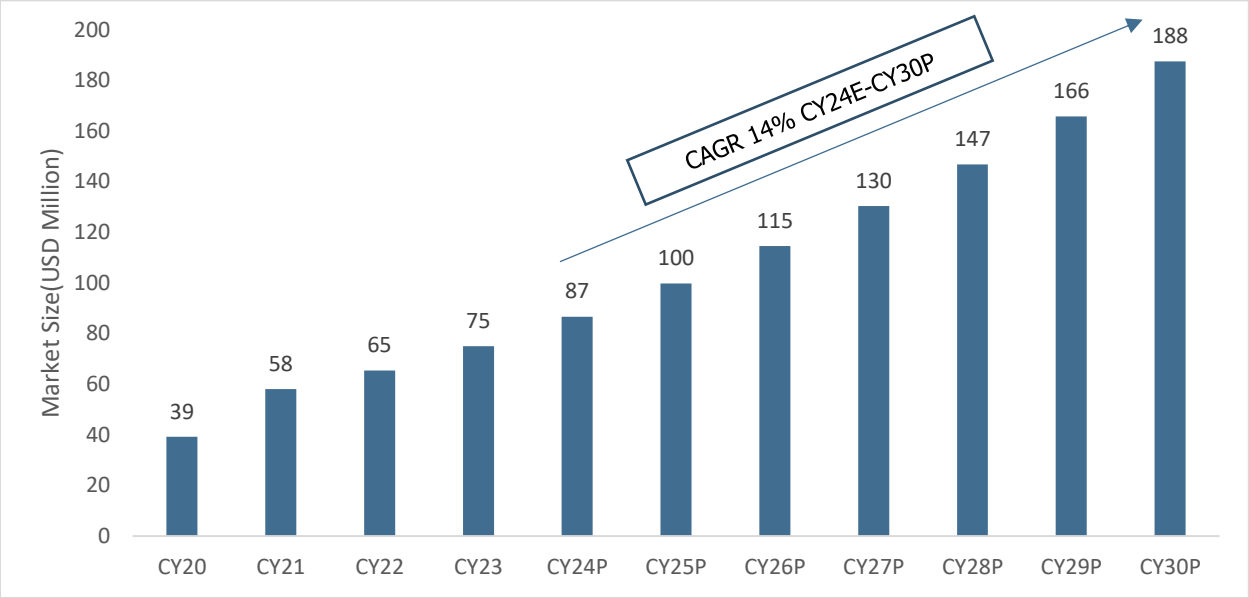
Further, India's solar energy sector has emerged as a key participant in grid-connected power generation capacity over the past decade. It contributes significantly to the government's objective of sustainable growth while emerging as a key anchor in meeting the nation's energy demands and ensuring energy security.

Moreover, the global solar industry is rapidly growing and so is the demand for specialty cables. India has a large amount of solar energy potential. Approximately 5,000 trillion kWh of energy is incident over India's geographical area each year. Throughout the years, India's solar energy sector has emerged as a key participant in grid-connected power generation capacity.

Solar energy accounted for 57% of the renewable energy basket as of March 2024. During FY19 to FY24, the segment added 54 GW of capacity, registering a CAGR of 24%, albeit on a low base. The solar energy segment contributes to the government's objective of sustainable growth while emerging as a key anchor in meeting the nation's energy demands and ensuring energy security.

With this, the contribution from the solar power segment in the specialty cable industry was valued at USD 75 million in CY23, which is expected to reach USD 87 million marking 16% y-o-y growth. This contribution is further forecasted to grow at a CAGR of 14% in CY24E-CY30.

Chart 24: Demand Trend from Solar Power for Specialty Cables (USD Million)



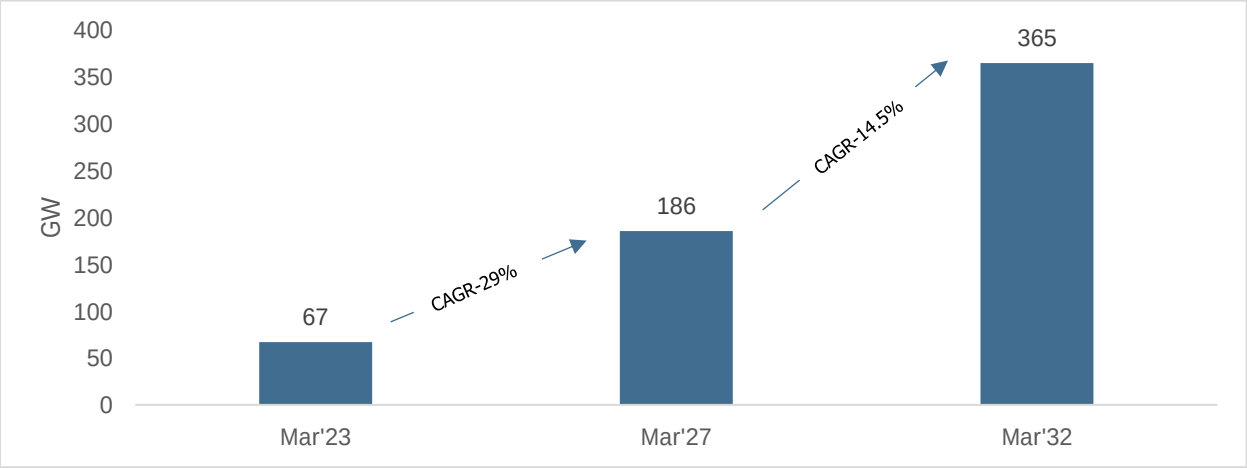
Source: Maia Research; CareEdge Research

India has a target of 500 GW of non-fossil fuel capacity by 2030. Hence, significant investments have commenced toward increasing and upgrading the transmission infrastructure. For integration of additional wind and solar capacity by 2030, the estimated length of transmission line and sub-station capacity planned is around 50,890 CKM and 4,33,575 MVA, respectively. The investment required for the green transmission is estimated to be around Rs. 2,440 billion as per the Ministry of Power.

Going forward, with India setting up an ambitious target of achieving 500-GW non-fossil fuel capacity by 2030, the regulatory framework is expected to remain supportive. The fund required estimates for the period FY23-FY27 for solar renewable energy is about Rs. 6.8 trillion and Rs. 7.9 trillion between FY28-32.

Whereas the capacity addition of solar power expected to be added until FY27 is 186 GW and until FY32 is expected to be 365 GW.

Chart 25: Solar Power – Trend in Future Installed Capacity Additions



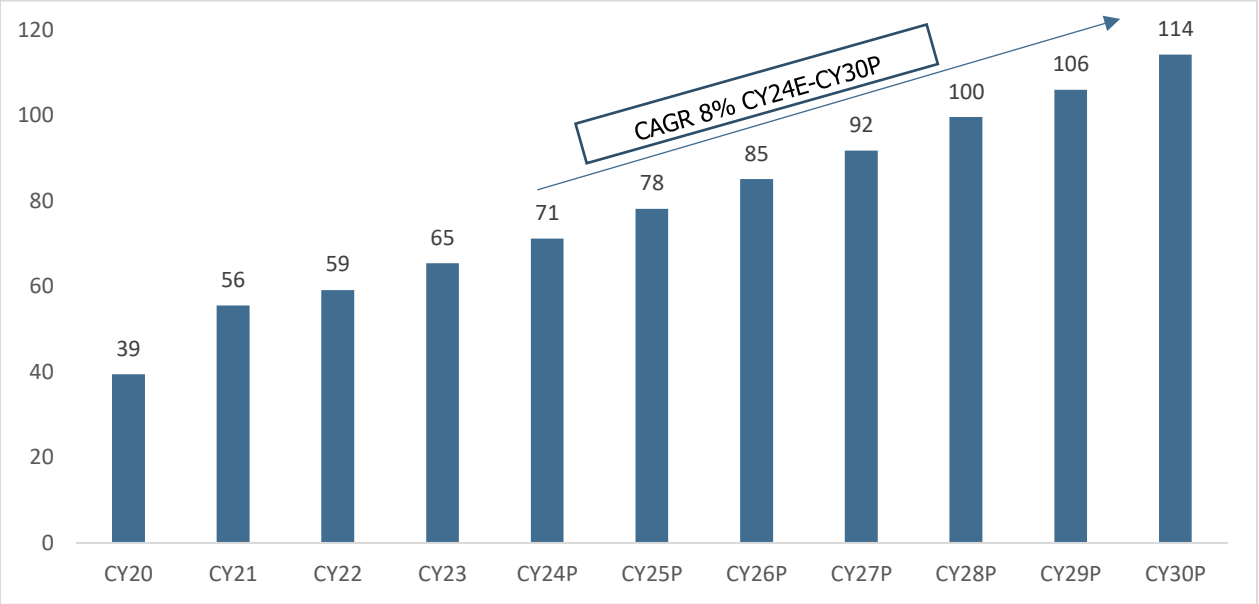
Source: National Electricity Plan Vol-1 (March 2023), CareEdge Research

Over the years, the renewable energy industry has benefitted on account of the government's strong policy support, India's largely untapped potential, the presence of credit-worthy central nodal agencies as intermediary procurers, and improved tariff competitiveness. Therefore, the specialty cable market growth is attributable to the positive outlook for the solar power segment, further accredited to government support and growing environmental consciousness.

2.2.6 Other Segment

The other segment includes special cables used in civil construction, communications, metallurgical machinery, and nuclear power plants. The contribution from this segment was valued at USD 65 million in CY23 which is expected to reach USD 71 million in CY24E. This contribution is further anticipated to grow at a CAGR of 8% during CY24E-CY30.

Chart 26: Demand Trend from Other Segment for Specialty Cables (USD Million)

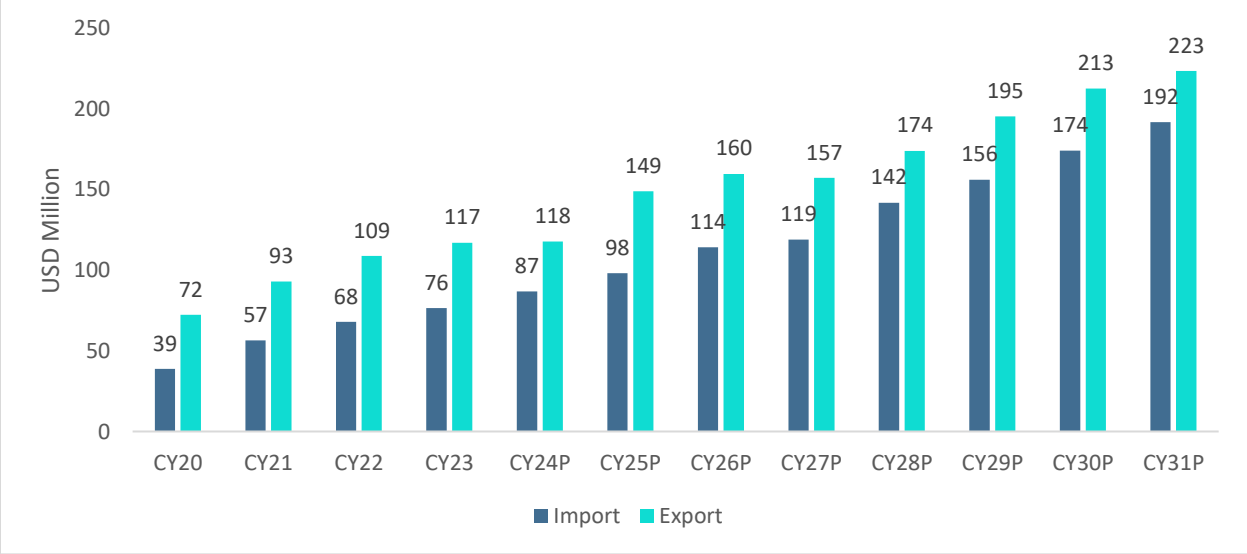


Source: Maia Research; CareEdge Research

2.3 Import and Export Trend

During CY23, the exports of specialty cable registered a 7.5% y-o-y increase and stood at USD 117 million. The exports of specialty cable grew at a CAGR of 18% during CY19-CY23. Overall, countries like the United States, the United Kingdom, and the United Arab Emirates added traction to exports of wires and cables. Segments like renewables, oil & gas, and infrastructure were the major growth drivers during the year. At the same time, the growing thrust for renewable power globally is also a notable factor in increasing exports. However, the transition to clean energy requires an overhaul of the existing system through laying fresh cables, which has supported export demand from the countries globally.

Chart 27: Import and Export Trend



Source: Maia Research; CareEdge Research

In a broader sense, India imports most of the wires and cables from China. Japan and South Korea are also among the major countries cables are imported from. In CY23, imports of specialty cables were valued at USD 76 million, which is about 11.7% higher than the previous year. However, the government is continuously supporting the domestic production of cables. The government is working on establishing quality norms for cables to curb imports and boost domestic manufacturing.

Further, in the domestic specialty cables market, the top five players held about 50.4% market share in CY23. These top five players are – KEI Industries, Polycab India, M.P. Birla Group, Finolex Cables, and Cords Cable. Despite the market comprising many large players with a global presence and strong brand names, it is fragmented due to low entry barriers

2.4 Key Growth Drivers

The long-term outlook for the specialty cables industry is positive on account of structural mega trends and growing focus on domestic manufacturing and technology. Some of these key growth drivers are as below:

- Government Push for Railway Infrastructure Upgradation

Please refer to section 1.2.9 budgetary allocation and 2.2.1

- Introduction of New Technologies as Control Systems in Indian Railways

The Indian Railways have taken various infrastructural changes to ensure rail safety and efficient functioning of railways. One such key infrastructural change has been the signalling and protection system. Railway signalling systems are used to control the movement of railway traffic on the rail network. It is one of the most important components of the railway systems, ensuring train movement safety.

Conventional signalling in the Indian Railways was based on colour light signals and train detection with the help of track circuits and axle counters. Although this technology is suitable for the detection and control of trains, it was still not able to utilize the section capacity to its full advantage. Over the last decade, railways have seen a huge transition from conventional railway signalling systems to modern signalling systems, including Electronic Signalling Interlocking Systems, Automatic Block Signalling, and interlocking with signals at level crossing gates to enhance safety at crossing.

The Indian Railways has also indigenously developed an automatic train protection system under 'Kavach,' which is designed to bring a train to a halt automatically when it notices another train on the same line within a prescribed distance. 'Kavach' is now being deployed across the railway lines. Since specialty cables can assist in the technological requirements of the advanced railway infrastructure, the demand for specialty cables is likely to sustain in the coming years, supplemented by ongoing technological developments.

- Growing Capital Expenditure on Naval Defence

India's increased spending on defence is also an important factor in promoting the growing demand for specialty power cables. India's increased spending on naval defence also indicates growth in demand for specialty power cables. In the Union Budget 2023-24, capital outlay toward the Navy increased by about 11% to Rs. 52,805 crores.

For detailed information on developments in defence sector and budget allocation please refer to section 2.2.2.

- Expansion of Renewable Energy Plans

With favourable government policies and an enabling environment, India continues to expand its renewable energy expansion plans. This augurs well for the specialty cables industry. Specialty cables are largely

applied in setting up solar energy plants and solar energy transmission. India's photovoltaic power generation and domestic supply chain are expected to drive further growth in the country's solar energy market, which essentially will propel the demand for specialty cables.

The detailed information on growing demand from solar energy in section 2.2.5

- Growing Demand for Electric Vehicles and Automotive

The automotive industry in India is booming due to rising disposable income, growing population, surging urbanization, and increasing middle class. Considering the growing push toward green mobility, there is a surging demand for electric vehicles. Accordingly, the Indian government has introduced several policies to accelerate the development of the electric vehicle industry. For instance, a target to switch from new sales of ICE (petrol and diesel) cars to 100% plug-in electric vehicles (EVs) by CY30.

Also, the government is working to transform India into a global hub for electric vehicle manufacturing. Currently, with the government's strong support for electric vehicles and people's demand for cars continuing to increase, the scale of the automobile market also continues to expand. Such expansion in the automotive industry offers various growth opportunities to specialty cable players.

2.5 Threats and Challenges

Despite the market growth potential, there are certain challenges to the specialty cable industry. These are:

- High Competition

There is an increasing number of market participants with expanding market demands, rendering the industry fiercely competitive. With regard to India, local state-owned brands face competitive risks brought by European, American, Chinese, and other corporate brands. Compared with Indian brands, European and American corporate brands have advanced technologies in terms of high-temperature resistance, wear resistance, durability, and shielding performance. Accordingly, for the specialty power cable market, the competitive risks brought by European, American, Chinese and other companies are one of the challenges faced by the industry.

- High Production Process Requirements

Production technology directly determines the quality and production efficiency of specialty power cables. It is an important factor affecting the development of the industry. The production technology includes a series of processing technologies such as formula improvement and innovation of polymer materials, metal smelting and rolling, optimized design of product structure, composite shielding, etc. In addition, products from trial production to final development also need to go through a series of processes such as research & development, trial production, and testing. Besides, the joint process of the product is complex and requires special process methods and equipment. Therefore, the production technology requirements of Specialty Power Cables are relatively high.

At the same time, with the continuous expansion of downstream application scenarios, the market has put forward higher requirements for specialty power cable products in terms of environmental protection, durability, reliability, and other aspects. This has led to the need for specialty power cable companies to step up and strengthen product technology research & development. Accordingly, complex production technology and high technical barriers hinder the market growth.

- Raw Material Prices and Supply Risks

The major raw materials for specialty cables are steel, zinc, copper, and aluminium. The prices of these raw materials are easily affected by macroeconomic fluctuations. Any increase in the price of raw materials such as steel, zinc, copper, and aluminium, will adversely affect profit margins. Accordingly, the increasing raw materials will affect the cost and price positioning of products, which may adversely impact the specialty power cables industry and bring challenges to market development. Furthermore, if there are adverse changes in the operating and financial conditions of major suppliers, it may result in the company being unable to purchase normal quantities in a timely and sufficient manner.

- Brand Related Barriers

Compared with ordinary cables, downstream customers have strict requirements on mechanical properties, electrical properties, reliability in multiple climates, and other aspects of specialty power cables. After years of precipitation and long-term accumulation, major brand companies in the industry market have established strict product quality control systems and strong product research & development systems.

Downstream customers tend to choose products from big brand companies. Demand manufacturers pay more attention to the supplier's brand reputation in the industry when selecting and introducing suppliers. They require suppliers to have strong supporting and independent research & development capabilities as well as corresponding production and testing equipment. Only companies with strong comprehensive strength can be selected as suppliers. For industry companies, brand barriers and increasingly stringent quality supervision are among the industry development challenges.

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- Counterfeit and Shoddy Products

Specialty power cables are widely used as an important power transmission carrier. If inferior products are used, they may cause short circuits and electric shocks or may cause fires and causalities. During use, the quality of specialty power cables can be directly related to the quality of the project and the safety of people's lives and property.

At present, counterfeit and shoddy products often use raw materials with poor quality and substandard performance. Cheap counterfeit cables cause significant revenue losses to genuine cable manufacturers. In addition, these cables increase the risk of accidents due to their poor quality. For example, counterfeit and shoddy products often use inferior copper materials whose copper content is unstable, causing the resistivity of copper conductors to increase. This may cause the product to overheat during use, causing a short circuit and causing a fire.

Furthermore, the emergence of counterfeit cables forces genuine manufacturers to spend a lot of money to prevent the sale of counterfeit products. In general, the sales of fake and shoddy products hinder the sales of genuine products. Whereas the emergence of counterfeit and shoddy products increases the risk of accidents. This is a huge challenge for the development of the specialty power cables market.

- Shortage of Skilled Labour

Specialty power cables have high technical requirements. Downstream customers have strict requirements on the mechanical properties, electrical properties, reliability in multiple climates, and other aspects of the products. Therefore, many technical talents are needed in product production, research & development, and sales. At the same time, the technological progress of the industry and the increasingly fierce competition require special cable companies to continuously invest in manpower building and strengthen technical talent training. In the development process, there may be a risk of losing core technical talents if the corresponding welfare benefits for technical talents are not provided or due to management problems and other factors. Moreover, the loss of core technical talents will bring important challenges to the production and operation of industry companies, which is one of the risks faced by market development.

3 Indian Train Control System Industry

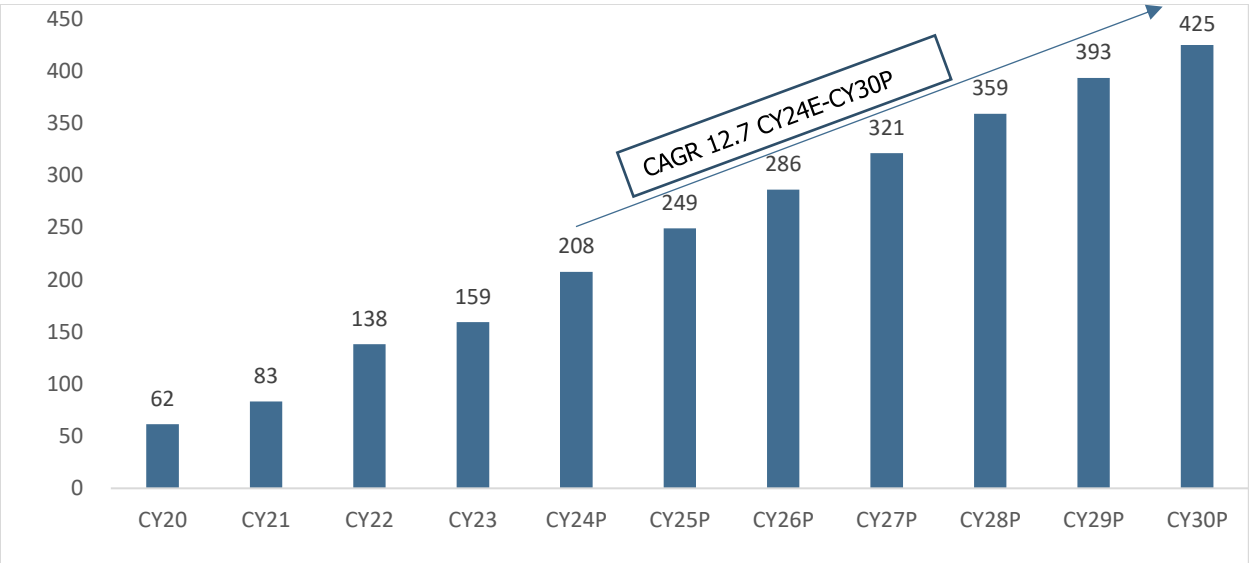
3.1 Overview

India has wide track length of over 1,28,305 kms as on March 2022. Despite, such extensive railway network, the legacy signalling and safety solutions have outlasted their useful lives. Even though, the landmass of railway network increases, the concerns related to achieving higher operating ratio and increasing accidents needs a careful attention. In FY23, 48 train accidents were reported which includes 36 derailment cases, 6 collision and 4 fire accidents. This marks increase in accidents compared to the previous year FY22 (34 accidents). Such situation alarms for a need to focus on more contemporary solutions in signalling and train management as well as control.

Train Control System is an advanced and cost-efficient technology that ensures safety of human life and the rail infrastructure. These are the hardware and software equipment that monitor train locations and movements. The primary focus of the system is to enhance the efficiency and safety of the railway network. The Indian train control system industry plays a crucial role in ensuring the smooth and secure operation of trains across the Indian Railways network. For which, Indian Railways is developing and creating technology in areas such as signalling and telecommunication with 15,000 kms being converted into automatic signalling and 37,000 kms to be fitted with 'Kavach', the domestically developed Train Collision Avoidance System. In Union Budget 2024-25, allocation towards Kavach was amounting to Rs. 557 crores. This shows the increasing efforts for scaling up the implementation of Kavach and ensuring safety by the government.

The Indian train control system market size was estimated to be valued at USD 208 million in CY23, which is further expected to reach USD 208 million in CY24E. For the forecast period CY24E-CY30, the market anticipated to grow at a notable CAGR of 12.7%. Factors such as growing urbanization and rising population in India are leading to increasing demand for high speed railway transit and network. Such growing demand bodes well for the train control system market for the coming years.

Chart 28: Indian Train Control System Market Size (USD million)



Source: Maia Research; CareEdge Research

In general sense, train control systems can be classified into the following categories:

- Automatic Train Protection - Automatic train protection (ATP) is a type of train protection system which continually checks that the speed of a train is compatible with the permitted speed allowed by signalling, including automatic stop at certain signal aspects. If it is not, ATP activates an emergency brake to stop the train.

- Dispatch Centralized System – Dispatch Centralized System is an integrated solution to control and manage the railway traffic from a single location. The system utilises a centralised train dispatcher that controls wayside station interlockings and train movements, improving the traffic regularity and optimising the railway operation within a designated territory.

- Centralized Monitoring System - Central Monitoring system enables central-operations personnel to remotely monitor transit vehicle activity and progress in real time, while also enabling vehicles to request signal priority for quick passage through intersections.

In CY23, the Automatic Train Protection segment held the major share of about 71%, followed by Dispatch Centralized System 21% and remaining 13% by Centralized Monitoring System.

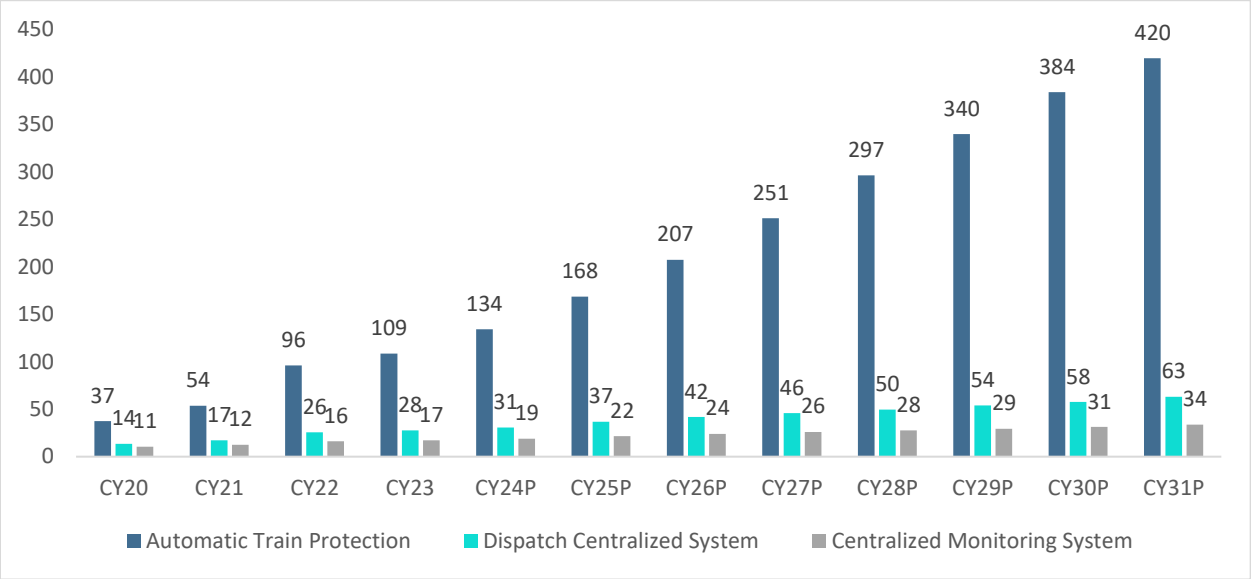
In Indian Railways, the implementation of these systems is part of ongoing efforts to modernize and improve safety in railway operations. Both ATP and Electronic Interlocking systems contribute to safer and more efficient train operations by reducing the risks associated with manual signalling and route management. These technologies are particularly important in a network as extensive and busy as the Indian Railways, where safety and efficiency are paramount. With automatic signalling, efficiency in the train management and seamless movement are facilitated.

Over the last decade, railways have seen a huge transition from conventional railway signalling systems to modern signalling systems including electronic signalling interlocking systems, automatic block signalling, and interlocking with signals at level crossing gates to enhance the safety at crossing.

Kavach is one of such indigenously developed an Automatic Train Protection System which is designed to automatically bring the train to a halt when it notices another train on the same line within a prescribed distance.

In CY23, the market size of Automatic Train Protection System segment was valued at USD 113 million. While, the market size of Dispatch Centralized System was valued at USD 29 million. These two segments are forecasted to register a significant growth at a CAGR of 14% and 9%, respectively, during forecast period CY24E-CY30.

Chart 29: India Train Control System Market Size – By Type (USD million)



Source: Maia Research; CareEdge Research

Furthermore, to meet the growing demand for rail transportation, the Indian Railways is working on increasing its capacity. This necessitates advanced signaling and train control systems to manage and optimize the movement of trains and reduce congestion. These factors supplement the Indian train control system market growth.

3.2 Growth Drivers

The growth of the train control system industry in India is influenced by several key growth drivers that promote modernization, efficiency, and safety in the Indian Railways network. These growth drivers include:

- Increased Government Spending

Investment and maintenance of transport infrastructure positively impact economic growth. In recent years, India has been increasing its budget to focus on developing railway infrastructure. Accordingly, the budgetary outlay toward Indian Railways has been on the rise over the past few years. A total of Rs. 2.52 lakh crore has been earmarked in capital expenditure for the Indian Railways in the Union Budget 2024-25. This is approximately nine times the amount spent in fiscal year 2013-14.

Further, the government has introduced various schemes such as Dedicated Freight Corridor (DFC), National Logistics Policy (NLP), General Purpose Wagons Investment Scheme (GPWIS), PM Gati Shakti & Gati Shakti Multi-Modal Cargo Terminal (GCT), Liberalised Wagon Investment Scheme (LWIS), Automobile Freight Train Operator Scheme (AFTO), multi-modal logistics parks, etc., to boost railway infrastructure and share of railways in freight traffic. The passenger segment has also seen multiple developments through initiatives like High-Speed Rail Corridors and Vande Bharat Express.

Moreover, the government has announced plans to upgrade the railways by 2030. Upgrades include 100% electrification of railways, upgrading existing lines with more facilities and higher speeds, expansion of new lines, upgrading railway stations, introducing and eventually developing a large high-speed train network interconnecting major cities in different parts of India, and development of various dedicated freight corridors to cut down cargo costs within the country. Therefore, such government investment in railway projects is expected to drive the train control system market growth during the forecast period.

- Increased Demand for Passenger and Freight Capacity

Rail is one of the most efficient & cost-effective modes of transportation for both passengers and goods. In India, railways are the economic lifeblood as a large number of passengers use them every day. Additionally, railroads are important for transporting coal, metals, oil, chemical fertilizers, and grain. Industrial raw materials and finished products are transported to production sites by rail. Besides, agriculture could be commercialized only with the help of railways. Farmers could sell their agricultural products to distant places via rail transport and railroads played an important role in agricultural development. Thus, India's railways link the country's economic life and accelerate the development of industry and agriculture.

Furthermore, the railway passenger and freight volumes are increasing year by year and are expected to continue to grow in the coming years. The passenger traffic is expected to grow at a CAGR of 2.6% between FY21 and FY31, driven by population growth and growing workforce. In terms of freight carriers, the Indian Railways envisages increasing the modal share of the railways in freight to 45% by CY30. To meet such growing demand efficiently, the train control system is expected to provide various services like smooth passenger and freight operation management, safety monitoring, and railway communication and network to meet the changing needs of passengers while reducing commuting time and enhancing travel experience.

- Surging Demand for Efficient and Reliable Transportation Systems

According to a World Health Organization (WHO) fact sheet, road traffic injuries are the leading cause of death among people aged 15-29, with 1.25 million people dying on the road every year. Further, 90% of the world's road fatalities occur in low- and middle-income countries, even though these countries own approximately 54% of the world's vehicles. In addition, for most countries, road traffic accidents cost 3% of their GDP. Also, road accidents cause huge economic losses to individuals, families, and the country. Therefore, the growing demand for safe, reliable, and efficient transportation systems has greatly contributed to the Indian train control system market growth.

Railway transportation is considered the safest and most economical mode of transportation, further boosting demand for railways. The latest trains are equipped with onboard cameras, sensors, and communications equipment. Furthermore, such trains in most places run underground or above ground and are highly protected by fences or walls to prevent intrusion. In addition, modern advanced trains consume less energy due to their advanced acceleration, traction, and braking systems.

Moreover, the train control system provides integrated diagnostic and prognostic capabilities for the train, enabling visualization of system problems & performance and recommending corrective actions to the driver. In addition, such trains can provide flexible schedule coordination, thereby improving all aspects of system performance, thus promoting the rail industry growth. Therefore, consumer demand and preference for safe, reliable, and efficient transportation are driving the train control system market growth.

- Application of Advanced Technologies such as Artificial Intelligence (AI)

The integration of advanced technologies like artificial intelligence (AI) in railway operation monitoring or surveillance can help in combating train delays, optimizing train scheduling, improving passenger travelling experiences, and so on. Also, the adoption of AI-based traffic management systems has been gaining wide popularity within railway infrastructures over time, owing to varied benefits including real-time passenger data availability, shortened time delays, supporting video surveillance, and many others.

Furthermore, growing initiatives or investments toward improving urban railway networks utilizing AI-based video analytics, the rising rate of train fatalities or accidents, and government efforts toward leveraging

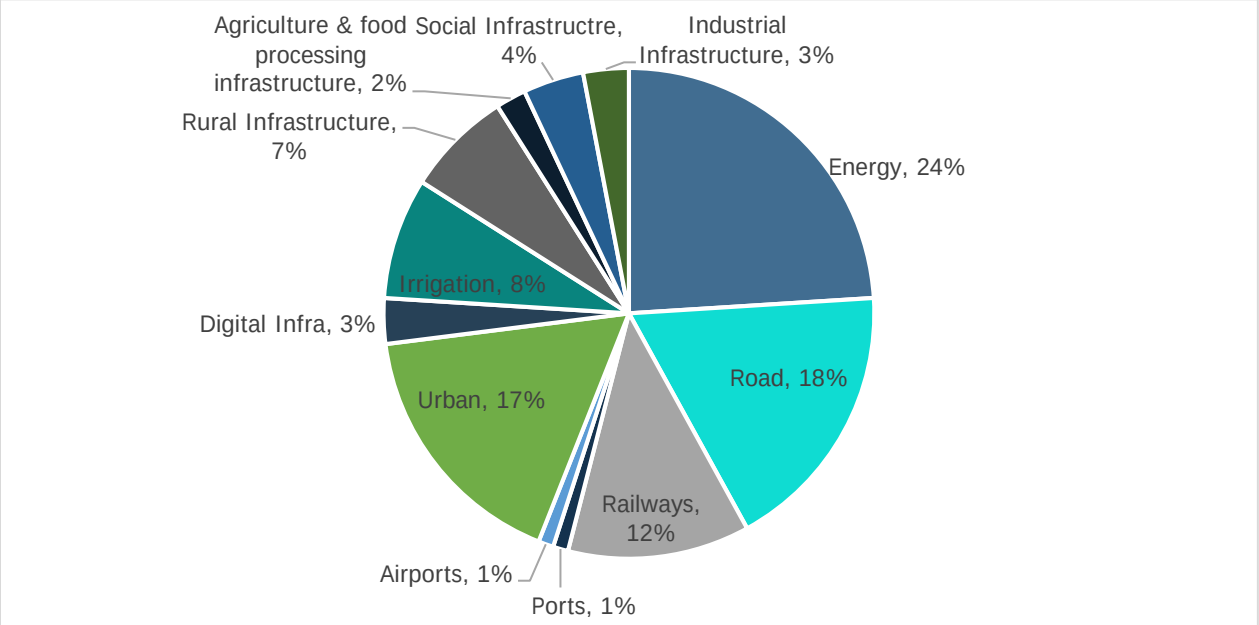
advanced technologies for improving railway transport services or facilities can also aid its market growth in the long run. This will help to develop opportunities for the train control system industry.

3.3 Budgetary Outlay and Government Initiatives

- In the Union Budget 2024-25, the government has allocated Rs 2.52 lakh crore towards railways which is the highest ever allocation and an increase of about 5% over previous year.

- Before the onset of the pandemic the Government of India had unveiled the National Infrastructure Policy (NIP) covering various sectors and regions indicating that it is relying on an 'infrastructure creation' led revival of the country's economy. The NIP which covered rural and urban infrastructure entailed investments to the tune of Rs.111 trillion to be undertaken by the central government, state governments, and the private sector during FY20-25. The below chart depicts sector-wise break up of capex of Rs. 111 trillion:

Chart 30: Sector-Wise Break-Up of Capital Expenditure of Rs. 111 Trillion during Fiscal 2020-25



Source: National Infrastructure Pipeline

Under NIP, the transport infrastructure promoting trade growth involves the Road, Railways, Port, and Airport segments. The capital expenditure plan between FY20 to FY25 for these sectors are depicted in the table below:

Table 7: Capital expenditure plan between FY20 to FY25

Particulars (Rs. crore)	FY20	FY21	FY22	FY23	FY24	FY25	Total
Road	3,32,559	3,83,283	3,56,966	2,52,780	2,40,761	3,32,659	20,33,823
Railways	1,33,387	2,62,465	3,08,800	2,73,831	2,21,209	1,67,870	13,67,563
Port	13,357	18,104	20,649	15,863	7,724	10,002	1,21,194
Airport	18,667	21,655	24,820	21,334	25,386	5,141	1,43,448

Source: National Infrastructure Pipeline

- Historically, capital investment in railways has been mainly from the government and a minor proportion was from private players. The involvement of private players is limited to allied activities such as track laying and maintenance, maintenance of coaches and wagons, construction of bridges, stations, signalling, and telecommunication works.

- Over the last decade, railways have seen a huge transition from conventional railway signalling systems to modern signalling systems including electronic signalling interlocking systems, automatic block signalling, and interlocking with signals at level crossing gates to enhance the safety at crossing. Railways has also indigenously developed an automatic train protection system under '**Kavach,'** designed to automatically bring the train to a halt when it notices another train on the same line within a prescribed distance. Kavach is now being deployed across the railway lines. It is a highly technology intensive system, which requires safety certification of highest order. Below are some of the key highlights of Kavach project:

    - Kavach aids the loco pilot in train running within specified speed limits by automatic application of brakes in case Loco Pilot fails to do so and also help the train safely run during inclement weather.

    - The first field trials on the passenger trains were started in February 2016. Based on the experience so gained and Independent Safety Assessment of the system by a 3rd party (Independent Safety Assessor: ISA) three firms were approved in FY19, for supply of Kavach.

    - Subsequently Kavach was adopted as a National ATP system in July 2020

    - As on February 2024, Kavach has so far been deployed on 1465 Route km (Rkm) and 139 locomotives (including Electric Multiple Unit rakes) on South Central Railway on following sections: Lingamapalli – Vikarabad – Wadi and Vikarabad - Bidar section (265 Rkm), Manmad-Mudkhed-Dhone-Guntkal section (959Rkm), Bidar-Parbhani section (241Rkm)

    - Kavach tenders have been awarded for Delhi – Mumbai & Delhi – Howrah corridors (approximately 3000 Route km) .

    - As on February 2024, Indian Railways is preparing Detailed Project Report (DPR) and detailed estimate for another 6000 RKm.

- Presently, as on February 2024, there are three Indian OEMs who are approved for Kavach - Medha Servo Drives, HBL Power Systems, and Kernex Microsystems. Efforts are being made by the government to develop more vendors to enhance the capacity and scale up the implementation of Kavach.

- The Cost for provision of Track side including Station equipment of Kavach is approximately Rs. 50 Lakhs per Km and cost for provision of Kavach equipment on loco is approximately Rs. 70 lakh per loco. The amount spent so far on Kavach implementation is Rs. 351.91 crores. The budgetary allocation for Kavach during the year 2024-25 is over Rs. 557 crores.

- A fund namely '**Rashtriya Rail Sanraksha Kosh' (RRSK**) has been created in 2017-18 with a corpus of Rs. 1 lakh crore over a period of five years for critical safety related works. The works identified under this fund are Civil Engineering Works, Safety works at Level Crossings, Signalling and Telecommunication work, Mechanical Engineering, Electrical Engineering and Human Resource Development. For which, an outlay of Rs. 10,000 crores have been made in Union Budget 2023-24.

- Railway Safety Fund (RSF) was created in 2001-02 initially to fund works relating to Level Crossing and Road Over Bridge & Road Under Bridge. Its scope has subsequently been expanded for capital expenditure on other safety works also. In Union Budget 2024-25, Rs. 45,000 crores have been allocated towards this fund.

- Automatic Block Signalling is a cost-effective solution to increase line capacity to run more trains on existing High-Density Routes of Indian Railway. During FY23, Indian Railway has upgraded 582 kms with automatic signalling compared to 530 kms compared to FY23, registering an increase of 10%. These are the best figures achieved by Indian Railway so far.

- Large number of Digitally Interlocked Stations have been created from old lever frame to computer-based operating system. These are being adopted on a large scale to derive benefits of digital technologies in train operation and to enhance safety. During FY24, about 551 stations were provided electronic interlocking as compared to 538 stations in FY23, marking an increase of ~2%.

3.4 Threats and Challenges

The Indian train control system market faces several challenges that may impact its growth and development. These challenges include:

- High Capital Requirements

One of the major constraints of the train control systems market is its capital-intensive nature as train costs are very high. Track and engineering structures such as communication systems, train signalling, power supply for electrified sections, bridges and tunnels, and terminal infrastructure require significant capital and maintenance costs. Thus, the market growth is constrained by infrastructure costs and costs associated with equipment, land acquisition, and financing. It also includes costs associated with integrating new train control systems into existing infrastructure is challenging and installing new systems.

- High Technical Barriers

The train control system industry is technology-intensive. It integrates modern communication technology, computer technology, security and reliability technology, digital signal processing technology, sensor technology, network transmission technology, and other professional and multi-field professional technology applications. The technological achievements in history rarely spread. Most core technologies

are mastered by a small number of backbone enterprises. Accordingly, there is a lesser possibility for other enterprises to systematically master the relevant technical systems.

Further, the transportation system of Indian Railways is huge and complex. The railway operating lines are widely distributed and faced with complex terrain and changing natural environments. Railway running safety system has high requirements for accuracy and operational stability, and it is difficult for enterprises lacking a deep understanding of the national railway operation and management needs, a strong technical reserve history, and a technical verification history to enter the relevant fields.

At the same time, train safety technology, especially train operation control technology, is the result of long-term accumulation and requires years of research & development and field application verification to ensure the reliability, safety, and adaptability of related products. It will be difficult for new market entrants to achieve substantial breakthroughs in a short period of time. Accordingly, there are high technical barriers in the train control system industry.

- Security Management and Technology Upgrade Risk

The train control system is the key to ensuring the safety and stability of railway transportation. Once a problem occurs, it may cause a major accident and have a significant impact on national safety and enterprises in the industry.

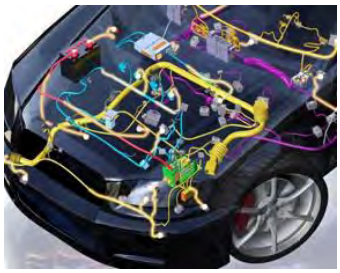
The large-scale application of railway driving safety systems must be guaranteed by a strict and mature application management system. Also, when a new technology is introduced, smooth integration of old and new systems must be ensured. This includes, but is not limited to, the large-scale testing of new systems, preparation of contingency plans, and simulation of possible failure scenarios. Therefore, train control system companies must make careful planning, thorough testing, and comprehensive consideration of possible risk factors for product application.

4 Indian Interconnect Products Industry

4.1 Overview

The Indian interconnect products industry refers to the sector involved in the design, manufacturing, and distribution of various interconnect solutions. Interconnect products play a critical role in facilitating electrical and electronic connections between different components or devices. These components enable the flow of signals, power, and data within electronic systems. The industry encompasses a wide range of products and technologies, including connectors and wire harnesses.

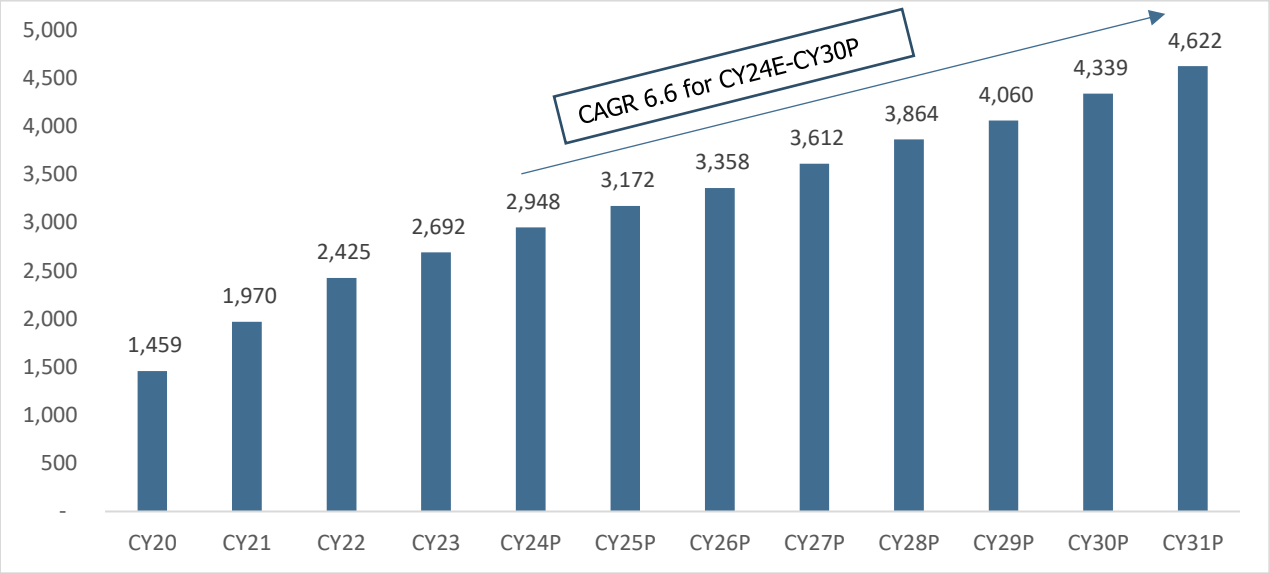
Further, electrical connectors and wire harnesses play a critical role in many electrical assemblies. A wire harness is a collection of cables or wires used to transmit electrical power, signals, and data, while connectors, also known as electrical connectors, are end components used to join wire.



Moreover, these connectors and wiring harnesses are widely used in sectors like automotive, rail vehicles, defense, telecom, and medical equipment. Accordingly, the growing thrust toward infrastructural development and the increasing industry size of these segments are expected to propel the interconnect products market growth in the coming years.

In CY23, the domestic interconnect products market was valued at USD 2,692 million, which is further expected to reach USD 2,948 million in CY24E. For the forecast period CY24E-CY30, the market is predicted to grow at a CAGR of 6.6%.

Chart 31: Indian Train Control System Market Size (USD Million)



Source: Maia Research; CareEdge Research

Overall, technological innovations and advancements are projected to optimize the product performance, making it more widely used in downstream applications. This is further expected to support the interconnect products market growth.

4.2 Growth Drivers

There are several factors contributing to the domestic interconnect products industry growth:

- Growth of the Automobile Industry

The thriving automotive industry propels the electrical connector and wiring harness market growth. The automotive industry encompasses companies involved in manufacturing vehicles, including two-wheelers, three-wheelers, and four-wheelers. Wiring harnesses are embedded in the body, engine, and chassis of a car and are critical to its efficient performance and safety. According to the Society of Indian Automobile Manufacturers (SIAM), the industry produced a total of 2,84,34,742 vehicles including passenger vehicles, commercial vehicles, three-wheelers, two-wheelers, and quadricycles in FY24, as against 2,59,31,867 units in FY23. Moreover, the total passenger vehicle sales increased from 38,90,114 in FY23 to 42,18,746 units in FY24; sales of passenger cars increased from 17,47,376 to 15,48,943; utility vehicles from 20,03,718 to 25,20,691 and vans 1,39,020 to 1,49,112 units, in FY24, compared to the previous year. Such uptrends in the automotive industry drives the electrical connector and wiring harness market.

- Continuous Advancements in Automotive Technology

Automobile manufacturers are implementing various technologies in their upcoming models to stay competitive in the market. Technologies such as automatic high beam control, self-driving, cruise control, and automatic lift gates are highly adopted by automobile companies as buyers are largely lured by attractive design, specifications, quality, and features. Wire harnesses are one of the most important components of a vehicle's electrical system. It bundles up to 5 km of cables in an average car.

Moreover, in modern vehicles, the majority of components, such as engine, air conditioning, instrumentation, audio speaker, lights, and battery are connected through front, rear, and roof wire

harnesses. In addition, owing to the increasing technological advancements, the demand for wire harnesses is growing in the automobile industry. Furthermore, consumers are moving toward electric vehicles (EVs), which is also propelling the wire harness market growth.

- Increasing Demand from Railways

Rail transport is one of the most efficient & user-friendly modes of transportation. Electrical connectors and wiring harnesses are needed in the railway system to connect various components of the train, including power, lighting, and communication equipment inside the carriages. Electrical connectors and wiring harnesses play a vital role in the construction process of the railway transportation system.

In recent years, India has been raising investments in railway infrastructure. In the Union Budget 2024-25, the government has allocated Rs 2.52 lakh crore toward railways, which is the highest-ever allocation and an increase of about 5% over the previous year's allocation. Such increasing commitment to rolling stock manufacturers and infrastructure development is expected to support the interconnect products market in India. With the development of Indian railways, the market demand for electrical connectors and wiring harnesses is likely to expand in the coming years.

- Rising Demand from Defence

The technical level of the aviation, aerospace, and weapons industries represents and symbolizes the strength of national defence. In order to meet the needs of the rapid development of national defence modernization, the supporting products are constantly being updated and the electrification, automation, and systematization of equipment are constantly improving. Therefore, the use of electrical connectors and wiring harnesses as 'blood vessels and nerves' is also increasing.

In recent years, India's defence manufacturing has grown continuously, with increasing investments in aerospace and defence manufacturing, which is aiding the electrical connector and wiring harness market expansion. Whereas in the Union Budget 2024-25, India's capital allocation related to modernization of defence services and infrastructure development has been increased to Rs. 1,72,000 crore. Further, the Ministry of Defence has set a target of Rs. 175 crore turnovers in the aerospace and defence manufacturing industry by CY25, including Rs. 35,000 crores in exports.

As of April 2023, a total of 606 industrial licenses have been issued to 369 defence sector companies. To support the domestic defence industry, the government aims to ensure transparency, predictability, and ease of doing business by creating a strong ecosystem and supportive government policies. To this end, the government has taken steps to de-license, deregulate, promote exports, and liberalize foreign investment. Moreover, to promote exports and liberalize foreign investments, FDI in the defence sector was increased to 74% through the automatic route and to 100% through the government route. Such consistent government support in defence manufacturing augurs well for the electric wire and harness industry.

- Increasing Market Demand for Medical Devices and Equipment

The market demand for wire harnesses in the medical device and equipment industry is growing rapidly, attributed to advancements in technology that have facilitated the development of new & innovative medical devices and equipment. Wiring harnesses play an important role in these medical devices and equipment as they provide the necessary electrical connections between the various components.

Furthermore, the demand for the biocompatible wire harness market for medical devices and equipment is increasing due to the rising incidence of chronic diseases and ageing population. Such key factors are likely to propel the growth of the wiring and harness market in India.

4.3 Threats and Challenges

The interconnect products industry in India, which includes various components and technologies for connecting electronic devices and systems, faces several challenges. These challenges can affect both domestic and international businesses operating in this sector.

Some of the key challenges include:

- Fluctuations in Raw Material Prices

Electrical connectors and wire harnesses are manufactured using copper, aluminium, and plastic. Copper is used in electrical connectors and wire harnesses due to easy assembly & manufacturing, small bundle size capability, high conductivity, flexibility, and reliability. The supply and demand imbalance leads to fluctuating copper costs, keeping it on an increasing scale. Whereas the demand for copper is huge, which primarily governs the price globally. Also, copper and its alloys are versatile engineering materials with a wide range of valuable properties that make them suitable for a vast number of applications.

Further, many electrical connectors and wire harness manufacturers use aluminium because of its lightweight and low cost, but aluminium has lower conductivity and must be larger than copper wires for the same power rating. Additionally, aluminium requires various termination technologies to overcome the problems of galvanic corrosion, oxidation, deformation with ageing, high thermal expansion, lower flexibility, and tensile strength. Nevertheless, as aluminium poses various challenges, copper remains the first choice for electrical connectors and wire harness applications. Thus, the fluctuating prices of copper can impact the profitability of electrical connectors and wire harness manufacturers.

- Strict Quality and Delivery Requirements

The electrical connector and wire harness industry usually has extremely high product quality requirements, but tight delivery times. Design changes often occur late in the design process, causing delays. At the same time, legislation requiring traceability and documentation puts increased pressure on manufacturers to implement ongoing verification and validation processes. For example, ISO 26262 requires a certain level of redundancy in wiring harnesses for autonomous vehicles. Thus, strict regulations are a challenge to adhere to.

- High Competition

As India's economy continues to grow, rapid developments and advancements have entered all walks of life, resulting in a huge rigid demand for electrical connectors and wire harnesses. The electrical connector and wire harness industry has developed rapidly, rendering the competition more intense. Companies in the electrical connector and wire harness industry can compete with each other in several ways. One of the most important ways is through the use of technology. Accordingly, several companies are heavily investing in R&D to create new & innovative products that will give them a competitive advantage.

Further, companies are looking for ways to reduce costs and improve efficiency. This is often accomplished by automating production processes and using lean manufacturing techniques. Another way companies compete is by providing excellent customer service and support. This can include offering better warranty coverage or more timely technical assistance.

Finally, companies also compete by offering lower prices or discounts on products and services. Moderate competition is conducive to market development. On the other hand, fierce competition can bring pressure and threats to participants. Overall, enterprises are stepping up their efforts to upgrade technology, improve service quality, and bring better products & services to customers.

5 Peer Comparison

5.1 Quadrant Future Tek Limited

Table 8: Business Information – Quadrant Future Tek Limited

Particulars	Description
Company Name	Quadrant FutureTek Private Limited
Website	www.quadrantfuturetek.com
Year of Establishment	2015
Business Overview	Quadrant FutureTek Private Limited is a Technology & Innovation-driven enterprise Certified to ISO/IRIS/TS Quality Management Systems. The state-of-the-art machinery, Testing & Product Development infrastructure constitute the facilities at Mohali. Quadrant FutureTEK offers Products & solutions in the following four verticals: End End Solutions in Train Control & Signalling Solutions; Speciality Cables; Cable Assemblies & Interconnect Solutions; electrical/Electronic Systems & Displays
Key Products	Specialty Cables, Train Control Systems and Interconnect Products

Source: Company Reports

Table 9: Standalone Financial Information - Quadrant Future Tek Limited

Indicators	Unit	FY20	FY21	FY22	FY23
Total Revenue	Rs. million	730.95	729.35	1,053.46	1,532.22
EBITDA	Rs. million	105.31	111.68	97.19	263.51
PAT	Rs. million	56.24	71.18	16.32	130.70
EBITDA Margin	%	14.43%	15.33%	9.22%	17.21%
PAT Margin	%	7.71%	9.77%	1.55%	8.54%
Debt to Equity	Times	2.59	1.84	3.31	2.14

Source: Company Reports

5.2 Apar Industries Limited

Table 10: Business Information - Apar Industries Limited

Particulars	Description
Company Name	Apar Industries Limited
Website	www.apar.com
Year of Establishment	1958
Business Overview	Established in India in 1958, Apar Industries is a manufacturer and supplier of conductors, various cables, specialty oils, polymers and lubricants and has expanded its operations to more than 140 countries.
Key Products	Speciality Oils, Conductors, Cables, Telecom Solution, Polymers, Lubricants, Specialty Automotive, Innovations
Geographical Outreach	Worldwide

Source: Company Reports

Table 11: Consolidated Financial Information - Apar Industries Limited

Indicators	Unit	FY22	FY23	FY24	H1 FY25
Total Revenue	Rs. million	93,490.60	1,43,737.70	1,62,394.10	87,031.10
EBITDA	Rs. million	5,804.60	12,644.00	16,081.40	7,811.90
PAT	Rs. million	2,567.30	6,377.20	8,251.10	3,964.10
EBITDA Margin	%	6.23%	8.82%	9.96%	9.03%
PAT Margin	%	2.76%	4.45%	5.11%	4.58%
Debt to Equity	Times	0.17	0.14	0.10	0.11

Source: Company Reports

Table 12: Segmental Information - Apar Industries Limited (Rs. million)

Segment	Revenue	EBIT	Capex*
Conductor	80,309.80	8,575.30	897.40
Transformer & Specialities Oils	48,369.30	2,917.80	226.80
Power/Telecom Cables	38,588.80	4,050.60	1,292.40
Other	1,232.80	120.00	39.80

Source: Company Reports, * Capex is for FY23 rest are FY24 numbers.

5.3 Polycab India Limited

Table 13: Business Information - Polycab India Limited

Particulars	Description
Company Name	Polycab India Limited
Website	www.polycab.com
Year of Establishment	1964
Business Overview	Polycab India Limited is engaged in the business of manufacturing and selling wires and cables and fast electrical products under the brand name 'POLYCAB'. Polycab India Limited except wires and cables. Also manufactures and sells FMEG products such as electric fans, LED lighting and fixtures, switches and switchgear, solar products, and conduits and accessories.
Key Products	Energy Cables, Specialty Cables, Communication Cables, Polycab Wires, Etira Wires, Fans, Lighting and Luminaires, Hohm - Smart Automation Solution, Switches, Switchgears, Solar Products, Conduits and Accessories, Pumps, Appliances, EPC and Telecom
Geographical Outreach	Domestic and export to about 70 countries
Presence of Factories	25 Manufacturing facilities
Capacity	Wires & Cables 5.4mn kms

Source: Company Reports

Table 14: Consolidated Financial Information - Polycab India Limited

Indicators	Unit	FY21	FY22	FY23	FY24
Total Revenue	Rs million	89,115.17	1,22,936.84	1,42,411.10	1,82,603.19
EBITDA	Rs million	12310.08	13525.67	19,761.77	27,126.80
PAT	Rs million	8,859.13	9,172.84	12,830.86	18,029.17
EBITDA Margin	%	14.00%	11.08%	14.01%	15.04%
PAT Margin	%	10.08%	7.52%	9.09%	9.99%
Debt to Equity	Times	0.05	0.01	0.02	0.01

Source: Company Reports

Table 15: Segmental Information – Polycab India Limited (Rs. million)

Segment	Revenue	EBIT	Capex*
Wires and Cables	1,61,072.50	23,606.60	3,157.00
FMEG	12,988.20	-942.00	1,329.38
Others	11,008.10	1,248.20	97.67

Source: Company Reports, * Capex is for FY23 rest are FY24 numbers

5.4 Radiant Corporation Private Limited

Table 16: Business Information - Radiant Corporation Private Limited

Particulars	Description
Company Name	Radiant Corporation Private Limited
Website	NA
Year of Establishment	1976
Business Overview	Radiant Corporation Private Limited is an unlisted private company incorporated in the year 1976. The company is engaged in the business of developing and manufacturing specialized electronic and electric wires & cables.
Key Products	Industrial Electrical Wire, Heat Resistant Electrical Wire, Blue Electric Wire, KEI Electrical Wires, Bulk Electrical Wire and Building Wires

Source: Company Reports

Table 17: Consolidated Financial Information - Radiant Corporation Private Limited

Indicators	Unit	FY20	FY21	FY22	FY23	FY24
Total Revenue	Rs million	1,497.47	729.28	928.89	911.70	
EBITDA	Rs million	0.00	0.02	0.02	0.02	
PAT	Rs million	-138.95	89.28	107.02	77.47	
EBITDA Margin	%	0.00%	0.00%	0.00%	0.00%	
PAT Margin	%	-9.45%	12.26%	11.85%	8.70%	
Debt to Equity	Times	0.00	0.00	0.00	0.00	

Source: Company Reports

5.5 Medha Servo Drives Private Limited

Table 18: Business Information - Medha Servo Drives Private Limited

Particulars	Description
Company Name	Medha Servo Drives Private Limited
Website	www.medha.com
Year of Establishment	1984
Business Overview	The company is focused on rail transportation. The company specialises in products for application on locomotives, trainsets, coaches, railway station and yards. The company specialises in designing and engineering the products to withstand shock and vibration, wide temperature variations, and electrical disturbances that are typical of harsh locomotive environment.
Key Products	High-tech electronics products for application on locomotives, coaches, railway stations and yards, Propulsion Systems, Rolling Stock Equipment, Fuel Saving Solutions, Signaling

Source: Company Reports

Table 19: Consolidated Financial Information - Medha Servo Drives Private Limited

Indicators	Unit	FY20	FY21	FY22	FY23
Total Revenue	Rs million	19,799.60	16,550.40	17,937.90	23,676.30
EBITDA	Rs million	3,750.90	3,516.90	3,203.70	2,584.00
PAT	Rs million	2,814.50	2,425.80	2,360.40	1,201.70
EBITDA Margin	%	19.26%	22.10%	18.59%	11.06%
PAT Margin	%	14.45%	15.24%	13.69%	5.14%
Debt to Equity	Times	0.00	0.00	0.00	0.18

Source: Company Reports

Table 20: Segmental Information – Medha Servo Drives Private Limited (Rs. million)

Segment	Revenue	EBIT	Capex
Railway Equipment and other	13,524.70	2,598.50	510.60
Solar Project	6.10	5.30	-
Canal Automation Project	3,705.20	566.20	4.20

Source: Company Reports

5.6 HBL Power Systems Limited

Table 21: Business Information - HBL Power Systems Limited

Particulars	Description
Company Name	HBL Power Systems Limited
Website	www.hbl.in
Year of Establishment	1986

Particulars	Description
Business Overview	HBL Power Systems Limited is an India-based company that is engaged in design, development and manufacturing of specialized batteries and electronic solutions. The Company operates its business under three primary verticals: battery, electronics and defence. Its electronics business vertical is sub-divided into railway electronics and electric mobility. Its flagship products in this vertical are the train collision avoidance system (TCAS), which addresses the issue of safety, and train management system (TMS), which is designed for efficient track utilization. It has developed electric drive train kits for retrofitting light commercial vehicles and passenger buses. It manufactures specialized batteries for various applications, such as fighter aircraft, unmanned aerial vehicles and torpedoes, among others.
Key Products	Industrial Batteries, Electronics, Motors, Build to Print Manufacturing
Geographical Outreach	Over 80+ countries

Source: Company Reports

Table 22: Consolidated Financial Information - HBL Power Systems Limited

Indicators	Unit	FY21	FY22	FY23	FY24	H1 FY25
Total Revenue	Rs million	9,216.68	12,505.84	13,863.62	22,512.63	10,588.0
EBITDA	Rs million	770.01	1,533.54	1,691.21	4,413.69	2,368.69
PAT	Rs million	137.27	937.10	970.92	2,626.56	1,518.59
EBITDA Margin	%	8.44%	12.41%	12.36%	19.76%	22.75%
PAT Margin	%	1.51%	7.58%	7.19%	11.76%	14.59%
Debt to Equity	Times	0.07	0.06	0.08	0.05	0.04

Source: Company Reports

Table 23: Segmental Information – HBL Power Systems Limited (Rs. million)

Segment	Revenue
Batteries	14227.90
Electronics	5406.60
Unallocated	981.30

Source: Company Reports

5.7 Kernex Microsystems (India) Limited

Table 24: Business Information - Kernex Microsystems (India) Limited

Particulars	Description
Company Name	Kernex Microsystems (India) Limited
Website	www.kernex.in
Year of Establishment	1981

Particulars	Description
Business Overview	Kernex Microsystems (India) Limited is engaged in the manufacture and sale of Safety Systems and Software services for Railways. The company is specialized in Integrating Technologies related to Wireless Front-end, Satellite Communication, Embedded Systems, Signal Processing, Network Management and Software development.
Key Products	Train Protection System, Level Crossing Protection, Information System, Turnkey Product Development, Electronic Product Design, Embedded Software Design
Geographical Outreach	Domestic and Overseas

Source: Company Reports

Table 25: Consolidated Financial Information - Kernex Microsystems (India) Limited

Indicators	Unit	FY21	FY22	FY23	FY24
Total Revenue	Rs million	195.82	83.82	48.22	209.04
EBITDA	Rs million	50.86	-77.03	-163.35	-194..51
PAT	Rs million	20.21	-172.12	-200.20	-267.09
EBITDA Margin	%	27.89%	-115.81%	-404.38%	-99.24%
PAT Margin	%	11.08%	-258.76%	-495.60%	-128.18%
Debt to Equity	Times	0.32	0.37	0.13	0.25

Source: Company Reports

5.8 G.G. Tronics India Private Limited

Table 26: Business Information - G.G. Tronics India Private Limited

Particulars	Description
Company Name	G.G. Tronics India Private Limited
Website	www.ggtronics.com
Year of Establishment	2003

Particulars	Description
Business Overview	The company is situated in Bengaluru and involved in Design, Manufacturing, Supply and Installation of Electronic Safety Embedded Systems for Railway Transport sector.
Key Products	Single & Multi Section Digital Axle Counter SSDAC / MSDAC for track section, Train Collision Avoidance System(KAVACH) and many more.
Geographical Outreach	Domestic

Source: Company Reports

Table 27: Consolidated Financial Information - G.G. Tronics India Private Limited

Indicators	Unit	FY20	FY21	FY22	FY23	FY24
Total Revenue	Rs million	710.64	748.37	766.61	991.30	1060.75
EBITDA	Rs million	92.12	92.92	94.32	137.30	141.79
PAT	Rs million	62.70	62.98	49.56	114.60	112.04
EBITDA Margin	%	13.09%	12.58%	12.53%	13.85%	13.37%
PAT Margin	%	8.91%	8.52%	6.58%	11.56%	10.56%
Debt to Equity	Times	0.00	0.00	0.00	0.00	0.36

Source: Company Reports

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