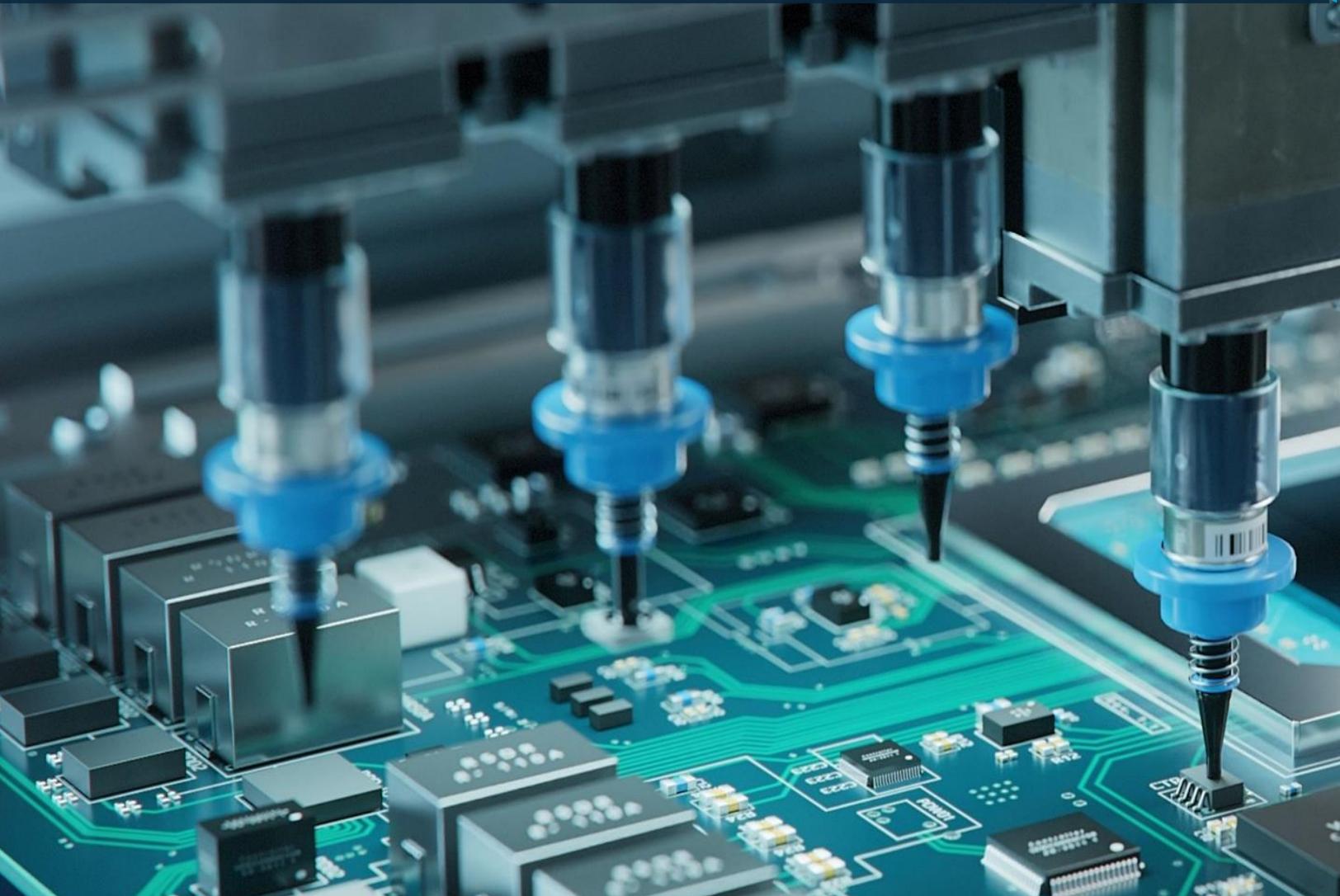


# MARKET ASSESSMENT FOR INDIA EMS INDUSTRY



SUBMITTED TO  
**CYIENT DLM LTD.**  
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## ACRONYMS

Title	Abbreviations	Title	Abbreviations
5G	Fifth Generation	ITAR	International Traffic in Arms Regulations
A&D	Aerospace and Defence	IVD	In-Vitro Diagnostics
ADAS	Advanced Driver Assistance System	LCA	Light Combat Aircraft
ATM	Air Traffic Management	LCD	Liquid-crystal Display
ATMP	Assembly, Testing, Marking, and Packaging	LED	Light Emitting Diode
B2B	Business to Business	LPG	Liquefied Petroleum Gas
B2C	Business to Consumer	LVHM	Low Volume High Mix
BIS	Bureau of Indian Standards	MEIS	Merchandise Exports from India Scheme
BOM	Bill of Material	MEMS	Microelectromechanical Systems
CAGR	Compound Annual Growth Rate	ML	Machine Learning
CAPEX	Capital Expenditure	MNC	Multi National Company
CE&A	Consumer Electronics and Appliances	MSME	Micro, Small, and Medium Enterprises
CHIPS	Creating Helpful Incentives to Produce Semiconductors	NCAP	New Car Assessment Program
CM	Contract Manufacturing	NMZ	National Manufacturing Zones
CPI	Consumer Price Index	NPE	National Policy on Electronics
CSR	Corporate Social Responsibility	NSTC	National Semiconductor Technology Centre
DAP	Defence Acquisition Policy	ODM	Original Design Manufacturer
DDTC	Directorate of Defence Trade Controls	OEM	Original Equipment Manufacturer
DGFT	Directorate General of Foreign Trade	PC	Personal Computer
DPSU	Defence Public Sector Undertakings	PCB	Printed Circuit Board
DRDO	Defence Research and Development Organisation	PCBA	Printed Circuit Board Assembly
EDA	Electronic Design Automation	PLI	Production Linked Incentive
EMC	Electronics Manufacturing Cluster	PMP	Phased Manufacturing Plan
EMS	Electronics Manufacturing Services	POC	Proof of Concept
EU	European Union	PPP	Public-private partnerships
FDI	Foreign Direct Investment	R&D	Research and Development
FMS	Flight Management System	RBI	Reserve Bank of India
FTA	Free Trade Agreements	RF	Radio Frequency
GDP	Gross Domestic Product	RoCE	Return on Capital Employed
GST	Goods and Services Tax	RoE	Return on Equity
HDI	High Density Interconnect	RSBVL	Reliance Strategic Business Ventures Ltd
HR	Human Resource	SEZ	Special Economic Zone
HVLM	High Volume Low Mix	SME	Small and Medium Enterprise
IC	Integrated Circuit	SMT	Surface Mount Technology
IED	Intelligent Electronic Devices	SoC	System on Chips
IESA	India Electronics & Semiconductor Association	TRAI	Telecom Regulatory Authority of India
IIP	Index of Industrial Production	UDAN	Ude Desh ka Aam NaagriK
IIPME	Industry Innovation Programme on Medical Electronics	USA	United States of America
IMF	International Monetary Fund	USML	United States Munitions List
IoT	Internet of Things	VAS	Value Added Services

## DEFINITIONS

Title	Definition
Box Build	Also called as systems integration, can range from a simple PCBA housed in a small enclosure to a cabinet comprising an electromechanical system.
Components	It includes active, passive, wound, electro-mechanical, bare PCB, and other components that go into electronics products manufacturing.
EMS (Electronic Manufacturing Services)	Companies that provide various manufacturing services to Electronics OEMs such as design, sourcing, manufacturing, assembly, testing, distribution, and after-sales services.
OEM (Original Equipment Manufacturer)	OEMs are manufacturers that provide the resources required to bring an original, branded product to market.
ODM (Original Design Manufacturer)	EMS companies that have the capability to design, develop, and manufacture products as per their own specifications or as per the specifications provided by the OEMs.
CM (Contract Manufacturer)	EMS companies that only provide contract manufacturing services to the OEMs. They do not have capability of designing any product.
HVLM (High Volume Low Mix)	This is typically a contract manufacturing setup where only a few types of assemblies are produced in large quantities. Such a production arrangement may last for weeks or even months using the same set-up.
LVHM (Low Volume High Mix)	This type of contract manufacturing puts a high focus on complex solutions customized as per customer requirements.
B2B (Business to Business)	Businesses that are carried out between the two enterprises. In this case, products that are sold to segments such as telecom, industrial, automotive, medical, aerospace and defence.
B2C (Business to Consumer)	Businesses that are carried out primarily between an enterprise and consumers. These are products such as consumer electronics, mobiles, lighting products etc.
B2P (Build to Print)	It is a type of contract manufacturing that refers to the process of manufacturing products as per client's instructions, who in turn provides the specifications and other required needs for the final product to be manufactured.
B2S (Build to Specification)	It refers to the process of manufacturing products from scratch, as per clients need and specifications. The EMS company develops design and specifications and manufacture the product as per client's specific requirements.
CY (Calendar Year)	The calendar year is defined from January to December. For instance, CY21 refers to 1st January 2021 to 31st December 2021
FY (Financial Year)	The financial year in India is defined from April to March. For instance, FY20 refers to 1st April 2019 to 31st March 2020

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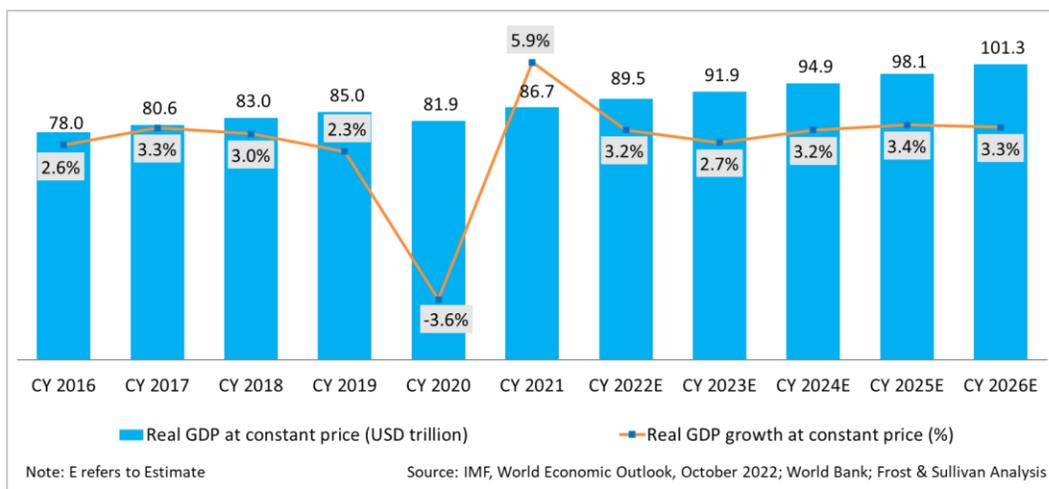
# CHAPTER 1 - GLOBAL MACROECONOMIC OVERVIEW

## Global macroeconomic overview

The Global economy (real GDP), which is now well on the path of recovery, has undergone stress in the last few years due to extended trade conflicts, slowdown in investments across the world and then a novel virus. Global economy was showing signs of slowdown since CY2018 and then entered a recession in CY2020 owing to the unprecedented crisis caused by COVID-19 pandemic. The pandemic brought economic activity to a near standstill in CY2020 and to an extent in CY2021, as many countries had to impose strict restrictions to curb the spread of the virus. While in CY2022 the economy was affected due to Russia-Ukraine war; slowdown in US, Europe; supply chain issues and other factors. Russia's war against Ukraine continues to affect the EU economy, setting it on a path of lower growth and higher inflation.

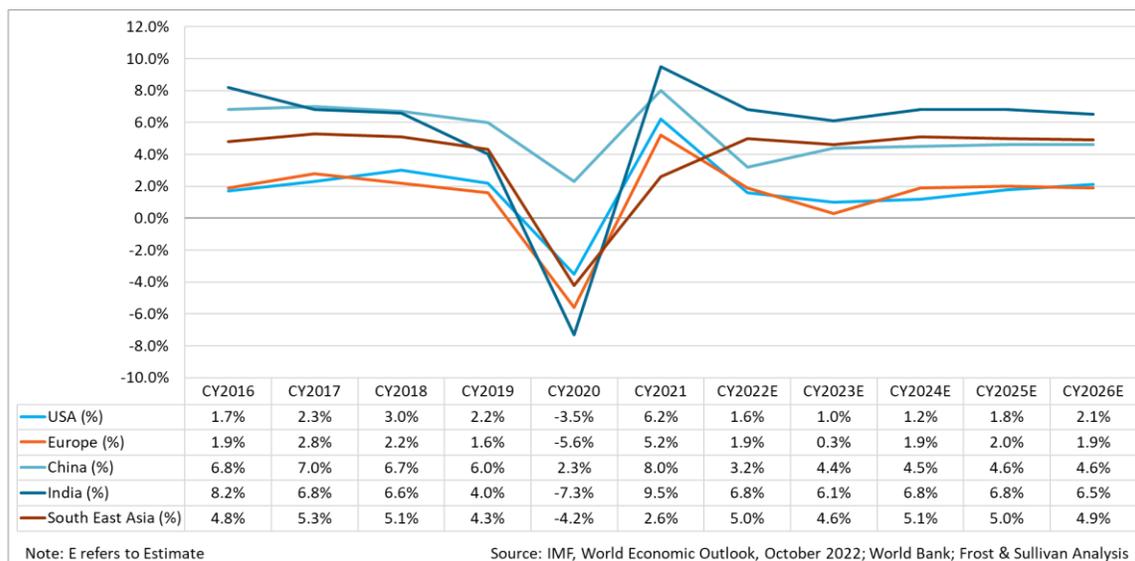
## Global real GDP

**Chart 1.1: Global real GDP and real GDP growth (annual percentage change), value in USD trillion, growth in %, CY2016-CY2026E**



## Real GDP for key regions

**Chart 1.2: Real GDP growth (annual percentage change) in key economies (USA, Europe, China, India, Middle East, South East Asia), growth in %, CY2016-CY2026E**



In CY2021, the global economy grew by 5.9% (by real GDP), owing largely to the inherent strength of major economies such as the United States of America (USA), China, Japan, Germany, United Kingdom, and India. However, the beginning of CY2022, saw the global economy grow to a reasonably strong position, and the major economies like—the USA, China, and India, had managed to regain their pre-pandemic levels, while countries in Europe and South East Asia were on the trajectory of reaching their pre-pandemic levels. After gaining significant experience from the pandemic, governments across the world took steps they need to deal with similar black swan events in the future.

However, global economic activity is experiencing a sharper-than-expected slowdown in the second half of CY2022, with inflation levels higher than ever before. Cost-of-living, tightening financial conditions in most regions, and Russia's invasion of Ukraine, are all weighing heavily on the outlook. One of the most important effects of this war is seen on commodity prices and expected to see further fluctuations in the global fuel prices. Global growth is forecast to slowdown from 5.9% in CY2021 to 3.2% in CY2022 and 2.7% in CY2023.

#### **A) United States of America (USA)**

The USA economy was progressing well with more than 2% growth between 2017 and 2019 before it experienced the biggest decline in 2020 when the economy contracted by over 3.5%. In CY2021, the real GDP in USA witnessed a positive recovery of 6.2% after a slow period of growth. However, the economic impact of Russia's invasion of Ukraine has contributed to a slowdown in US activity in CY2022. Supply disruptions although improved may take some more time to fully ease. Inflation is still quite high along with an increase in unemployment. As of mid-November, more than 73,000 workers in the U.S. tech sector have been laid off in mass job cuts so far in CY2022. The reason, broadly, is twofold: Business growth is slowing, while labour costs are increasing, because of which, the US economy is anticipated to grow at the rate of 1.6% in CY2022 and 2.1% in CY2026.

#### **B) Europe**

The European Union (EU) economy shrunk by 5.6 % in 2020 and had a recovery of 5.2% in 2021. Spain, UK, Italy, Greece, and France were the worst affected economies, experiencing a GDP decline of 10.8 %, 9.1 %, 8.9 %, 8.2 % and 8.1 % respectively in 2020. In order to curb the issue of low production, European companies started redesigning production to revive the economy from a crisis situation to continue doing business. However, disruptions caused by the ongoing war in Ukraine, surging energy prices, persistently high inflation, and the looming risk of Russia cutting off gas supplies in the winter months have put the Eurozone economy under an unprecedented level of stress. This persistent uncertainty has also shaped economic sentiment in the region. Another key reason for the decline is the drop in consumer confidence growth, which reached its record low of -23.9% point in September 2022 from an all-time high of 15% point in May 2021 (source: CEIC data). As a result, Frost and Sullivan expects the European economy to grow to grow at a rate of 1.9% in CY 2022.

#### **C) China**

China was the only large economy to register a positive GDP growth of 2.3% in CY2020 and showed its resilience during the pandemic and registering 8.0% GDP growth in CY2021. China's economy recovered well with the government focusing on supporting Small and Medium Enterprise (SME's) and allowing delay of loan repayments. As the recovery gained traction in CY2021, the composition of aggregate demand shifted toward private domestic consumption. In CY2022, the lockdown caused both life and economic activity in China to grind to a halt, as it had due to the pandemic two years earlier. The achievement of the 5.5% economic growth target pledged by the Chinese government is now looking increasingly difficult. While new policy initiatives are expected to produce results, there are also fears it will only further increase the issues. As a result of these factors, the GDP is expected to grow at 3.2% in CY2022.

#### **D) India**

The Indian economy continued to grow between 2017 and 2019, and there was a moderation in the growth rate during these years. As the Government was taking various measures to improve the economy, Covid-19 created havoc in 2020 which resulted in 7.3% contraction of the country's economy. India has demonstrated rapid and sustainable growth post-COVID-19, driven by strong manufacturing-led industrial expansion and consumption demands from the private sector. Indian GDP grew by 9.5% in CY2021. One of the key reasons for the growth of Indian economy is the country's focus on the manufacturing sector.

However, disruption to two major trade routes, Russia, and Ukraine, along with subsequent sanctions imposed on Russia by various economies has had a major impact on global supply chains. As a result, oil prices surged to record highs, which in turn pushed up inflation. This effect was felt by India as well. The price of domestic LPG, pipeline gas, jet fuel also soared. However, India was not impacted as much as some of the other major economies. Despite volatility, the Indian economy has shown resilience and the economic pain seems to be easing. The Indian GDP is expected to grow by 6.8% in CY2022, owing to strong macroeconomic fundamentals such as the implementation of key structural reforms, and improved fiscal and monetary policies.

## E) South East Asia

South East Asia went through a socioeconomic crisis during the pandemic, with GDP falling by 4.2 % in CY2020. Declining tourism and businesses have caused a sharp downturn in the overall economy of the region. Low material movements and lockdowns affected countries dependent on trade and tourism. While the South East Asian countries recovered marginally with a GDP growth of 2.6% in CY2021, Russia's unprecedented invasion of Ukraine was not good news for South East Asia's post-COVID economic recovery. The biggest economic impact overall on people's lives in South East Asia is inflation caused by the rapid rise in the price of oil and gas in the wake of the war, which has increased the costs of production and transport. Russia and Ukraine are also major exporters of agricultural inputs, food grains, and critical minerals needed for semiconductors, which could cause further shortages in South East Asia. The commodity price hikes have had different effects across the region. The overall South East Asian GDP is expected to grow at 5% in CY2022.

## Impact of Covid 19 pandemic on different economies

The outbreak of the COVID-19 pandemic threw the entire world into an unforeseen crisis in terms of both public health and the economy. The global economy plunged into a deep depression in 2020 causing a severe impact on spending and employment. Most of the economies had to enforce desperate measures such as lockdowns, travel restrictions, social distancing etc. Various containment measures including the closure of offices and factories, slowdown of public services, etc. were taken which resulted in a significant drop in investments during 2020.



**United States of America** - USA became the epicentre of the pandemic with the highest number of reported casualties in the world with a devastating impact on the country's economy. As per the U.S. Bureau of Labour Statistics, the unemployment rate almost tripled between Q4 CY2019 to Q2 CY2020, from 3.6% to 13%. Over thirty million Americans had filed for unemployment benefits due to job losses during this period. However, the unemployment rate fell to 6.7% by Q4 CY2020 due to a slew of economic measures taken by the Government. The U.S. economy was strengthened by massive fiscal support and widespread vaccination and the economy grew by 6.2% in CY2021, the fastest pace since 1984.



**Europe** - The situation was no different in Europe. Post China, Italy was the second country to experience massive casualties in the initial months of the pandemic outbreak. While the pandemic triggered sharp declines in job opportunities and millions of job cuts, the region was also at the forefront in easing down economic lockdowns and opening economic activities. Compared to the global economy, the euro area suffered a bigger hit in 2020. Manufacturing industries were impacted by short-term supply shortages, but most of them recovered relatively quickly during Q3 CY2020. Sectors that thrive on human contact and interactions, such as the cultural and creative industries and the aerospace industry, were substantially hit by the crisis, and are likely to have longer recovery paths. Pharmaceuticals and Digital sectors were the least impacted sectors.



**South East Asia** - Even though the health, economic and political impact of COVID-19 has been significant across South East Asian nations, the virus has not spread as rapidly in this region as compared to other parts of the world. Although the region could not match the fiscal incentives of many of the western world countries, fiscal policy in Southeast Asia has still been more generous and this has played a crucial role in limiting the economic and social fallout from the pandemic. Southeast Asia plays a major role in the global manufacturing supply chain. Lockdowns and social-distancing measures in the region, primarily in Taiwan, have prolonged a global shortage of semiconductors and constrained the supplies of goods such as coffee and clothing.



**China** - Covid-19 outbreak started in China and then rapidly spread into other parts of the world. Before the pandemic, China was already grappling with slower growth and rising unemployment along with trade conflicts with economic giants like the USA. The impact of the Pandemic was severe on the country's economy in Q1 CY2020. The Govt. had to adopt strict containment measures and as China is the biggest exporter to many countries in the world, there were supply chain disruptions in the first few months of 2020 which impacted the manufacturing sector

globally. However, the country could restore its operations within the next few months and was one of the leading suppliers of medical consumables and equipment globally in CY2020. China's economy, which did not contract in CY2020, grew at 8% in CY2021 as the country's focus shifted to reducing financial stability risks.



**India** - India, one of the potential superpowers in the world and one of the emerging manufacturing destinations, could not decouple itself from this global disaster. Indian manufacturers had to face supply-side bottlenecks as there was no supply from China in Q1 2020. The Indian Govt. had to impose a strict country-wide lockdown much faster than most of its western counterparts. Indian manufacturing sector could not withstand this double blow – first from the supply side and then from the demand side. However, the country has shown strong resilience since then. India has not only become self-reliant on medical supplies, but it is also now one of the largest producers of Covid-19 vaccines globally as manufacturing emerges as one of the focus areas for the government. India has also emerged as the second most sought-after manufacturing destination across the world indicating the growing interest shown by manufacturers in India as a preferred manufacturing hub over other countries.

India and other South East Asian Countries are gaining share from China in terms of manufacturing, due the fact that global players started relocating their supply chain to alternative locations.

**Other countries** - The economic impact of the COVID-19 pandemic has been different across different countries. Iran had the highest number of corona cases in Middle East, followed by Iraq and UAE. Countries such as Saudi Arabia and UAE where tourism is the biggest revenue generator, were now conservative in allowing tourists, which has badly affected the region's tourism revenue as governments have taken swift measures to reduce the impact of the virus in the region. Africa is one of the most affected regions globally due to COVID-19 pandemic. It is one of the most susceptible regions in terms of controlling the pandemic due to lack of proper health care services and basic infrastructural amenities. For many countries, the Small & Medium Enterprises are expected to play a key role in economic and employment recovery in these countries. Digitalization is also playing a key role in economic rebound across Africa as healthcare apps, payment platforms, e-commerce portals and micro-insurance systems are witnessing positive traction across end users.

## **Geopolitical situation and their impact**

The economic recovery post Covid, caused supply chain challenges and sparked the beginning of inflationary spikes. The Russia-Ukraine crisis has exacerbated the growing cost-of-living crisis and its inflationary impact is already being felt across the world in a variety of sectors. Impacts are flowing through three main channels. One, higher prices for commodities like food and energy will push up inflation further, in turn eroding the value of incomes and weighing on demand. Two, neighbouring economies in particular will grapple with disrupted trade, and supply chains, as well as a historic surge in refugee flows. And three, reduced business confidence and higher investor uncertainty are adding to tightening financial conditions and potentially spurring capital outflows from emerging market

The trade war, accompanied by a slowdown in China's economy and the impact of the COVID-19 pandemic, has resulted in the World Bank predicting a significant slowdown in the global economy as well as a lower prediction for the economic growth in the United States and China. The increasing geo-political tensions and the growing chip shortage has enhanced the need for moving the semiconductor ecosystem to other regions across the world and this has created a unique opportunity for India as an alternative location to focus on and invest in.

### **A) Russia-Ukraine war**

The ongoing war in Ukraine has dimmed prospects of a post-pandemic economic recovery for emerging and developing economies in the Europe and Central Asia region. The global economy continues to be weakened by the war through significant disruptions in trade, food, and fuel price shocks, all of which are contributing to high inflation and subsequent tightening in global financing conditions. The Ukraine-Russia conflict is expected to further impact the already stressed global semiconductor supply as raw materials exported from the two countries such as neon gas, chemical C4F6 and palladium are critical for semiconductor manufacturing. This has also put the Indian electronics and automobile manufacturing industry in a wait-and-watch mode. While the consumer appliances sector in India is more likely to be impacted by the increase in prices of other raw materials such as steel, semiconductor shortage is expected to put pressure on the supply of smartphones, laptops, and automobiles

Activity in the euro area, the largest economic partner for emerging and developing economies of Europe and Central Asia, has deteriorated markedly in the second half of CY2022, due to distressing supply chains, increased financial strains,

and declines in consumer and business confidence. The most damaging effects of the invasion, however, are surging energy prices amid large reductions in the Russian energy supply. The hardest hit will be countries with medium to high reliance on natural gas imports for heating, industry, or electricity, as well as countries closely connected with EU energy markets. Both Russia and Ukraine are major commodity producers, and disruptions have resulted in soaring global prices, especially that of oil and natural gas. Supply chains for high-value goods and critical components, including those of automotive and electronics, particularly bore the brunt of interruptions in the trade corridor between Europe and Asia.

The Russian invasion of Ukraine has been met with unprecedented trade and other economic sanctions. The war and resulting sanctions have also had adverse effects on the key transportation links between Russia and Ukraine. Russia's connections to European ports have been cut, and commodity exports to other destinations have been constrained. Ukraine's Black Sea ports have been blocked, leaving the country with few routes for its commodity exports. Air freight between Europe and Asia is now rerouted to avoid Russian airspace. Rail transit through Russia is slowing due to checks for sanctions compliance, and further rounds of sanctions could risk halting rail transit entirely.

## **B) Supply chain disruptions**

Supply chains are being tested, due to the extraordinary events in Russia and Ukraine. Organizations are scrambling to mitigate the disruption to their business and to keep goods, funds, and information flow across the supply chain. The conflict in Ukraine reinforces the imperative for organizations to have in place more resilient supply chains. Companies that survived the volatility of CY2021 likely did so by getting lean, selling through inventory, and focusing on their working capital. At times, the supply chain crisis has no doubt felt unwieldy. Suppliers and manufacturers from all over the world have largely been put to the test, encountering massive stock shortages, fulfilment delays, and lengthy backorders on popular inventory items. The following are 2022's biggest supply chain challenges faced by product-based businesses from all over the globe.

**COVID-19-driven disruption in the supply chain:** The COVID-19 pandemic has disrupted the manufacturing supply chain and curtailed the commodity demand. Although manufacturing of mobile phones is boosted through the 'Make in India' initiative, India is heavily dependent on China for the supply of raw materials, components, and accessories. Such high dependency on imports with some critical components being produced in China is expected to have a significant impact in the future if there is a reoccurrence of any similar outbreak. Hence, OEMs based out of India are planning to develop a local supply chain in order to follow the 'China + 1' strategy and become 'Atmanirbhar (Self Reliant)'.

**Material Scarcity:** Insufficient inputs have been a concern since the pandemic began, due to an abrupt rise in consumer demand like never before. Even now, retailers and suppliers alike are struggling to meet this demand in the midst of limited availability for many parts and materials. Key metals such as aluminium, nickel, platinum, and copper along with semiconductor chips are all expected to be impacted which is expected to have a cost effect across industries using these products. Simultaneously, disruption to the flow of electronics, raw materials, and parts supplies emanating out of China and other locales has seriously impeded global trade, forcing companies to recalibrate and in some cases, wholly reconsider their long-standing supply chain and partner ecosystems. As a result of such shortages, we foresee a shift to raw materials flowing from Asia and Africa instead. Some changes will be permanent, but they are unlikely to change in the short to medium term.

**Port Congestions:** Port congestion caused by the pandemic and now the war remains one of the top challenges for the world's supply chains, seeing as port owners, carriers, and shippers are collectively still scrambling for a viable solution to this problem. Although the loading/unloading process typically goes according to plan, labour shortages and social distancing associated with the pandemic have notably steered things off course (creating major bottlenecks at a number of busy global docks).

**Alternate Source of Supply:** The immediate effect on the supply chain has been the sharp rise in the prices of commodities, including petrol and diesel, which has hit hard. Oil and gas prices, in particular, have already skyrocketed across the globe due to the high dependence on imports from Russia, the supplier of 40% of Europe's gas. This rapid price inflation is forcing companies across the globe to explore alternative sources – not just to find cheaper materials but also for surety of supply. Russia is also the world's biggest exporter of all three major groups of fertilizers, again pushing up input costs. This could lead to a potential food crisis in major importing regions, including the Middle East and North Africa if alternatives are not quickly found

### C) Chip shortage

**Causes:** The demand for microchips exceeded supply even in the pre-pandemic era. The spread of COVID-19 globally created a storm for the semiconductor industry, resulting in a severe supply crunch. First, as the global stay-at-home orders and lockdowns resulted in unprecedented usage of smartphones, laptops, and streaming devices, the already excessive demand for chips shot up. Second, the worldwide shutdown of production facilities halted chip production temporarily. Finally, massive supply chain bottlenecks were witnessed, as some major ports across the world ceased operations.

**Impact of Global chip shortage on the EMS industry:** The global chip supply shortage intensified in 2021 after the COVID-19 pandemic, as major companies across industries have failed to meet the rising demand for electronic goods and components. Supply chain disruption due to the pandemic, rising demand for electronic products as more people work from home, and a lack of investment in chip production capacity have all contributed to the global chip shortage. As a result, the prices of household appliances and electronics have increased. The supply of finished electronic products and components necessary for local manufacturing has been delayed due to prolonged congestion at Chinese ports and a lack of containers. As semiconductor companies have a high book to bill in the end market shows strong demand. This will significantly increase capital expenditure to meet this demand. Based on the current timing of capacity ramping, analysts predict that there would be a broad-based oversupply of semiconductors at some point in 2023.

**Struggles during the COVID-19 crisis:** Demand in the auto industry dropped substantially in the first half of 2020. Moreover, while new vehicle sales improved in the second half of 2020, the highly unclear sales outlook at the time meant that automakers did not meaningfully increase their semiconductor orders. At the same time, the shift to remote working and the associated greater need for connectivity significantly drove consumer demand for servers, PCs, laptops, and equipment for wired communications, all of which considerably depend on semiconductor chips. Even as the auto industry significantly reduced chip orders, other markets encountered an increased need.

**Lack of new capacity:** In recent years, the semiconductor industry has matured and achieved greater scale through consolidation. In the last decade, semiconductor utilization was constantly high at or above 80%. The utilization rate in 2020 reached around 90%, which many industry leaders regarded as full utilization since exceeding that level often results in excessively long lead times. While the semiconductor industry increased its production capacity by nearly 180% since 2000, its total capacity remains nearly exhausted at the current high utilization rate.

**5G rollout and overlapping chip demand:** The demand for semiconductors differs by node size in the industry. The most advanced chips in small ranges are 14 and 7 nanometres or smaller. These are increasingly used in several leading-edge technology applications. An expansive rollout of 5G services warrants a huge number of radio-frequency semiconductor chips and large node sizes as auto chips. This also holds true for power-electronic chips needed to boot up PCs and servers. This amount of overlap implies that as the 5G rollout occurs over the next few years, auto manufacturers might face an ongoing shortage of chips.

**Industries Impacted:** More than 150 industries have been impacted by the chip shortage, but some have been hit much harder than others. The global semiconductor shortage has affected several industries for over a year now. Industries are presented with two options: paying more for a product and getting it considerably faster or waiting a little more and getting products at the market rate. The shortage has affected the production of several household appliances, smartphones, laptops, printers, gaming consoles, PCs, automobiles, airplanes, and medical devices, among others.

**Current Situation:** The market for semiconductors has been volatile in the last 2 years and experts predict supply chain challenges across the semiconductor industry will extend to late 2023 and early 2024. Nonetheless, construction plans are underway for new semiconductor fabs to address the current microchip shortage and future demand for Artificial Intelligence, 5G, the Internet of Things and other emerging technologies. At the same time, industry professionals understand the need to not oversaturate the market with new inventory, and manufacturers are working for a balance between new 200mm and 300mm technology and supporting older technology and geometry process nodes.

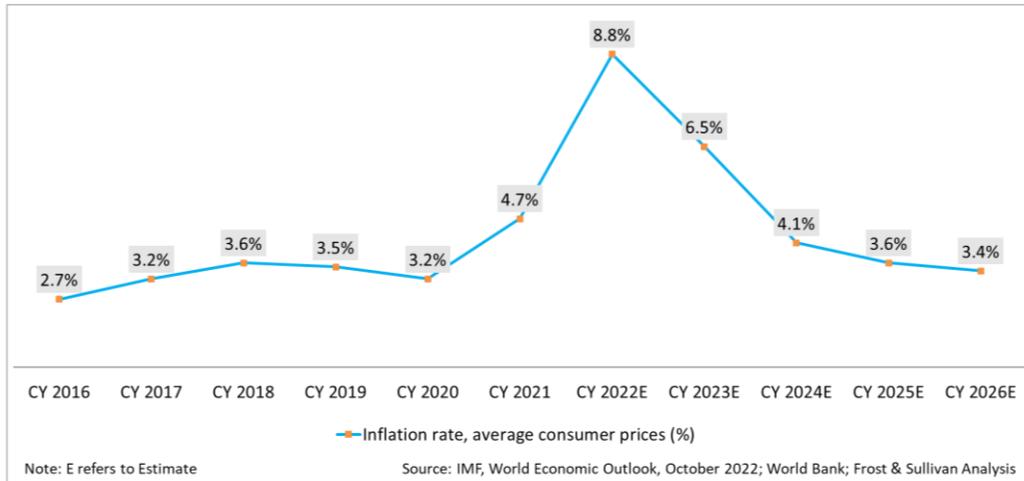
### D) Global Inflation

Inflation increased worldwide due to the on-going Russia-Ukraine war, as well as China's extensive lockdown, which is having an impact on the global market, where inflation is expected to be high in CY2022. Supply chain disruptions, strict labour markets in a few countries, and especially soaring commodity prices are some of the key reasons. Prices for oil and natural gas have risen because of concerns that Russia, the world's largest oil exporter, may be unable to supply oil

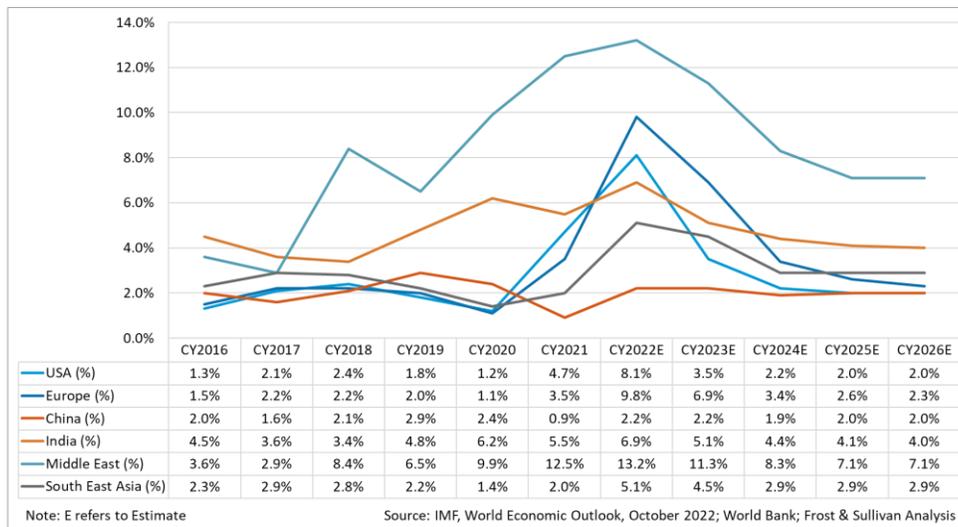
or gas in the event of the conflict. On top of that, global demand is on the rise as the global economy recovers from the economic downturn. Global inflation is forecast to rise from 4.7% in CY2021 to 8.8% in CY2022 but to decline to 6.5% in CY2023 and to 4.1% by CY2024.

Inflation is expected to slow down in CY2023; however, it may not reach pre-pandemic levels. Having said this, supply disruptions are slowly improving and may take some more time to fully ease.

**Chart 1.3: Global Inflation rate, average consumer prices (annual percentage change), growth in %, CY2016-CY2026E**



**Chart 1.4: Inflation rate, average consumer prices (annual percentage change) in key economies (USA, Europe, China, India, Middle East, South East Asia), growth in %, CY2016-CY2026E**



### E) Global Trade War

**US-China Trade War:** Beginning in early 2017, the US government began making threats of tariffs on Chinese imports. In the month of March of 2018, the administration endorsed its first of three rounds of tariffs which ultimately covered a varied range of Chinese exports comprising many manufactured by the country's 4,500+ EMS companies. Overall, the US-China trade war has reduced US goods imports from China. Imports declined immediately after tariffs were imposed. China is now the source of only 18% of total US goods imports, down from 22% at the onset of the trade war. The imports are transferred to other countries due to the trade war between these 2 major economies. Asian countries especially India, Vietnam, and Indonesia, are likely to benefit more than the rest of the world due to lower wages and their geographical proximity to China.

Overall, the US-China trade war has reduced US goods imports from China. Imports declined immediately after tariffs were imposed, falling further beginning in March 2020 as global trade collapsed in the wake of the COVID-19 pandemic, and have since recovered only slowly. Today, US imports from China remain well below the pre-trade war trend compared to US imports from the world. China is now the source of only 18% of total US goods imports, down from 22% at the onset of the trade war.

The war is not the only factor weighing on world trade at the moment. Lockdowns in China to prevent the spread of COVID-19 are again disrupting seaborne trade at a time when supply chain pressures appeared to be easing. This could lead to renewed shortages of manufacturing inputs and higher inflation.

#### **F) The need for China + 1**

**Decoupling from China:** For Indian governments, policy initiatives for decoupling its economy from China is not a new phenomenon. Since 2009-10, India had embarked upon countable opportunities for overcoming large imports from China. India's trade deficit with China, however, remains huge. Nevertheless, some decoupling trends in India also became visible since 2019/20, mainly owing to the pandemic which has paved the way for the growth of manufacturing in India.

**Rising labour cost in China:** The aspiration level of Chinese workers has increased, and they are focusing on high-tech jobs, leaving gaps in the low end of manufacturing value chain. This has led to scarcity of the labour and a higher cost due to lack of availability of the manpower. The average cost of manufacturing labour per day is USD 6.2 in India and USD 28.2 in China, which make manufacturers to move out of China.

**Threat on EMS industry in China:** Over the past few years, China has realized its stake of challenges, and what some individuals recognize as the potential threats to China's current position as the world's biggest EMS host country. Trade tensions, allegations of currency manipulation, and a resurrection of economic patriotism in the US, UK and some other western nations have all formed a new level of emphasis and scrutiny on the China's EMS business. All of the above issues have been exacerbated by allegations and blame games, resulting in a perfect storm for China's EMS industry. OEMs' need to diversify their supply chain to reduce risk has fuelled the expansion of the EMS industry in countries like India, Vietnam, and Mexico. Mobile phones from brands such as Apple, Xiaomi, Vivo, Oppo etc., which were earlier imported from China, are now manufactured in India. EMS partners such as Foxconn, Wistron, Pegatron, etc. have all invested in manufacturing facilities in India which have given huge boost to the Indian EMS industry.

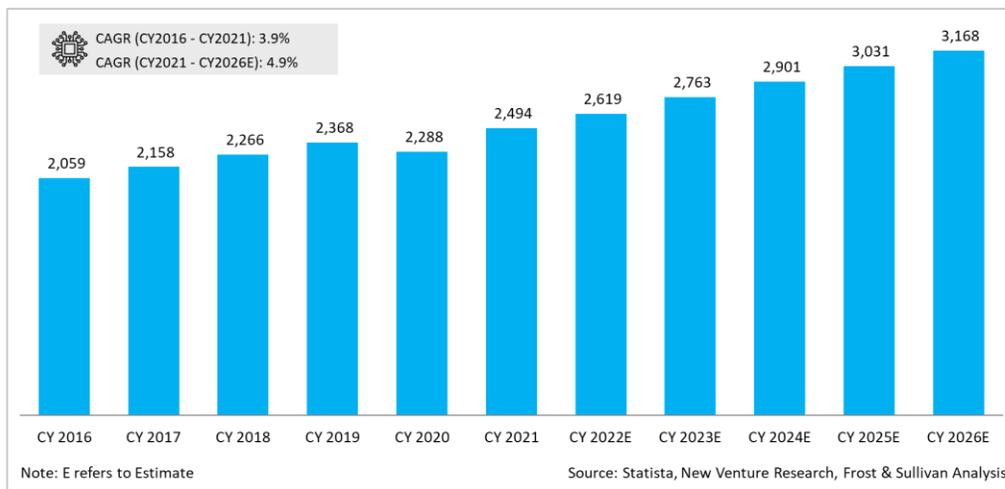
## CHAPTER 2 - GLOBAL ELECTRONICS INDUSTRY OVERVIEW

### Global Electronics Industry

#### Overview of the global electronics industry

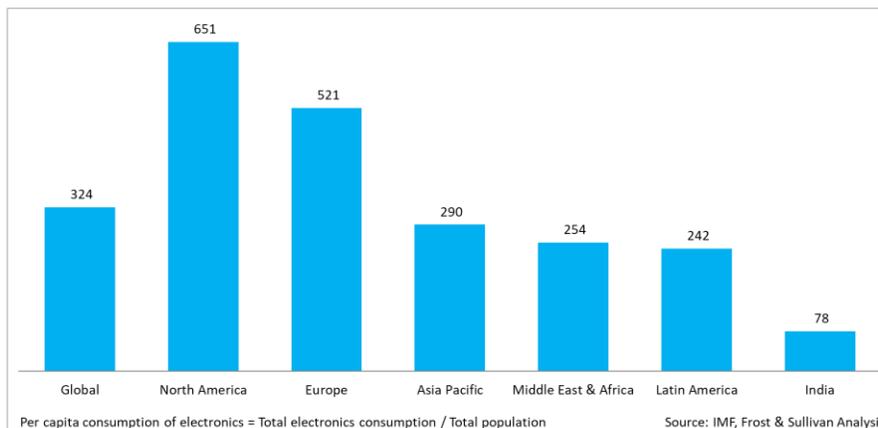
The global electronics industry has evolved tremendously over the last 60 years. Global demand for the electronics industry is created by emerging and multiple disruptive technologies. The overall electronics market is inclusive of electronics products, electronics design, electronics components, and electronics manufacturing services. Traditionally a strong growth market, however, the market contracted by 3.4% in 2020, owing mostly to a decline in private expenditure triggered by the COVID-19 pandemic. The global electronics industry was valued at USD 2,288 billion in CY2020 and grew to USD 2,494 billion in CY2021. As per Frost & Sullivan's analysis, the industry is expected to grow at a CAGR of 4.9% to reach USD 3,168 billion by CY2026. Some of the critical factors driving this growth are increasing disposable income, improved acceptability of audio and video broadcasting, higher broadband penetration, the inclination of the youth towards next-gen technologies, emergence of e-commerce, rising demand from rural markets, etc.

**Chart 2.1: Global electronics industry market size, value in USD billion, growth in %, CY2016-CY2026E**



#### Per capita consumption of electronics in major economies

**Chart 2.2: Per capita consumption of electronics in major economies, value in USD, CY2021**



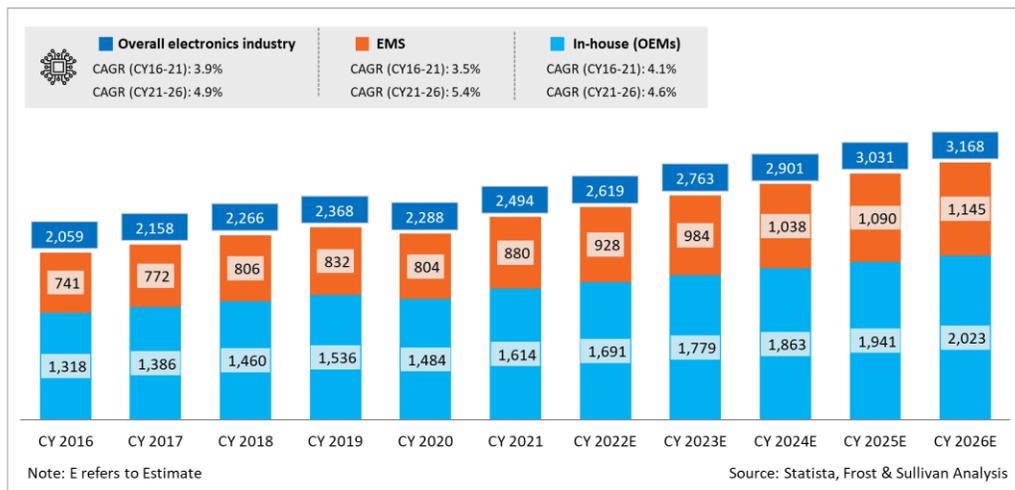
Globally, per capita, electronic consumption is increasing and is currently USD 324. Per capita consumption is the highest in the West and increasing rapidly in major economies such as the North America and Europe, driven by the growing adoption of wireless connectivity for several electronic devices. Increasing investments in Research and Development

(R&D) in consumer electronics and technological advancements, coupled with the growing popularity of wearable electronic devices, are also driving the market. Per capita consumption of electronics in India is only USD 78, 1/4th of the global average, however domestic electronics consumption is increasing rapidly because of urbanization and the adoption of electronic products in Tier 2 and Tier 3 cities.

### Global electronics manufacturing market split between in-house and EMS

Electronics manufacturing has been divided into two categories: products that are produced in-house by OEMs and those that are produced by EMS companies. Currently, in-house electronic manufacturers account for approximately 65% of the total electronics market, which is a significant contribution. However, in recent years, the involvement of EMS players has expanded significantly, making the job of OEMs easier to manage.

**Chart 2.3: Global electronics manufacturing market - Split between in-house and EMS, value in USD billion, CY2016-CY2026E**



### Key parameters considered for in-house vs EMS

Contracting task to external EMS providers helps in the reduction of fixed costs which helps in investing the available cash for other strategic initiatives. This helps the OEMs to reduce the employed workforce directly under their payroll eventually reducing the cost of labour.

**Hidden Cost:** There are quite a few hidden costs involved in deploying an outsourced manufacturer that OEMs should very much take into consideration and discuss with EMS providers. These include costs such as initial design modification, product testing, and others. It would be ideal that OEMs request the EMS to provide a complete breakdown of all the costs that could be incurred.

**Technical Capability:** It would be essential to evaluate the kind of flexibility an EMS provider would be offering along with the time to market, and sustained quality. EMS providers, offer a combination of the following services: PCB assembly, cable assembly, electro mechanical assembly, contract design, testing, prototyping and aftermarket services.

**Value-Added Service:** EMS providers offer numerous value-added services, including configure-to-order and outbound logistics, among others. OEMs in sectors such as aerospace and defence, as well as in regulated industries such as medical, A&D and telecom, typically have complex electronics, and it is essential to determine whether the EMS provider can track rapid changes in new technology or adherence to the latest regulations. EMS providers in some cases are also seen to have a stake in the supply chain contributors.

**Design for Excellence (DFx):** It is important for EMS providers to have an efficient management process and the ability to manage change orders, making them more adept at managing OEM requirements. The design of any electronic device requires extensive knowledge and comprehensive experience. The EMS providers are known to consider all these factors, such as safety, reliability, availability, and much more. This causes the design teams of EMS companies to strive for excellence from the product's inception through its production phase.

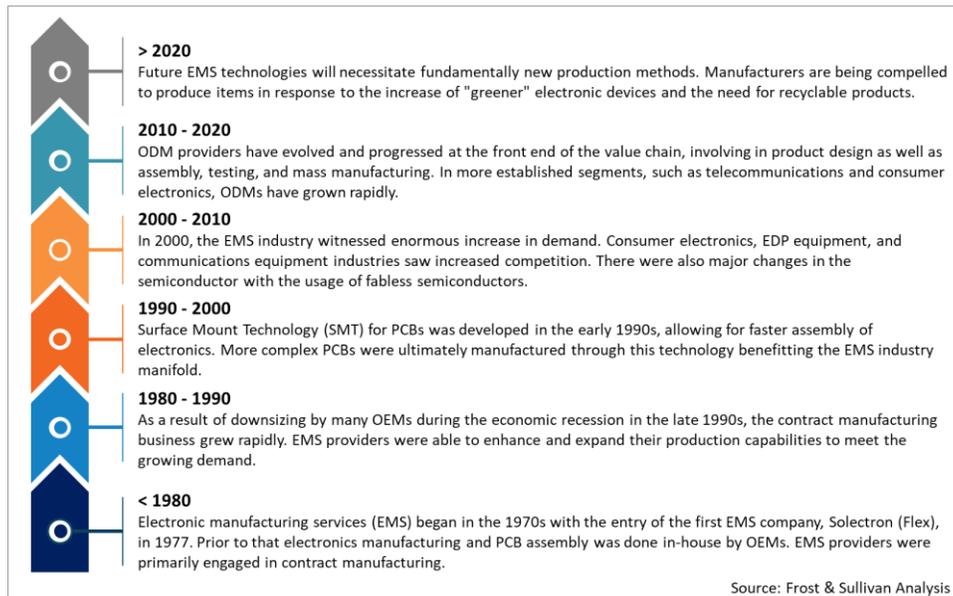
## Global Electronics Manufacturing Services (EMS) Industry and Outlook

The global EMS market witnessed a period of steady growth till 2018, riding on the wave of increased outsourcing activities from brand manufacturers and increasing electronics content. There are obvious inherent economic benefits to outsourcing. There is no denying the fact that manufacturing outsourcing has seen a steady uptrend over the past couple of decades. With clear benefits in terms of production efficiency, reduced overhead, labour costs, and faster new product introductions, OEMs today continue to collaborate with EMSs to develop their products. In addition, OEMs are also increasingly moving product design and development processes, to EMS partners.

In 2019, however, the opportunities started stagnating due to a multitude of factors. Firstly, a decline in global automotive sales and saturation of consumer electronic sales. Secondly, supply chain restrictions due to heightened trade tensions between US and China, followed by the pandemic in the end of 2019. According to Frost & Sullivan's analysis, the EMS market continues to face some challenges with the supply chain in 2022 and will continue until 2023 as well, which will have a medium restraining effect. The situation is expected to settle by end of 2023, through various measures including part localization. Additionally, as the electronics content increases, the demand for electronic components will increase in the future which will drive the EMS market.

### Evolution of the global EMS industry

Chart 2.4: Evolution of the global EMS industry, 1980 to 2020

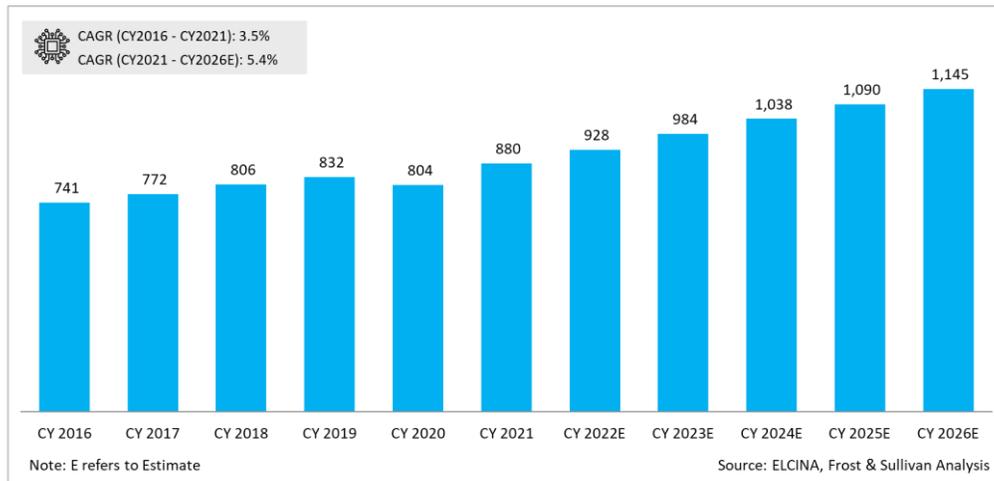


The EMS market was established more than five decades ago to execute manufacturing designs from government, defence, and research institutions. As the years progressed, the EMS market grew to support the demand that exceeded manufacturing capacity of the Brands. By mid 1990s, the advantages of EMS concept became extremely evident and major brands started outsourcing PCB Assembly in large scale. By the end of 1990s and in early 2000s, several brand having own manufacturing facility sold their assembly plants to the EMS players, aggressively striving for the market share. A wave of partnerships followed as the more cash-rich EMS companies started buying the existing plants and the smaller EMS companies to consolidate their position in the global market.

As technology advances, the size of the components and the circuits usually becomes smaller. With the demand for novel features and products growing up in recent years, manufacturers are turning towards more state-of-the-art and sophisticated technical solutions to streamline their manufacturing processes. Electronics manufacturing is observing substantial traction in the adoption of advanced robots, due to their capability to perform tasks at enhanced precision levels. Artificial intelligence is another transformative technology in the EMS segment, primarily changing the way the machines' function and interconnect. Partnerships, mergers, agreements, and other types of strategic initiatives are becoming more and more prevalent among the Brands, EMS providers, OEMs, ODMs, and stakeholders as they work to familiarize with the speedy transitions in the manufacturing space.

## Overview of the global EMS industry

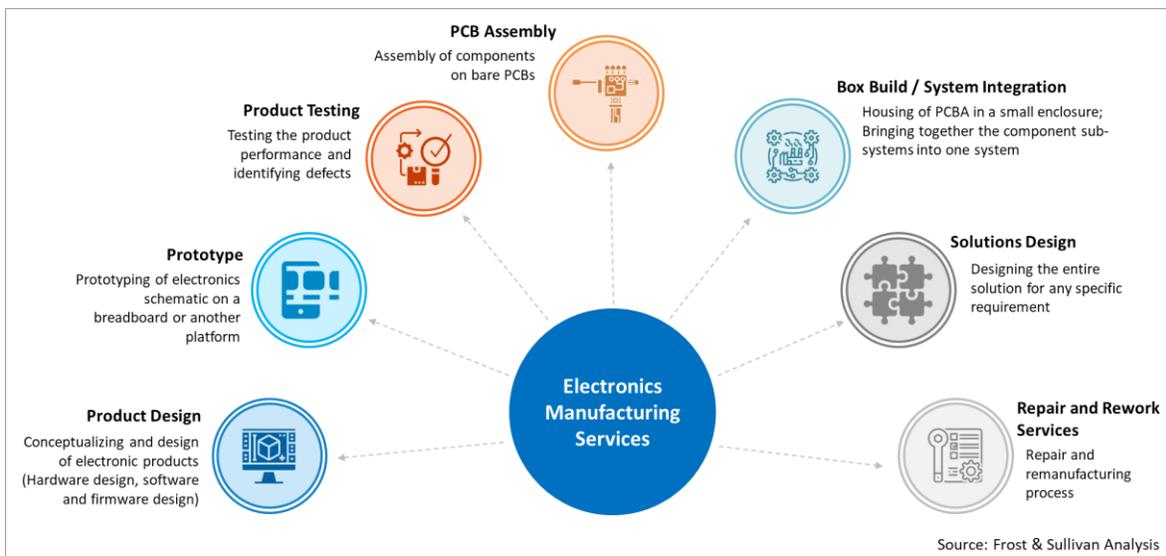
Chart 2.5: Global EMS industry market size, value in USD billion, CY2016-CY2026E



The global EMS market is traditionally comprised of companies that manufacture electronic products, predominantly assembling components on Printed Circuit Boards (PCBs) and box builds for OEMs. Today OEMs are seeing more value from EMS companies, leading to involvement beyond just manufacturing services to product design and development, testing, and aftersales services (repair, remanufacturing, marketing, and product lifecycle management).

## Range of services offered by EMS companies globally

Chart 2.6: Range of Services offered by EMS companies, global, CY2021



EMS companies are equipped to provide a gamut of services which include design, assembly, manufacturing, and testing of electronic components for OEMs. EMS companies can be contracted at different points in the manufacturing process.

**Design services and solutions:** Design services include multiple associated actions that occur after determining the customer's specific requirements and before manufacturing or at the beginning of an assembly. The EMS Company based on inputs from the OEMs creates conceptual design and the same is shared with the OEMs for inputs and approvals.

**Prototyping:** The next step is to create a Proof of Concept (POC) to demonstrate that concept of design, functions. Post that, once design for manufacturability, design for testing and design for servicing are established, prototypes are made

to make sure that the product will serve its proposed purpose after it is manufactured as a part of a bigger production run.

**Testing services:** Testing is an essential element across the entire EMS value chain. EMS companies which can design test solutions for both at PCBA level and at the end of line product testing, including functional testers and fixtures are preferred by the OEMs.

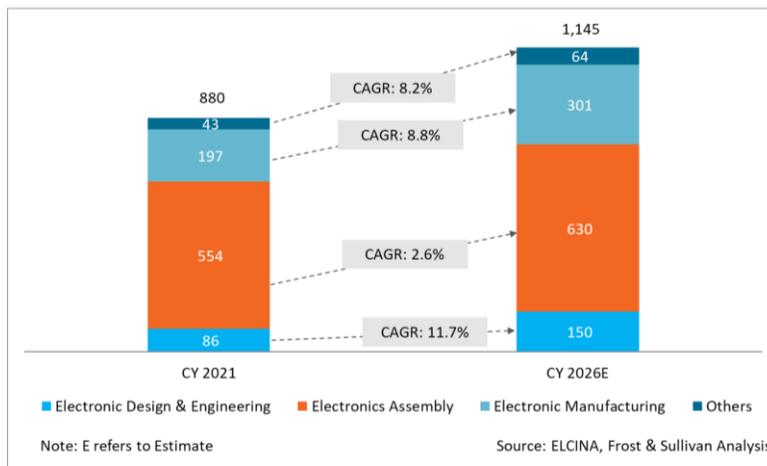
**PCB Assembly:** At the heart of the electronics industry is Printed Circuit Board or PCB. A PCB with components mounted on is called an assembled PCB and the manufacturing process is called PCB assembly or PCBA for short. PCB assembly is a major activity and normally outsourced to EMS companies.

**Box Build:** In this, an OEM outsources complete product manufacturing to an EMS company, which manufactures the final product, adds the OEM’s logo, and dispatches it to the OEM’s warehouse for selling. This model is largely used in high volume low mix (HVLM) type of products such as mobiles, computer hardware and industrial segments.

**Aftersales Service (Repair and Rework):** The demand for repair and remanufacture is not high, because majority of electronic products do not necessitate repair or remanufacturing and are focused more on replacement. Niche verticals like aerospace and defence, railways and high-end electronics segment is opening to accept third-party repairs due to high cost of equipment and re-design which provides immense potential for this segment.

### EMS market segmentation by services

**Chart 2.7: Global EMS market - Segmentation by services, value in USD billion, CY2021 and CY2026E**



The EMS market has been split by services into the following:

**Electronic Design & Engineering:** New and advanced technologies such as IoT, artificial intelligence, and virtual reality, coupled with smart and connected devices are driving the electronics design market.

**Electronics Assembly:** Electronics assemblies are large and diverse. It is very attractive and profitable for many EMS suppliers because of the wide range of complex and high mix of electronic product assemblies.

**Electronic manufacturing:** Contract manufacturing of electronic components and finished products.

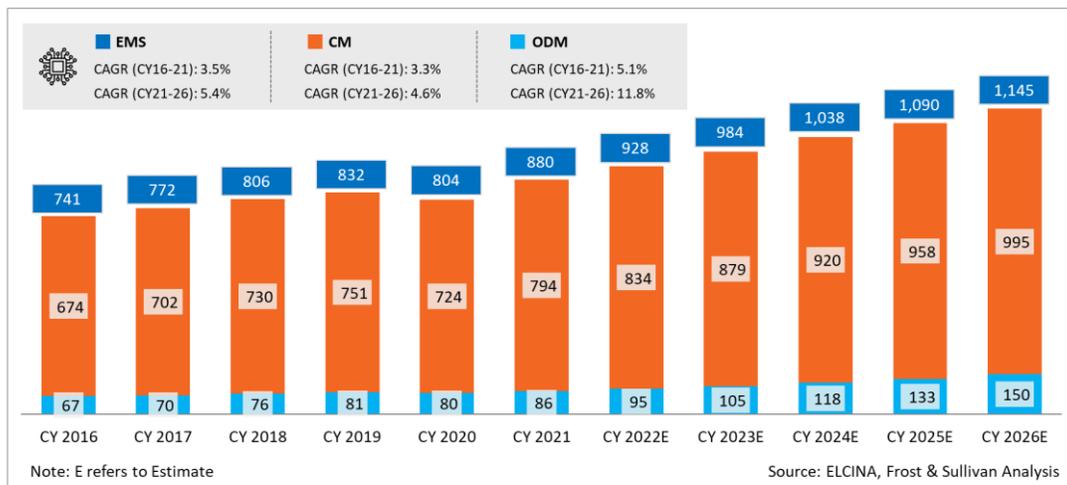
**Others:** It includes all other activities like supply chain, management, and other aftermarket support services. offered by EMS.

Large EMS companies who have mastered the art of manufacturing and assembly, are now trying to move up the value chain and planning to offer additional services such as Design, Testing and Sourcing of components - In short, the industry is moving from Original Equipment Manufacturing (OEM) to Original Design Manufacturing (ODM). The share of ODM business is likely to increase from 9.8% in 2021 to 13.1% in 2026.

## EMS market segmentation by ODM vs CM

The global EMS market leads the bandwagon in the production of total electronics, and accounts for 35% of the total electronics market. While outsourcing increased rapidly in 2019, it remains the most anticipated manufacturing model for the assembly of advanced electronics products accessible to OEM companies. Large EMS companies have the capability to offer an entire range of services starting from design, sourcing of components, assembly, prototyping, PCB assembly, cable assembly, box assembly, and testing, while small and mid-size EMS companies offer primarily PCB assembly and testing services. The EMS market was valued at USD 880 billion in 2021, is split by Contract manufacturing which enjoys the majority share valued at USD 794 billion and expected to grow to a value of USD 995 billion in 2026; ODM has a market share of around 10%, is worth USD 86 billion in 2021, and is expected to grow to approx. 11.8%, worth USD 150 billion, by 2026.

**Chart 2.8: Global EMS market – Segmentation by ODM vs CM, value in USD billion, CY2021 and CY2026E**



**Chart 2.9: Advantages and Disadvantages of ODM and CM**

Original Design Manufacturing (ODM)	Contract Manufacturing (CM)
<ul style="list-style-type: none"> <li>✓ ODM retains IP rights to their design, giving them better negotiating power.</li> <li>✓ ODMs may produce client products themselves or through subcontract; also, into final assembly of products.</li> <li>✓ ODMs will manage the technical resources required for the successful completion of the production process.</li> <li>✓ It is difficult for OEMs to switch suppliers since ODM players hold the rights for the design.</li> <li>✗ Product development costs will be high</li> <li>✗ Minimum order quantity requirements are quite high.</li> </ul>	<ul style="list-style-type: none"> <li>✓ CM helps in quicker production time</li> <li>✓ OEMs save on their capital costs by involving EMS providers for CM</li> <li>✓ Better economies of scale when the business grows, when CMs produce for multiple customers.</li> <li>✗ OEMs gain complete ownership of all IP rights, including product specifications. EMS providers do not have negotiating power.</li> <li>✗ Lack expertise in producing their own set of products, development starts from the scratch.</li> <li>✗ OEMs can easily move to other providers, as they own rights for the design.</li> </ul>
<p>✓ Advantages      ✗ Disadvantages</p>	<p>Source: Frost &amp; Sullivan Analysis</p>

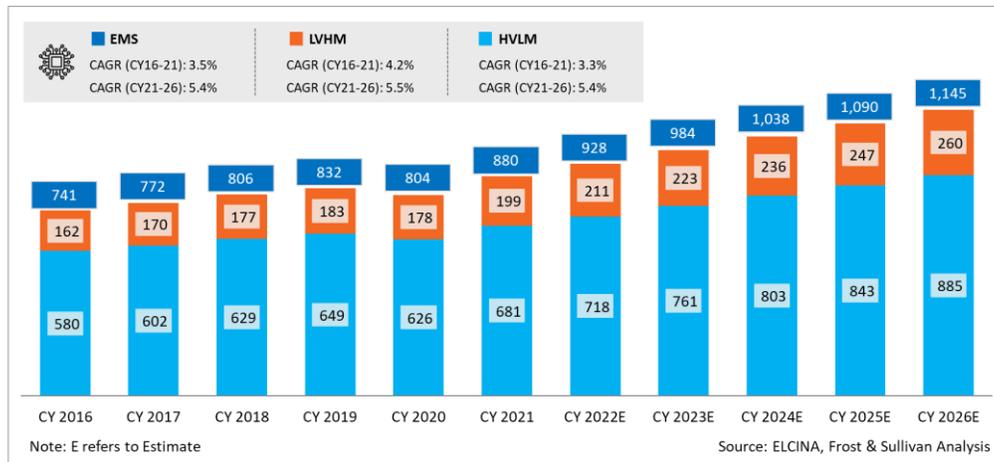
Constantly increasing logistics and raw material costs are resulting in a rise in total manufacturing costs, which serves as a catalyst for the OEMs to choose the ODM model and provide an end-to-end solution, including product design and after-sales support, owing to higher margins and increased visibility. Established supply chains aid in reducing lead times, which has a substantial positive effect on the profitability of ODMs. Additionally, ODM offers to collaborate with the OEMs on product localization and design. The ODM companies have versatile capabilities in system designs, plastic moulding, PCBA, software engineering, and more. Instead of investing in R&D, new entrants or Tier-II players collaborate with ODMs to select and develop specific models from existing models to enter the market. The secondary benefit for ODMs from such collaborations is the improvement of capabilities to handle fresh clients.

Example of two major global EMS companies:

- Flex’s original agenda was to provide manufacturing of PCBs for companies that are based out of Silicon Valley. Over several decades Flex broadened its scope to become a leading CM firm which was the first American company to build a manufacturing facility outside of the country in Singapore. Flex went on to acquire other manufacturing and design firms to expand its global footprint and become one of the largest ODM company.
- Foxconn is a key component supplier to many OEMs and its core focus is on the mass production. Foxconn can achieve massive economies of scale which effectively makes overall production cheaper. Foxconn provides its customers with fully integrated solutions covering the whole manufacturing process. It utilizes its manufacturing expertise and the large scale of its production facilities that help to decrease production cost per unit.

## EMS market segmentation by HVLM vs LVHM

Chart 2.10: Global EMS market - Segmentation by HVLM vs LVHM, value in USD billion, CY2021 and CY2026E



HVLM (High Volume Low Mix) is a model used by companies that manufacture significantly or highly automated consumer electronics, computers, and mobile phones. Electronics assembly manufacturers in aerospace and defence, industrial electronics, and the medical industry frequently use an LVHM (Low Volume High Mix) operating model.

**High volume, low mix (HVLM):** This is typically a contract manufacturing setup where only a few types of assemblies are produced in large quantities. This technique generally allows changes to be kept at a minimum and the equipment utilization rate significantly high. Contract manufacturers are proven to be more efficient when running at high volumes and require minimal engineering intervention.

Most global MNC firms work in the HVLM space catering to the needs of mobiles, computer peripherals, consumer devices and storage devices. This also means that this business requires large-scale deployment of resources and supply chain arrangements. Also, large EMS players with global presence have a wide product portfolio and end-to-end solutions. Their centralized procurement helps them procure in bulk which helps them pass the benefit on to the buyers giving the tier 1 players a competitive advantage.

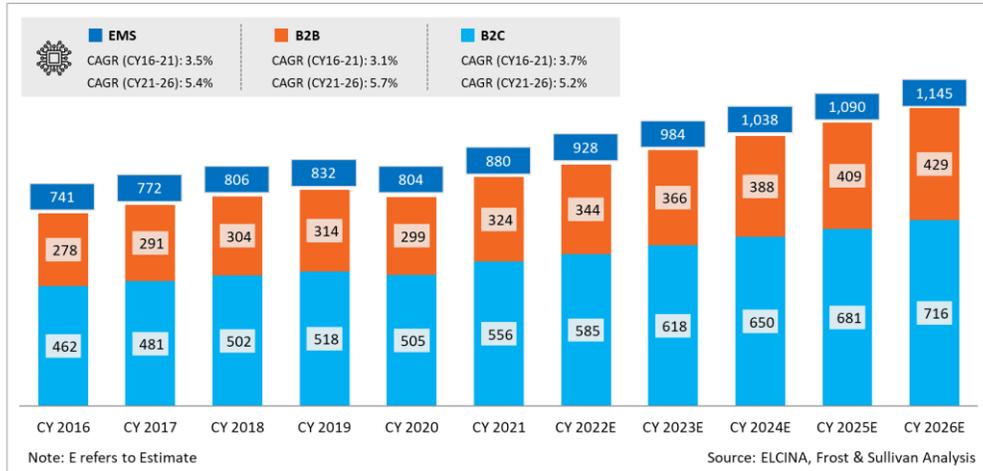
**Low Volume, High Mix (LVHM):** This type of contract manufacturing typically has a very high emphasis on quality and customization which changes according to the requirements of the customer. Considering that their products have high margins, even major changes in market dynamics do not heavily impact the production process. OEMs that prefer such solutions prefer to pay higher prices without compromising on quality.

Most companies in the LVHM space cater to the needs of industrial, medical, aerospace, and defence applications. Due to the nature of the operations, their scale is limited, and they face high component costs and limited bargaining power. The LVHM production comes at a cost as it typically mandates additional accreditation, facilities, and skill levels, which effectively translate into overhead costs. LVHM products involve high complexity and are safety critical with high entry barriers. LVHM products involve the make-to-order manufacturing method, which is commonly used to manufacture unique and more complex products with specific quality requirements. Continuously rising capex investment in the industrial, medical, and A&D sectors, which are the key contributors to LVHM, will drive this segment to grow at a faster pace than HVLM. Due to the high level of complexity in the LVHM category, the customers of an EMS partner would be

reluctant to source similar solutions from other competitors. Cyient DLM Ltd. has a strong presence in the LVHM category. Cyient DLM's technical expertise, capabilities in safety-critical electronics in highly regulated industries, and customer engagement act as high entry barriers for its competitors.

## EMS market segmentation by B2B and B2C

Chart 2.11: Global EMS market - Split between B2B and B2C, value in USD billion, CY2016-CY2026E



The EMS market is also segmented into B2B and B2C segments. Mobile phones and CEA are entirely B2C, whereas segments such as automotive are mostly B2C, with a few B2B sub-segments (for example, railways). Industrial and information technology are two industries that fall under the purview of the pure-play B2B segment. The B2C market was valued at USD 556 billion in CY2021 and is expected to maintain its dominance, reaching USD 716 billion in CY2026, at a CAGR of 5.2%, while the B2B market is not far behind. In 2021, the B2B market was valued at USD 324 billion, and it is expected to grow to USD 429 billion by 2026, at a CAGR of 5.7%. The B2B segment primarily caters to high value products in some of the key segments such as telecom, industrial, automotive, medical, aerospace and defence, which are driving the market for this segment majorly and will help for faster growth. An increase in the number of connected devices and data bandwidth will drive data centre expansion and upgrade, increasing revenue opportunities for EMS providers.

## Size of the Box-build split by cost components

### Box Build Systems

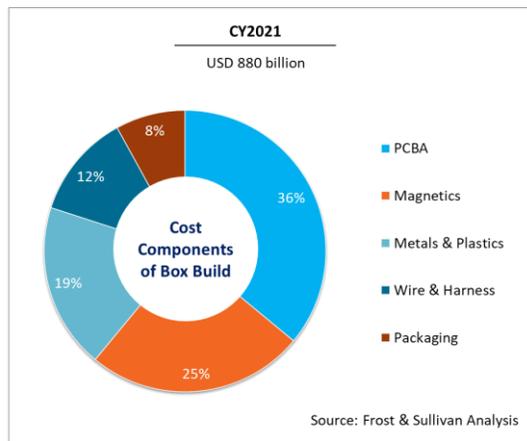
In the box build system, the OEM outsources the complete product to a third-party EMS firm, and the EMS firms, make the final finished product, puts in the OEM logo, and dispatch it to the OEM warehouse to be resold. In this case, the EMS firm takes care of both electronic BOM, Mechanical and Electrical BOM and assembles the final product, and does the required testing before it is dispatched. This is largely used in high volume low mix types of products such as mobiles, computer hardware, etc. A box build includes all the other assembly work involved in an electromechanical assembly, other than the production of the printed circuit board. The box build system includes PCBA, cables, wires and harnesses, electromechanical components, and other electronic components specific to the product category.

The box build process is very specific to each project and the degrees of complexity vary from project to project. The most common box-build assembly processes include the installation of sub-assemblies, installation of other components, routing of cabling or wire harnesses, and fabrication of enclosures. Key components of box build are mentioned below:

- **Electromechanical Components:** Electro-mechanical components are those that utilize an electrical signal to create a mechanical change. The electronic components market can be largely categorized as follows:
  - Passive components - capacitors, resistors, wound components, and crystals
  - Active components - diodes, transistors, ICs, and LEDs
  - Electromechanical components - PCBs, switches, relays, cables, and connectors
  - Associated components - optical discs, magnets, RF tuners, heat sinks, magnetrons, etc.

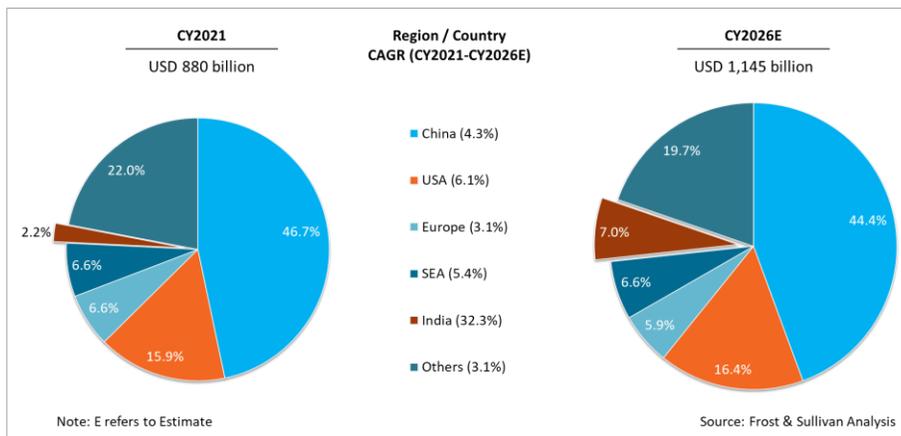
- **PCBA (Printed Circuit Board Assembly):** The PCBA is the core of an electronic device, which includes Flash Memory, Application Processor, Graphics Processor, and other semiconductor-based active and passive sub-components. All electronic devices derive their intelligence and functionality from the PCBA.
- **Wire & Harness:** A wire harness, often referred to as a cable harness or wiring assembly, is a systematic and integrated arrangement of cables within an insulated material. The purpose of the assembly is to transmit signal or electrical power. The wire harness simplifies the connection to larger components by integrating the wiring into a single unit for “drop-in” installation.
- **Magnetics:** It includes electrical components that use magnetism in the storage and release of electrical charge through current. Primarily includes passive components such as transformers, inductors, motors/ generators, etc.
- **Metals & Plastics:** It includes parts of electronic devices made of sheet metal or plastic mouldings. It also includes electronic packaging, which is the outer box that houses the electronic components. Sheet metal, cast metal, moulded plastic, or other materials are commonly used for the outer box.

**Chart 2.12: Global EMS market - Box-build market split by cost components, in %, CY2021**



### EMS market segmentation by the manufacturing locations

**Chart 2.13: Global EMS market - Segmentation by the manufacturing locations, value in USD billion, split in %, CY2021 and CY2026E**



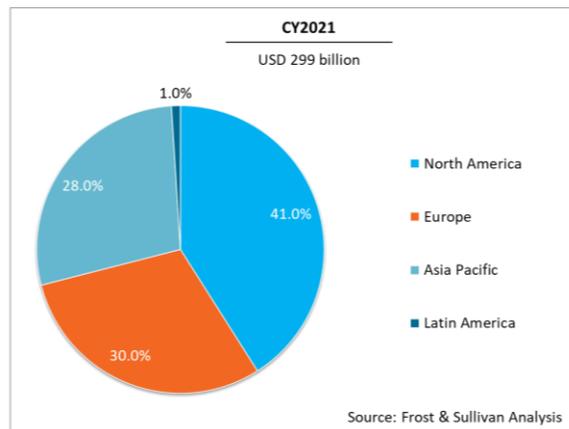
China leads the global EMS business with a 46.7% share in 2021. It is a global leader due to operational cost benefits, availability of a large number of highly skilled personnel, infrastructure, logistical advantages, and proximity to the largest end-user base across all end-user verticals. However, many global electronics manufacturers are now contemplating on China + 1 strategy and looking for alternate manufacturing locations for exports, creating tremendous investment potential for countries like Vietnam, India, and the Philippines etc.

North America is a leader in adopting next-generation technologies and devices. In the next five years, demand for EMS will be driven by a rise in electronic device demand, a well-established EMS infrastructure, and evolving government policies that encourage local production. The EMS industry is poised for a robust growth over the next five years. The EMS market in the United States was around USD 140 billion in CY2021, and it is expected to grow at a CAGR of 6.1% to USD 188 billion by CY2026. The electronics manufacturing industry in North America has benefited from skilled labour force, advanced technology, and pro-business policies. Within North America, the United States (US) leads this industry in terms of total market share, followed by Mexico and Canada. The US remains very attractive for the low- to medium-volume and complex electronics product manufacturing, predominantly in the medical, telecom, IT, automotive, industrial, and military/aerospace divisions. In particular, the U.S. electronics manufacturing sector is an important intermediary supplier for other key industries. Mexico is an important location for low-cost manufacturing, which results in a high proportion of assembly revenue being exported.

The India EMS is a sizeable industry, contributing to 2.2% (USD 20 billion) of the global EMS market in CY2022. India's EMS industry is the fastest growing among all countries at a CAGR of 32.3% and is expected to contribute 7.0% (USD 80 billion) of the global EMS market in CY2026. There continues to be a strong push from the government to make India an ideal location for Electronics manufacturing in the region.

### EMS market segmentation by outsourcing geographies

**Chart 2.14: Global EMS market - Segmentation by outsourcing geographies, value in USD billion, split in %, CY2021**



\*The above split is based on the locations of the OEMs, specific only for the five end-use segments: Automotive, Medical, Industrial, Aerospace & Defence and Telecom

- North America: Primarily USA, some OEMs are also based out of Canada.
- EU: Prominent countries are Germany, Netherlands, Switzerland and France. Other countries where some OEMs are present are Italy, Sweden, UK, Ireland and Finland
- APAC: Primarily Japan. Some OEMs are also present in China, Taiwan and South Korea
- LA: Brazil and Colombia

### EMS market segmentation by end-user industries

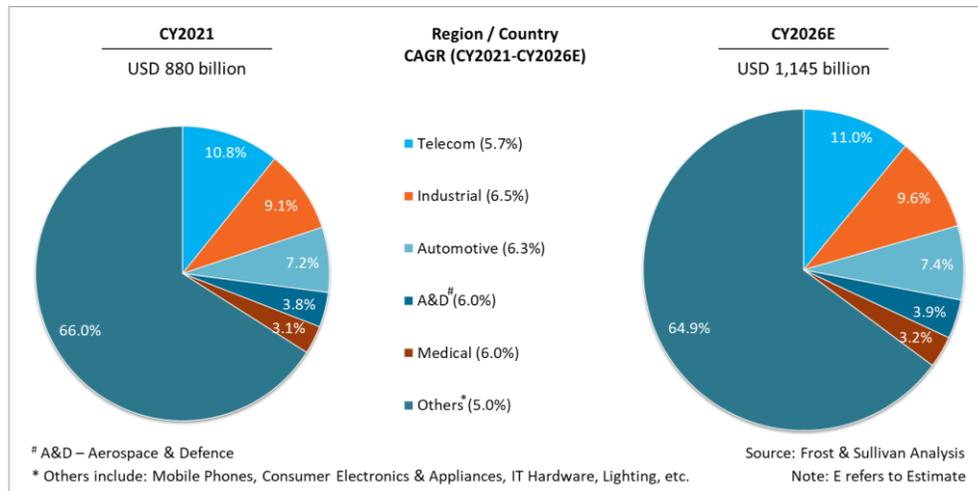
**Aerospace and Defence (A&D)** is a relatively small but key revenue-contributing segment. OEMs perceive EMS providers as strategic solution partners, as it gives them an average savings of 10% to 15%. The outlook for the aerospace and defence industry is optimistic. In the next few years, apart from cost, A&D OEMs will consider EMS providers' expertise in advanced technologies as a key partnership factor in boosting EMS revenue. Key trends that will drive new opportunity in this sector include digital thread and smart factory driving efficiencies, defence contracts building advanced military capabilities (like the ongoing US government support for the National Defence Strategy will likely keep defence spending stable), growth in the space in key areas like the launch industry, satellite trends, etc.

The major growth drivers for the commercial aerospace industry are increasing aircraft deliveries, replacement of aging aircraft, and growing demand for better safety and digital communication devices. Digital technologies are expected to provide a competitive advantage. The global defence spending was around USD 2.1 trillion in 2021, representing an increase of 6.7% over 2020 spending (Source: Statista). The increase represents that the countries chose to spend more

on defence even when they are facing severe economic contraction. USA, China, and India, contribute to around 55% of the total defence spend.

French industrial giant Thales is expected to grow profitably in the coming years in the aerospace and defence business. The group which specializes in avionics, radar, and air traffic management (ATM) announced an organic sales growth target of 3 to 6% and an EBIT margin between 10.8% to 11.1% in CY2022. Also, Honeywell forecast shows strong growth for aviation business as purchase plans increase sharply. Honeywell forecasts up to 8,500 new business jet deliveries worth USD 274 billion from 2023 to 2032, which is up 15% in both deliveries and expenditures.

**Chart 2.15: Global EMS market - Segmentation by end-user industries, value in USD billion, split in %, CY2021 and CY2026E**



**Medical** is a key revenue opportunity segment in the EMS market. Business is expected to boom in the medical device industry's electronic manufacturing services (EMS) segment. This is largely thanks to advanced technologies such as the Internet of Things (IoT), wireless, and artificial intelligence (AI). The other factor is that medical device manufacturers have been asked to speed up innovations and adopt newer more unfamiliar technologies without putting the quality into any kind of risk and without cutting corners. With the advancements in technology, single lab equipment is now able to perform various tasks. This has in many ways eliminated a lot of time-consuming, repetition of experimental steps which were performed earlier manually. In the age of collaborative business models, cloud computing is gradually gaining popularity in the medical equipment space. Many have either completely moved or have moved most of their processes to the cloud. Medical wearable technologies are also gaining traction in the last few years.

**Industrial electronics** is another important market, which is primarily divided into power and automation. Leading manufacturers are adding new applications to their portfolio by partnering with niche application providers. With the emergence of new applications, there are several opportunities for power electronic devices such as transformers, chokes, and inductors. Many electronics applications are concerned with the control and operation of heavy machinery. The worldwide actuators market is expected to grow due to their efficient operation, low maintenance, and other factors, and a sudden surge in demand coming from the automation sector. Though still nascent, AI-driven technologies are proving effective at making buildings more efficient. The rapid proliferation of smart devices within buildings and the interconnection of control systems and alarms have given rise to a new breed of security threats, making it necessary to protect OT systems and infrastructure as stringently as IT systems.

**Telecom** segment includes telecom infrastructure and networking equipments. Wireless technology in the last few years is growing tremendously. There are rapid expansions in mobile network coverage which has managed to reach even the remotest of areas. There is also an increase in demand which eventually leads to decreasing in charges that are incurred for using data. The increasing use of satellites used for connectivity is also a key factor driving this market forward. Furthermore, there is a growing need for spectrum trends, intelligence, and virtualization that is propelling the market for data centres. The development of multi-tiered data centres is adding to an increasing demand required by OEMs in augmented and virtual reality. Despite the capacity and speed of 4G technology, there are still cases where the quality of service is far from being perfect and reliable. 5G is a critical key driver of the telecom industry, especially for its future.

With greater bandwidth, higher download speeds up to 10GB per second is promised under this new tech. Researchers, telecom equipment vendors, and service providers are already working intensively towards 5G (fifth generation) of mobile communication which is very likely going to overcome the existing limitations of technology.

**Automobile** is one of the key growth opportunity verticals for EMS providers in the next 5 years, due to the technological transformation currently underway with autonomous cars development and electric car commercialization activities. EV is one of the key growth opportunity verticals, due to the technology transformation currently underway with autonomous cars development and EV commercialization activities. Moreover, the growing electronics content will accelerate the growth of EMS revenue from this vertical.

In the long term, the industry is likely to benefit from the global market. Long lead time for customer acquisition, onboarding, prototyping, OEM approvals, and production, coupled with the criticality and requirement for high-reliability anti-collision signalling systems, there are significant barriers to entry for railway projects. An increasing number of actions are being implemented by various authorities across the world to reduce road accidents. ADAS (Advanced driver assistance system) gives the owners the ability to adjust the speed of the car based on traffic conditions.

**Mobile phones and IT hardware:** Mobile phones have emerged as an important commodity in today's world and the segment commands a significant share of the global EMS market. On the other hand, IT hardware, though a saturated market, the onset of the pandemic has turned out to be positive, specifically because of the surge in demand for computers and tablets, driven by work-from-home and study-from-home needs.

**Consumer electronics and appliances (CEA):** The segment had a consistent performance in the last few years, which is aided by growth in advanced economies and developing countries. EMS companies have also profited from rising consumer spending and technological improvements. Rising demand for smart solutions will fuel future growth. Furthermore, OEMs and EMS manufacturers are progressively supplying both premium and mid-range appliances to meet the growing demand for both product categories and increase revenue.

## Trends, challenges, and entry barriers in Global Electronics Manufacturing

### Mega Trends in the Market Driving the Growth of the Global EMS Market

- **Technological advancements and acceptance of smart home devices:** The development of new manufacturing technologies and the emerging end-use sectors, such as the Internet of Things, are expected to boost demand for the EMS industry. Major manufacturers are strengthening their R&D investment in order to differentiate their products and attract new end-use applications. The rising popularity of smart home devices in developed nations such as the United States and European countries raises very high expectations for EMS companies.
- **Greater emphasis on vehicle electrification:** The Electric Vehicles market will be the most lucrative in the automotive industry over the next decade. With an ever-increasing electronic content in each car, energy-related modules, and sub-assemblies, as well as charging infrastructure, which requires an overall ecosystem; it is a paving out major potential for EMS firms to enter this fast-developing industry and serve the leading EV manufacturers.
- **Technological upgrade of facilities:** Most of the large manufacturing companies are investing heavily in the technological up-gradation of their facilities by adopting digitization and industry 4.0 concepts. This will increase demand for Industrial electronics products which in turn will boost the EMS industry
- **Product development activities:** The dependence created by electronics in product development activities across all verticals will turn out to be a significant driver for EMS, especially in consumer electronics and automotive segments, where new devices and systems are being developed. As the electronic content increases, the volume of manufacturing will increase, driving the market.
- **Accelerated demand post-COVID-19:** has currently increased the requirement for EMS services. This will subside in the mid to long-term once inventory is created. Also, major medical device manufacturers are very keen to design & manufacture smaller and smarter medical devices that integrate new technologies like IoT and other electronics-embedded features. Furthermore, the growing demand for the wearable and the smart medical devices is pushing the need for smaller, flexible, and light-weight products in the healthcare business.

- **Digital thread and Smart factory to drive efficiencies:** Going forward it is anticipated that A&D companies will accept digital thread and smart factories in 2023. Digital threads are considered very useful as it helps connect the life cycle of A&D products from the initial design of the product until the final stages. This helps in collecting dynamic feedback as we go along the process. This will effectively help in reducing the overall time to market, service costs and help in quickly adapting to the changing needs of customers
- **Electrification, an emerging trend in Aerospace segment:** Top aerospace companies as well as new entrants are investing in research and development centred around electrical propulsion, generation, distribution, storage, and conversion. Electrification means the migration of both the aircraft and propulsion systems to one which is powered by electricity instead of pneumatics, hydraulics, and jet fuel. While the industry awaits the magic battery, hybrid aircraft will be required to drive the electric propulsion technology forward. Many companies are investing in ushering in such advancements.

### Challenges/market restraints hindering the growth of Global EMS industry

- **Fragmented market:** Due to its strong growth potential, many companies are entering the industry which is causing stiff competition in the market. The existence of a high number of market participants in all areas results in competitive pricing, which reduces market revenue potential. This is mainly applicable for HVLM products. However, specialised sectors such as A&D and medical, are highly complex, and expensive, there are obvious challenges and barriers that make it almost impossible for new players to enter this market. High capital requirement and strict regulations are the key barriers preventing companies from entering these sectors.
- **Shrinking operating margin:** A majority of the market participants face challenges with respect to the operating margin. In the EMS industry, profit margins are relatively low. As component prices are on an average, key focus lies on the labour costs. A low operating margin is viewed as an impediment to growth, considering the impact it can create on expansion plans. Currently, this is viewed as a significant restraining factor for the market. However, in the long term, as overall demand increases, market participants will be able to expand through technological investments. Thus, the impact will lower in the mid to long terms.
- **Complex structure and delay in supply chain:** Supply chain delays causing shortage of components are likely to impact the revenue in the short term. Russia-Ukraine conflict has impacted supply chains in the semiconductor industry. The conflict may have particular impact on the supply of Neon and Hexafluoro butadiene gases, which are an essential element to manufacture semiconductor chips as these are used in the lithography processes for chip production. However, the overall, the impact of transformation is very low in the mid and long terms.
- **Shortened product lifecycles and uncertain demand:** Customer preferences and interests continue to evolve at a breakneck pace. To launch the items on schedule while fulfilling quality and volume objectives, a collaborative effort across different sections is required. The industrial sector should be able to handle the rise in demand if it reaches exceptional heights. If demand falls, companies must have a strategy in place for the idle raw materials or machinery.
- **Regulations and violations of IP:** Local stringent laws and trade pricing are having an influence on the EMS sector, driving OEMs to build in-house manufacturing capabilities. In addition, an increasing number of cases on infringement of intellectual property rights are posing a serious threat to EMS companies.
- **Skilled labour shortage:** There is substantial competition for R&D personnel, qualified technical experts, sales and marketing professionals, and post-sales services providers, as well as a rising attrition rate in the EMS industry
- **Sustainability:** Emerging regulations and requirements are forcing organizations to account more and more for Corporate Social Responsibility (CSR) in decisions. E-Waste, a famous subject today, is driving conversations about the disposal of merchandise and there has an effect on the environment. Companies must now reflect on consideration on of the whole product lifecycle in decisions.

### Entry barriers in the EMS industry

- **Capital Investment Cycle:** One of the issues which face the entire industry – especially component manufacturers and the EMS companies – is that of long capital investment cycles. It takes a long time, as

compared to other manufacturing industries, to realize a return on invested capital. This also acts as a barrier to entry for a newer player and the capital-intensive nature of the industry makes it hard for the smaller players to achieve scale.

- **Presence of established players:** Furthermore, the players are increasingly investing in R&D and exhibiting mergers, acquisitions, and partnerships as key growth strategies to gain a competitive advantage. The strong presence of established players in the marketplace poses high entry barriers for new players entering the consumer electronics market.
- **Uncertain Demand:** Uncertain demand for products closely affects the EMS provider. Companies may have to deal with volatile economy and variable demand which leads to fluctuations in productions. Consumers in today's day and age are very clear about their requirements, which sometimes leads to spike in demand for a certain product. A company is expected to be resourceful as inventory is also expected to keep up with the demand.
- **Long approval cycles:** There are challenges in the acquisition process, especially in the A&D segment. From the 'statement of case' for a major aircraft deal to 'acceptance of necessity' can take up a long time. Also, request for information and request for proposals and the selection and negotiation process takes three to four years, and the production or delivery takes another two to three years.
- **Need for certification and technical know-how:** Attaining and maintaining technical knowledge through continued training, and development, are essential elements in regulated industries such as A&D, medical, telecom and others. With high barriers to entry in these sectors (such as high capital costs for inventory, the need for specific certifications and the need to be close to the customer) it is unlikely that any new competitors will enter the market any time soon

## Government incentives and programs

### A) India

**Make in India:** In 2014, the government of India announced this initiative to make India a global manufacturing hub, by facilitating both domestic as well as international companies to set-up manufacturing bases in India. As per the scheme, government released special funds to boost the local manufacturing of mobile phones and electronic components.

**Production Linked Incentive (PLI) Scheme:** The scheme was first announced by the Government of India in 2019 to encourage incremental investment and sales of manufactured goods, specifically for the Indian mobile phone and component markets. It is expected to boost exports in the coming years. The scheme anticipates a total production value of INR 11,500 billion over the next five years.

**Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECs):** The scheme aims to strengthen the electronics and semiconductor manufacturing ecosystem, which helps to meet domestic demand for electronic components and semiconductors, improve value addition, and create jobs. Incentives up to INR 32.85 billion will be awarded under the scheme over a period of 8 years.

**Merchandise Exports from India Scheme (MEIS):** The government of India offers benefits of up to 4% under this scheme, depending on the country of exports and the products. The scheme's rewards are calculated as a percentage of the realized free-on-board value, and MEIS duty credit can be transferred to the company for working capital needs or used to pay various duties, such as basic customs duty.

**Modified Electronics Manufacturing Clusters Scheme (EMC 2.0):** The scheme aims to strengthen the infrastructure base for the electronics industry in India and to deepen the electronics value chain. The program offers financial incentives for the development of high-quality infrastructure, as well as common facilities and amenities for electronics manufacturers.

**Semiconductors and Display Fab Ecosystem:** Aim of the program is to provide appealing incentive support to companies involved in Silicon Semiconductor Fabs, Display Fabs, Compound Semiconductors/Silicon Photonics/Sensors (including MEMS) Fabs, Semiconductor Packaging (ATMP/OSAT), and Semiconductor Design (CAD). It is a comprehensive incentive program approved by the Government of India for the development of a sustainable semiconductor and display ecosystem in the country with an outlay of INR 76,000 crore.

**Defence offset policy:** The key objective of the Defence Offset Policy is to leverage capital acquisitions to develop Indian defence industry by (i) fostering development of internationally competitive enterprises, (ii) augmenting capacity for Research, Design and Development related to defence products and services and (iii) encouraging development of synergistic sectors like civil aerospace, and internal security (Source: Ministry of Defence, GoI). India has implemented the Defence Offset Policy for capital imports over INR 300 billion. Foreign vendors are required to invest at least 30% of the value of the purchase. Since 2007 when the first offset contract was signed, a total of 57 contracts have been inked.

Though India has extensively pursued defence offsets through an official policy in 2005, the earlier policies did not concentrate on technology and R&D capability dispersion from foreign to Indian defence companies. The Defence Acquisition Policy 2020 (DAP 2020) aims to redress such deficiencies by shifting the focus away from components to technology investments and export of platforms. Avenues for expanding offsets have been expanded in the DAP 2020, giving foreign entities direct credit in transferring critical technologies to the Indian industry. Though certain critical technologies such as hypersonic flight related technology, electromagnetic rail guns etc. has been reserved only for DPSUs and DRDO, most technologies used in defence equipment are now open to private players.

The government has tried to balance the interests of foreign stake holders here by allowing them to authorize their vendors to discharge offsets on their behalf. Note that the baseline indigenous component mandates for Buy (IDDM) and Buy (Indian) categories have been increased by 10% to provide more opportunities to the Indian industry. Overall, the new changes aim facilitating technological capability advances of indigenous companies while reserving a greater opportunity share for them in military contracts, accelerating the growth of the Indian defence industry.

## B) China

Semiconductor manufacturing has long been a priority for China, and this has gained steam further with the Made in China 2025 plan and its ultimate goal of becoming increasingly self-sufficient in semiconductors.

A broad set of policy levers exists both centrally and locally:

1. Investment incentives (land, grants, tax credits, etc.): In China, incentives are to the extent of up to 30%-40% of a new fabrication facility's total cost of ownership, which is almost well above other countries.
2. They are available for both domestic and multinational firms, but the best terms often require some technology transfer.
3. The additional support that China provides which is not typically found in other countries are:
  - Equipment is leased at preferential rates.
  - Firms have access to credit and loans at below-market rate
  - The state directly invests equity in domestic companies (which historically have delivered below-market returns)

It is estimated that the amount of government support extended by China to its top four semiconductor manufacturing companies exceeds 20-30% of their revenue.

## C) USA

**CHIPS Act:** To strengthen the U.S. position in semiconductor manufacturing and R&D, the US government has authorized a set of programs called Creating Helpful Incentives to Produce Semiconductors (CHIPS) in America. The intent of this set of programs is to restore the country's leadership in semiconductor manufacturing by providing incentives and encouraging investment to expand manufacturing capacity for the most advanced semiconductor designs as well as those of more complex designs which are still very much in high demand and would grow the research and innovation ecosystem for microelectronics and semiconductor R&D in the U.S., including the investments in the infrastructure necessary to better integrate advances in research into semiconductor manufacturing. Key highlights include

1. \$39B would be directed to incentivize the construction or modernization of facilities in the U.S. for semiconductor fabrication, assembly, testing, advanced packaging, or R&D; and
2. Another \$11.2B would support several R&D and infrastructure investments including the establishment of a National Semiconductor Technology Centre (NSTC), investments in advanced packaging, the creation of a Manufacturing USA institute targeting semiconductors, and expansion of R&D in support of semiconductor and microelectronics.

**ITAR Program:** International Traffic in Arms Regulations (ITAR) control the export and import of defence-related articles and services on the United States Munitions List (USML). This list includes the commodities and related technical data and defence services controlled for export purposes. The ITAR controls not only end-use items, such as radar and communications systems, military encryption, and associated equipment, but also the parts and components that are incorporated into the end use item. According to the US government, all manufacturers, exporters, and brokers of defence articles, defence services, and related technical data must comply with ITAR. Consequently, more businesses are requiring their supply chain partners to be ITAR compliant. It means the company must be “ITAR certified” and registered with the State Department’s Directorate of Defence Trade Controls (DDTC).

The U.S. is projected to be the largest spender on defence worldwide in 2021, and this trend is expected to continue until 2032. In 2021, the U.S. spent USD 742 billion on defence. The forecast predicts an increase in defence outlays up to USD 998 billion in 2032. A significant portion of this budget will be spent on contracts with third-party businesses, including contractors who supply the U.S. military with products, raw materials, and services. The global defence electronics market is valued at USD 130 billion and the US accounts for approximately 55%.

#### D) Europe

**European CHIPS Act:** The European Chips Act will help to address weaknesses in Europe’s semiconductor supply chain as well as promote research and production of these chips through investments in public and private chip fabs. This will help the region respond to any future supply chain disruptions. Additionally, it will help the EU achieve its goal of reaching 20% global production of semiconductors by 2030.

The European Chips Act has three main components that will help secure a supply of semiconductors as well as reduce dependency on chipmakers outside of Europe

- First, the act will pool resources from member states and countries associated with the existing Union programs. \$12.8 billion will be made available to strengthen research, development, and innovation for prototyping, testing, and experimentation of new devices, train staff, and more.
- Second, a new framework will ensure the security of supply by attracting investments and enhancing production capacities such as advanced processing nodes. The fund will also allow access to finance start-ups to help mature innovations and attract investors.
- Third, the act will enable coordination between member states and the Commission for monitoring the supply of semiconductors, estimating demand, and anticipating shortages. This will help monitor the value chain by gathering key intelligence from companies to map primary weaknesses and bottlenecks.

#### E) Southeast Asia

Southeast Asian discretionary incentives tend to be offered at a local authority level. In Thailand, new incentives have been released for semiconductor manufacturing, R&D, and other digital technology as the objective of the government is to take advantage of the soaring demand for products in this sector. The R&D and human resource (HR) incentives apply to companies making large investments in innovation. Eligible companies will benefit from extended tax holidays lasting up to 13 years without a corporate income tax exemption ceiling. In other words, these companies will be given an exemption from Thailand’s corporate income tax rate of 20%. Back-end semiconductor investments, such as in wafer SORT, die bank, assembly, and integrated circuit testing, qualify for tax holidays of eight years with machinery investments of at least 1.5 billion baht (US\$45.7 million), and five years for machinery investments below 1.5 billion baht (US\$45.7 million).

### Trends on alternative locations for manufacturing to China

#### Comparative Analysis of industry in India, China, Vietnam, and Mexico

Economic development in India is gaining support as a result of the continuing expansion of private consumption and investments some industries following the liberalisation of foreign ownership. The projected government expenditure expansion would further enhance growth by focusing on social infrastructure, making the best use of technology, digital India, make in India, job creation in Micro, Small, and Medium Enterprises (MSMEs), and heavy investment in infrastructure.

## A. Economic comparison of favourable manufacturing parameters

China is now the world's second-largest economy. The growth rate is impressive when compared to the size of the economy. The primary difficulties for its expansion are excess capacity issues, labour costs, and financial market weaknesses. India and Vietnam are gaining ground as the second-best destinations after China. The IMF estimates that India's GDP is improving, and projects that GDP will be around 6.5% by 2026. Various government initiatives and tax regimes are expected to stimulate India's domestic manufacturing sector.

India has the potential to become a global manufacturing powerhouse, competing with China, which now produces one-fifth of the world's commodities. With a relatively young population, India boasts the world's second-largest population. India's median age is 28.7 years, lower than China's median age of 37.4 years, Vietnam's median age of 31.9 years and Mexico's median age of 29.2 years (CIA's World Fact book, 2020). Chinese employees' aspirations have risen, and they are increasingly focused on high-tech jobs, leaving gaps in the industrial value chain. A lack of manpower has resulted in a labour shortage and increased costs.

**Chart 2.16: Economic comparison on favourable manufacturing parameters, India, China, Vietnam and Mexico, 2021**

PARAMETERS	INDIA	CHINA	VIETNAM	MEXICO	
Population (Million)	1,390.0	1,410.0	98.5	129.0	
Annual GDP (USD Trillion)	3.18	17.74	0.37	1.30	
GDP Growth (%)	CY2021	8.7	8.1	2.6	4.8
	CY2026	6.5	4.9	6.7	2.1
Inflation (%)	5.5	0.9	1.8	5.7	
Manufacturing Value Added (% of GDP)	14.4	26.2	25.0	18.0	
Export (USD Trillion)	0.42	3.36	0.34	0.50	
Imports (USD Trillion)	0.61	2.69	0.33	0.52	
Manufacturing Risk Index (Rank)	2	1	11	21	
FDI Investments (USD Billion)	45	334	20	32	

Source: World Bank, IMF, Frost & Sullivan

## B. Labour market comparison

India labour cost is one of the lowest globally. This along with a large surplus workforce, is expected to grow until the end of this decade, which gives it a competitive edge to challenge its rivals in Southeast Asia in the race for a China+1 strategy. In comparison to other Asian countries, India, and Vietnam benefit from lower labour costs. Vietnam, with a population of less than one-tenth that of China, is experiencing skilled labour shortages as global manufacturers rush to set up shop here to avoid US tariffs. It is also hampered by a scarcity of specialised supply chains. India is expected to fill this void due to its advantage in skilled and semi-skilled labour.

**Chart 2.17: Labour market comparison, India, China, Vietnam and Mexico, 2021**

PARAMETERS	INDIA	CHINA	VIETNAM	MEXICO
Total Labour Force (Million)	471.3	793.8	56.2	57.3
Total Labour Force, Female (% of Total population)	20.3	44.5	47.6	38.5
Labour force participation rate (% of total population)	52.1	75.9	83.1	65.3
Employment in Industry (% of Total Employment)	25.0	27.0	27.0	26.0
Wage and salaried workers (% of Total Employment)	24.2	55.3	45.7	68.1
Average Daily Wages - Nominal (USD)	~ 5.3	~36.0	~9.5	~13.3
Average Daily Wages - Manufacturing (USD)	~ 6.0	~6.5	~3.0	~4.8

Source: World Bank, IMF, ILO, Statista, Frost & Sullivan

With nearly 500 million people of working age, India has one of the world's largest workforces, next to China. Each year, tens of millions of students across the country graduate from colleges and enter the workforce. Apart from a favourable labour environment, India has an abundance of design talent (hardware and software). Most important factor perhaps that is driving the EMS industry in India is the labour force. Many people associate this with China's growth and how it is losing its price competitiveness with rising wage cost. Similarly, Mexico has expanded dramatically over the last decade,

mainly because of attractively low labour costs and the intense competitive environment within America. The employment rate of prime-age men in Mexico (66.6%) is low in comparison with other OECD countries.

### C. Manufacturing eco-system comparison

China has been the most ideal manufacturing destination due to its long history and supremacy in electronics manufacturing. The electronic sector in China has expanded at three times the rate of the country's GDP. Exports account for a large portion of China's electronics manufacturing, including notebooks, mobile phones, and flat panel displays. The current uncertainty in China's manufacturing favourability has stemmed from the global economic crisis and years of rapid expansion. Vietnam benefited significantly from the US-China trade war. Vietnam is aggressively investing in infrastructure to facilitate the strong inflows of FDI. Economic zones, industrial parks and clusters, hi-tech parks, and agri-tech zones are among the sectors targeted for investment. Vietnam has introduced new incentives to attract high-tech investment. Manufacturing in Mexico continues to grow across most industries, both in size and sophistication. In fact, Mexico is the 12th largest exporter in the world. Respective governments have streamlined certain regulations which allow businesses to establish operations in Mexico with little difficulty. Although many industries are moving their manufacturing to Mexico, the most prominent industries in Mexico are the automotive, aviation and aerospace, medical device, apparel and textile, and consumer products industries

The position of the Indian electronics sector is changing, and electronics is recognised as a key segment for policy focus. The National Policy on Electronics (NPE), 2019 has highlighted the local value addition and a supportive environment has been developed. The government is rapidly attracting the eye of global and domestic companies with an unimpeded focus on manufacture through Make-in-India policies. The favourable developments leave India with great aspirations to dominate electronics manufacturing in the region. The Product Linked Incentive (PLI) Scheme was announced in the years 2020 by the Government of India considering the incremental investment and sales of manufactured goods. The PLI scheme, which was first introduced for mobile phones and was later expanded to IT Hardware, White Goods, and Telecom and Networking Products, is now being expanded to other sectors in the coming years. Indian electronics manufacturers are heavily dependent on imports for raw materials sourcing. The phased manufacturing programme of the Government of India involves a mix of local assembly import levies and incentives. Since plastic components are driven by international prices, there is no noticeable disadvantage for Indian producers. As a large number of electronic manufacturing units are anticipated to undertake greater value addition, the component cost is likely to go down over the next 3 to 4 years. Various PLI schemes across sectors are expected to address this challenge by bridging the cost gap in between India and China.

**Chart 2.18: Manufacturing eco-system comparison, India, China, Vietnam and Mexico, 2021**



Source: Frost & Sullivan

## CHAPTER 3 - INDIAN ELECTRONICS INDUSTRY OVERVIEW

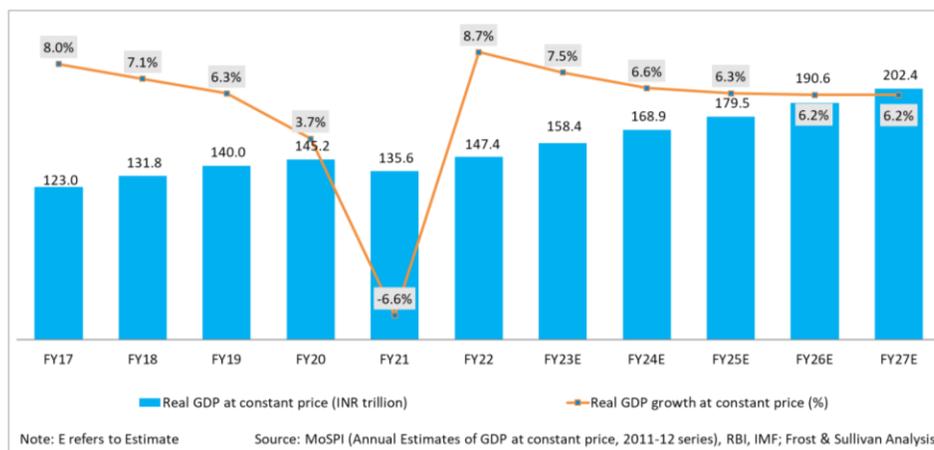
### India Macroeconomic Outlook

#### Real GDP

The last decade was a mixed bag for the Indian economy and the country has seen a see-saw movement in GDP growth between 2010 and 2020. However, the growth started slowing down in FY2018 and reached a low of 3.7% in FY20. Eminent experts have cited Demonetisation and GST implementation as the key reasons for this moderation in growth.

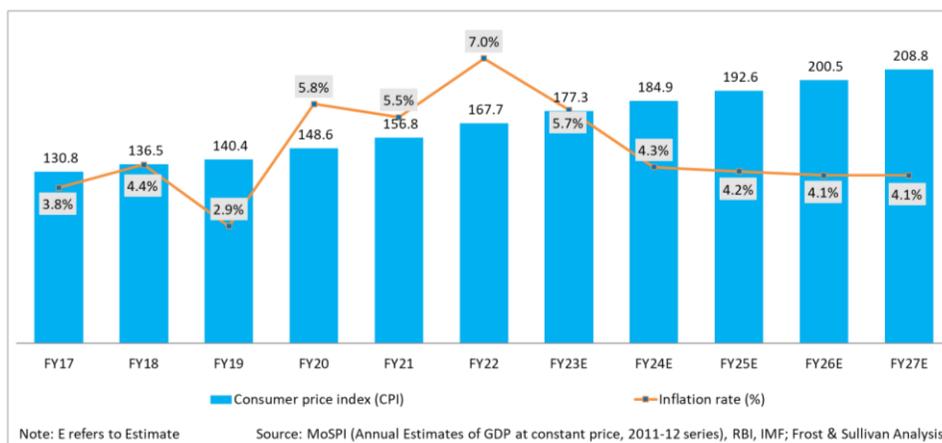
While the Government was taking corrective measures, the economy received a jolt from the Covid-19 pandemic at the beginning of FY21. The economy bounced back from Q3 FY21 on the back of huge pent-up demand and the festive season. FY22 was strong, and the Indian economy registered an 8.7% growth in the financial year. The Indian government has taken a slew of measures to bring the economy back on track. There is a strong focus on the growth of the domestic manufacturing sector through various policy initiatives such as Atmanirbhar Bharat, PLI schemes, etc. These initiatives will help the economy to register stable growth of approximately 6.6% in the medium term.

**Chart 3.1: Annual Real GDP and Real GDP growth (Annual %age Change), Value in INR Trillion, Growth in %, India, FY17-FY27E**



#### Consumer Price Index (CPI) and Inflation

**Chart 3.2: Consumer Price Index (CPI) and Annual Inflation Rate, Index in Number, Rate in %, India, FY17-FY27E**



India's inflation was estimated to be approx. 7.0% in 2022. The rate of inflation in 2022 is mainly due to the rise in prices of crude petroleum and natural gas, mineral oils, basic metals, etc. owing to the disruption in the global supply chain caused by the Russia-Ukraine conflict. The Central bank states that these are effects of the pandemic, the geopolitical

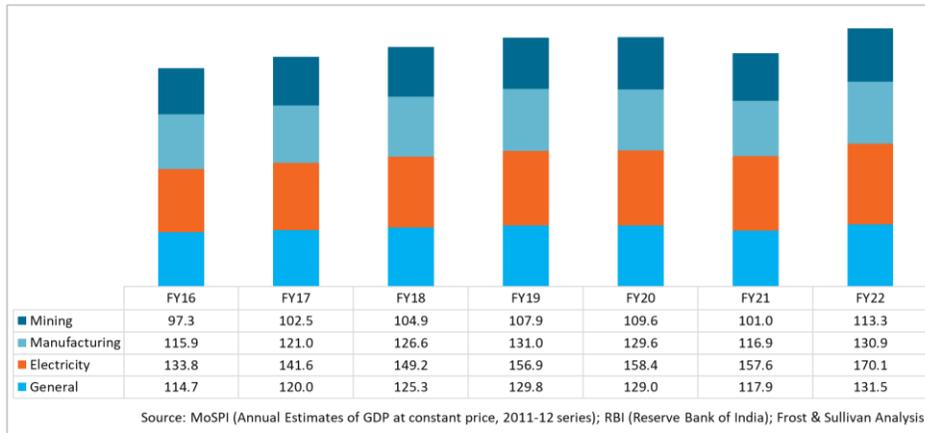
conflict, and the weakness in the Indian rupee which is also due to a mismatch in demand and supply of goods and services, leading to downside risks to growth. There are mandates from the government to the central bank to maintain retail inflation at 4% with a margin of 2% on either side for a five-year period ending March 2026

The RBI declared in August 2022 that it intends to lower inflation to its medium-term target of 4% within the next two years. The RBI released regulations intended to enhance the regulatory framework controlling these activities. In December 2022, the Monetary Policy Committee (MPC) raised its repo rate/ lending rate, by 35 basis points to 6.25 percent, based on an assessment of the current and evolving macroeconomic environment, in an effort to reduce persistent inflationary pressures. This is the fifth consecutive hike in the key lending rate by the RBI.

### Index of Industrial Production

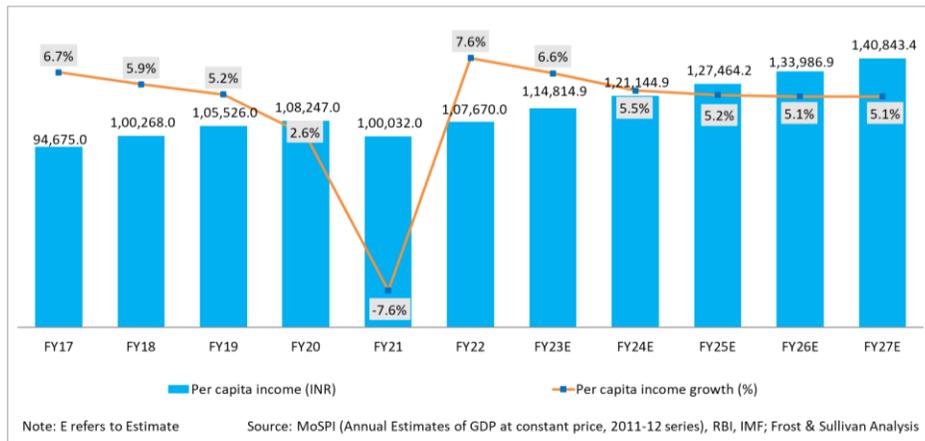
Due to the pandemic, investment activity was sluggish from March to May 2020. Project completions were delayed, and industrial activities remained muted during this period. Industrial output growth, returned to positive territory after a two-month period, owing mostly to the low-base impact and strong performances by the manufacturing, mining, and power sectors. As predicted by RBI, the business confidence improved from 97 in 2021 to 104 in 2022 (Source: OECD-Organisation for Economic Co-operation and Development). The manufacturing sector constitutes around 77 percent of the IIP. There has been an increase in industrial activity since June 2021, which gained momentum through FY22 and is expected to continue through FY23 as well.

**Chart 3.3: Index of industrial production based on sector, Index in Number, India, FY16-FY22**



### Per Capita Income

**Chart 3.4: Per capita income and growth (annual percentage change), value in INR, growth in %, FY17-FY27E**



The per capita income is a broad indicator of the prosperity of an economy. India's per capita income, calculated in correlation to Real GDP, was INR 100,032 during FY21 compared to INR 108,247 in FY20, an approximate decline of 7.6%.

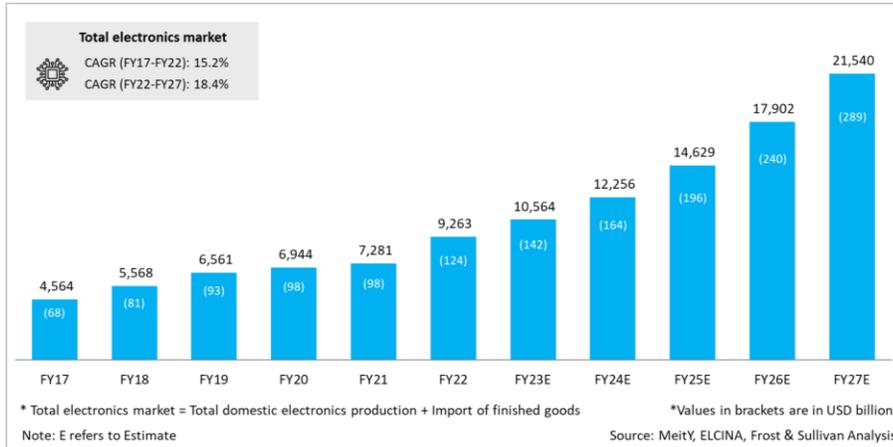
Per capita income increased by around 7.6% during FY22 to touch INR 107,670. The growth is likely to be stable at approximately 5.5% CAGR over the medium term.

## Indian Electronics Industry

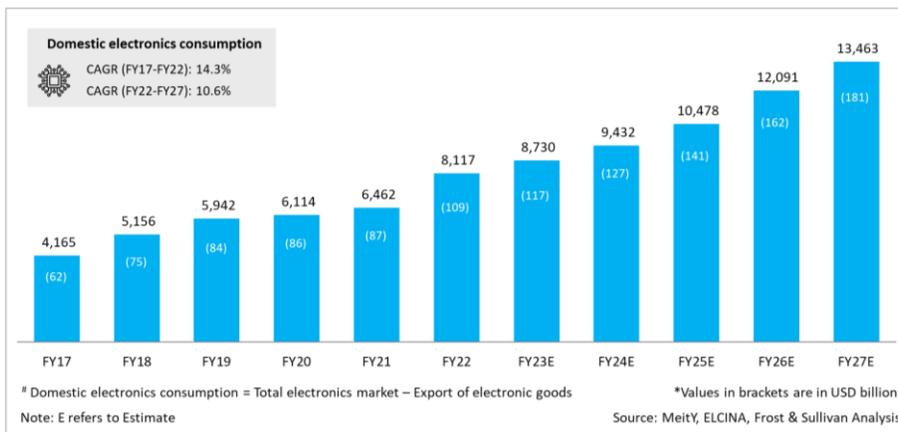
### Overview of the Indian electronics industry - Total market and domestic consumption

Electronics is one of the fastest-growing industries in the country. The total electronics market (domestic electronics production and imports of finished goods) in India was valued at INR 9,263 billion (USD 124 billion) in FY22, expected to grow at a CAGR of 18.4% to reach INR 21,540 billion (USD 289 billion) in FY27. The landscape of the industry is changing significantly, and revised cost structures have shifted the focus of multinational companies in India.

**Chart 3.5: Total electronics market, India, value in INR billion and USD billion, growth in %, FY17-FY27E**



**Chart 3.6: Domestic electronics consumption market, India, value in INR billion and USD billion, growth in %, FY17-FY27E**

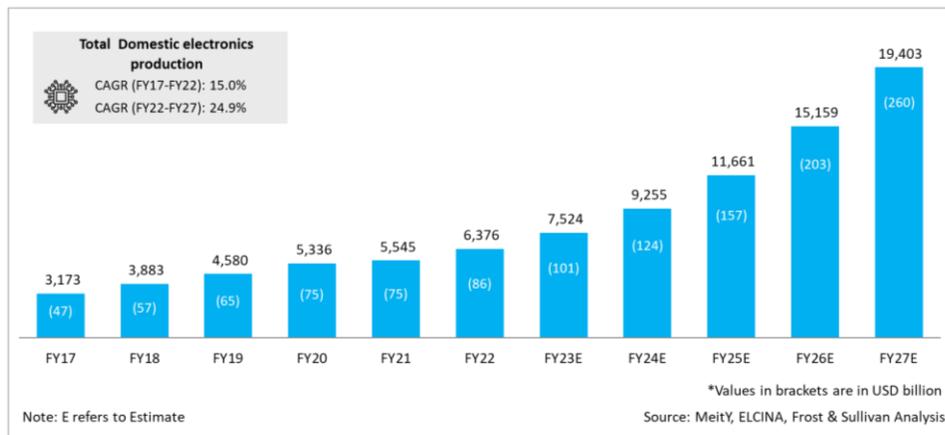


At present, the Indian government is striving to strengthen manufacturing capabilities across several electronics industries and fill the gaps to make the Indian electronics sector globally competitive. India is positioned as both a high-quality destination for design and a cost-effective option. Low manufacturing costs, a skilled workforce, and a vast geographical area are some of the driving elements behind the development of India's electronics ecosystem. Also, the manufacturers are slowly shifting their focus on product mix from high-volume, low-mix (HVLM) products to low-volume, high-mix (LVHM) products.

The demand for electronic goods in India has grown significantly in recent years. The domestic electronics consumption market is estimated at INR 8,117 billion (USD 109 billion) in FY22, expected to grow by 10.6% to reach INR 13,463 billion (USD 181 billion) in FY27. Increasing electronics penetration in semi-urban and rural markets, a shift in lifestyle among the Gen Y population, and the adoption of smart gadgets are some key drivers supporting domestic consumption.

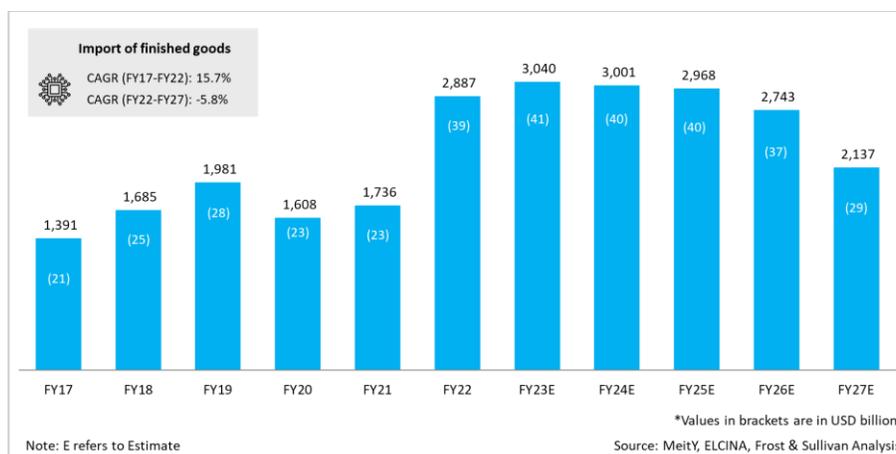
## Indian domestic electronics production vs. exports vs. imports

**Chart 3.7: Domestic electronics production market, India, value in INR billion and USD billion, growth in %, FY17-FY27E**



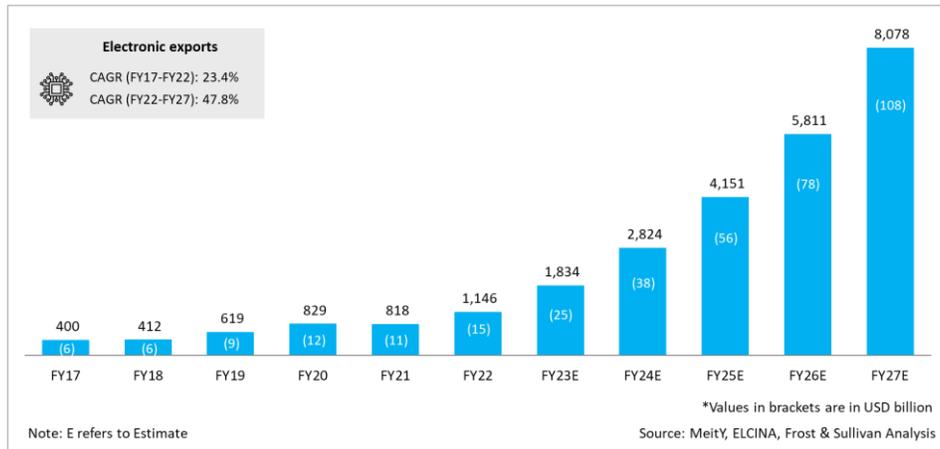
Domestic electronics production accounted for approximately 69% of the total electronics market in FY22, valued at INR 6,376 billion (USD 86 billion), and is expected to grow to approximately INR 19,403 billion (USD 260 billion) in FY27, owing to various government initiatives and the development of India's electronic ecosystem. India has the potential to be one of the most attractive manufacturing destinations and support the objective of "Make in India for the World". The government is spearheading various policies and initiatives in the electronics industry to build the complete electronics manufacturing ecosystem, to propel India into the top five countries for electronics production and the top three countries for electronics consumption. The government's stated objective of enhancing manufacturing capability within India has been backed by the creation of a favourable environment. The government has also taken several steps towards increasing the ease of doing business, which has resulted in increased manufacturing setups by multiple foreign manufacturers in the country. This environment has certainly encouraged the EMS market as electronics brands/ OEMs continue to push for collaboration and partnership.

**Chart 3.8: Import of finished goods market, India, value in INR billion and USD billion, growth in %, FY17-FY27E**



The total import value of finished goods in the electronics industry was valued at INR 2,887 billion (USD 39 billion) in FY22, compared to INR 1,736 billion (USD 23 billion) in FY21. Shortage of chips has slowed down domestic manufacturing in the last quarter of FY22 which resulted in higher imports of electronics products. China and Hong Kong accounted for ~ 63% of India's total electronic imports in FY22. Imports from the United States, Japan, and Taiwan now meet the majority of semiconductor demand. To reduce reliance on imports, the government is developing electronics manufacturing clusters (EMCs) across the country to provide world-class infrastructure.

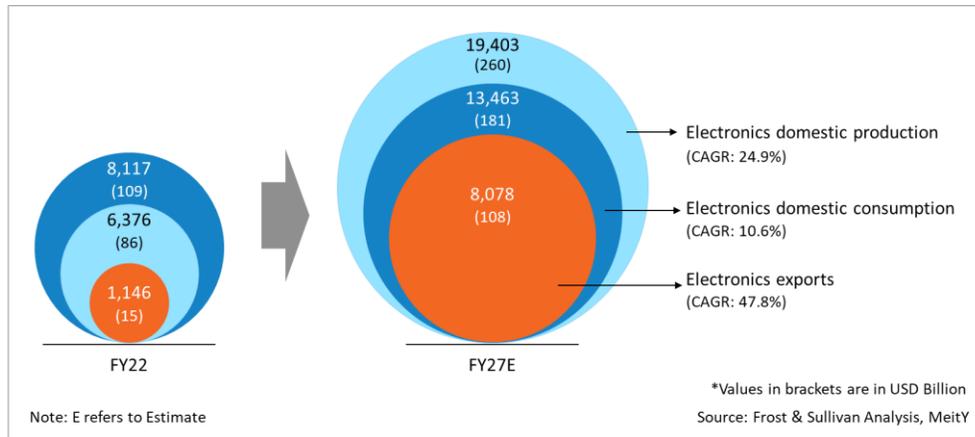
**Chart 3.9: Electronics exports market, India, value in INR billion and USD billion, growth in %, FY17-FY27E**



The value of total exports increased by 40% in FY22 to INR 1,146 billion (USD 15 billion), compared to FY2021, which was worth INR 818 billion (USD 11 billion). As domestic production increases, the export market is expected to grow significantly over the next five years at a CAGR of 47.8% to reach INR 8,078 billion (USD 108 billion) in FY27. The top 3 leading products in the export category are mobile phones, engine control units, and industrial machinery. India holds superior design competence and the availability of a talented workforce at lower wages compared to China, which fortifies its position as the futuristic, domestic-cum-export-oriented manufacturing destination.

**Comparison of Indian domestic electronics production vs consumption vs exports**

**Chart 3.10: Comparison of Indian domestic electronics production vs. consumption vs. exports, value in INR billion, USD billion, FY22 and FY27E**

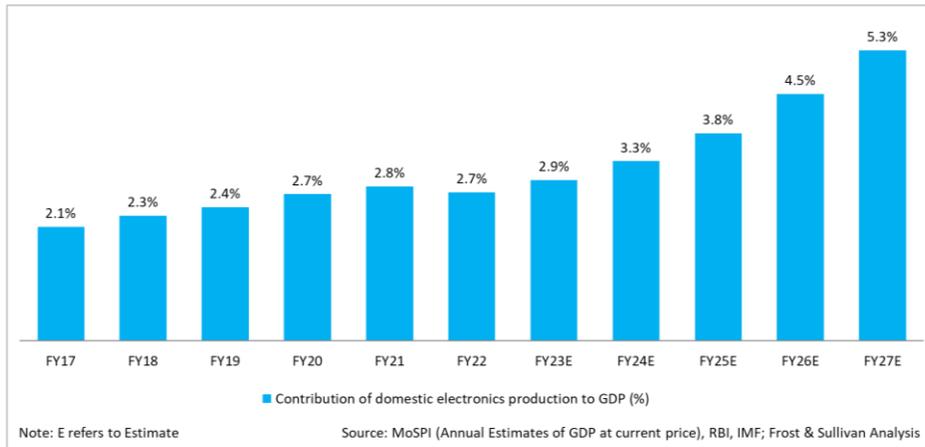


The government’s stated objective of enhancing manufacturing capability within India has been backed by creation of a favourable environment. Whether it is the customs duty for certain products or removal of duties on components or encouraging local component manufacturing, there has been appreciable movement to drive domestic manufacturing. The government has also taken several steps towards increasing the ease of doing business, which has resulted in increased manufacturing setups by multiple foreign manufacturers in the country. This environment has certainly encouraged the EMS/ ODM market as electronics brands/ OEMs continue to push for collaboration and partnership.

In recent years, India's demand for electronic products has increased substantially, primarily due to India's development in the EMS segment. Low manufacturing costs together with skilled workforce and a vast geographical area are some of the driving forces behind India's electronics ecosystem development. India is currently the world's second largest mobile phone manufacturer, and the Indian start-up ecosystem is still expanding, with the potential that Indian start-ups have shown a huge opportunity for India.

## Indian Electronics production as a % of GDP

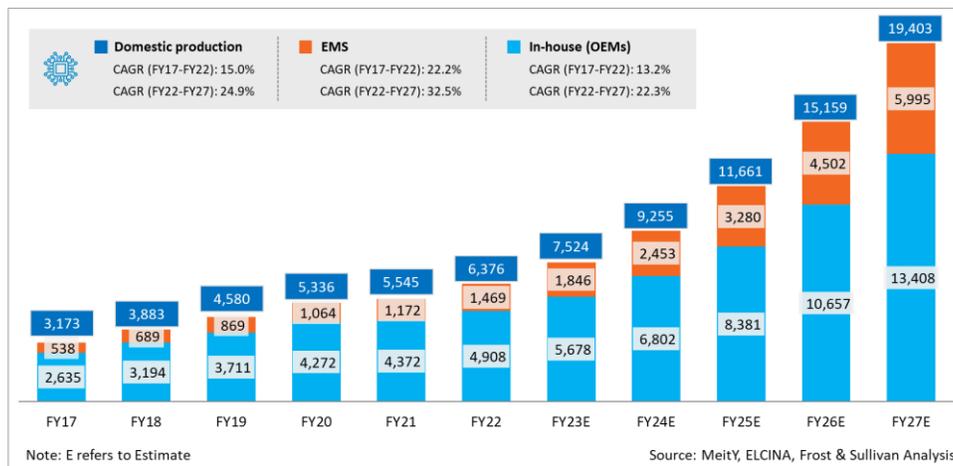
Chart 3.11: Contribution of domestic electronics production to Indian GDP, in %, India, FY17-FY27E



In FY22, the electronics production in India contributed to 2.7% of the nominal GDP (at current prices), which is expected to increase to around 5.3% by FY27. The Government's objective is to provide domestic manufacturers with a better facility to make them competitive with imports into the industry by simplifying the tariff system, simplifying the procedures, giving incentives, and improving the infrastructure. Considerable high value-added manufacturing takes place in the consumer electronics and appliances segment and most products command high brand equity globally, offering an excellent opportunity for ESDM companies to export.

## Indian domestic electronics production - Split between in-house manufacturing and EMS

Chart 3.12: Indian domestic electronics production market - Split between in-house manufacturing and EMS, value in INR billion, growth in %, FY17-FY27E



Domestic electronics production by OEMs with in-house capabilities currently accounts for nearly 77% of India's total domestic production market, estimated at INR 4,908 billion (USD 66 billion) in FY22. Many OEMs develop, design, and manufacture electronic products in-house. However, this scenario is slowly shifting to EMS partners. EMS providers are gradually evolving to offer complete design services in addition to contract manufacturing, which benefits both EMS providers and OEMs. This strategy allows EMS providers to gain higher margins, while OEMs benefit by outsourcing manufacturing and design activities, enabling them to focus on other expansion activities.

Due to the large, complex, and highly competitive nature of the electronics industry, OEMs may now focus on marketing and aftermarket services, leaving manufacturing to its EMS partners. Frequent technology changes, which an EMS player with economies of scale is better positioned to accommodate and allow for better price negotiations with raw material suppliers compared to OEMs.

## Key growth drivers for the electronics industry in India

**Improvement in demand and supply scenario:** India has witnessed more than 14% growth in electronics consumption between FY17 and FY22. The long-term growth outlook for the industry is extremely positive, primarily because market penetration for many electronics products is still very low compared to the global average. Besides factors such as a stable growth outlook for the economy, the Digital India program, rising disposable incomes, changing lifestyles, emerging work-from-home culture, expansion of organized retails to tier 2 & tier 3 cities, improving electricity and internet infrastructure, and better logistics infrastructure will provide additional impetus to the industry. It is with these strong fundamentals, many global brands along with their supply chain partners have invested in electronics manufacturing infrastructure in the country in recent years and India is ready to become an important electronics manufacturing hub globally.

**China + 1 Strategy:** There is a new urgency to examine practical alternatives to manufacturing in China given the tariff conflicts and the after effects of the COVID-19 pandemic, supply chain issues, rising manufacturing cost structures, and changing geo-political landscape. However, transferring production decisions is not very straightforward as there is strong vendor incorporation of all major components in China. Due to the above factors, OEMs are considering an alternative country for additional production rather than completely replacing China. India is well positioned to benefit from global OEM's strategy towards "China + 1" for supply chain diversification.

**Localization of supply chain:** High domestic volumes and consumption, and higher outsourcing volumes will influence domestic electronics manufacturers to bring in the component ecosystem locally and enhance local capabilities of component sourcing, thus making the ecosystem stronger and closer. Tier-2 companies (companies supplying products to Tier-1 companies/ OEMs) are increasingly focusing on product localization, innovative product design, and R&D. However, the extensive financial costs involved in setting up manufacturing, capacity additions/expansions, R&D, manpower, etc. influence them to leverage EMS services. In 2014, there were only 2 companies in India manufacturing mobile phones, which have increased to more than 270 in 2020.

**Emerging technologies:** Electronic product life cycles are becoming shorter due to rapid technological advancement and newer products with upgraded technology. Also, changing customer attitudes and various consumer-to-consumer websites have made it relatively easier for customers to replace existing electronic devices with newer products. Increased demand for high-speed data has also contributed to the rising demand for premium smartphones. This growing preference for high-tech products has fuelled rapid innovation in the consumer electronics industry. Emerging technologies such as IoT, AI, and the incorporation of robotics and analytics in the industrial and strategic electronics segments have all contributed to the overall development of electronic products, which has boosted local demand.

**System automation:** The Indian design companies work on end-to-end product development, with a focus on miniaturization, IoT, automation, AI. Advanced analytics and industrial automation enabled by the IoT provide manufacturers with greater efficiency and productivity gains. However, the rapid growth of AI, ML, the deployment of 5G technology, edge computing, and cloud computing has necessitated hardware innovation, resulting in high demand for electronic design automation.

## Indian Government policy/incentives driving domestic production and push for exports

The Government in India is encouraging domestic manufacturing through supporting policies and initiatives that are likely to lead to overall development in the ecosystem and has opened gates of opportunities for companies, vendors, and distributors in the market. Incentives for local manufacturing, demand side support through Government procurement, import barriers via duties, and favourable steps like GST that reduced the complexity of operations, are pull factors for MNCs to invest in India.



**Make in India:** In 2014, the government of India announced this initiative to make India a global manufacturing hub, by facilitating both domestic as well as international companies to set up manufacturing bases in India. As per the scheme, the government released special funds to boost the local manufacturing of mobile phones and electronic components. It has also introduced multiple new initiatives, including promoting foreign direct investment, implementing intellectual property rights, and developing the manufacturing sector. The Make in India initiative, a part of the 'Atmanirbhar Bharat Abhiyan' (Self-reliant India), would provide an additional boost to the country's business

operations by encouraging the substitution of imports of low-technology products from other countries and generating demand for local manufacturing. Atmanirbhar Bharat Abhiyan is planned to get carried out in two phases:

- Phase 1: The emphasis will be on segments like medical, textiles, electronics, plastics, and toys
- Phase 2: For products like gems and jewellery, pharma, and steel, etc.



**Production Linked Incentive (PLI) Scheme:** The scheme was initially announced in the year 2019 by the Government of India considering the incremental investment and sales of manufactured goods. It is expected to promote exports in the next few years. As per the scheme, a total production of INR 11,500 billion is expected including INR 7,000 billion in exports in the next five years. Production Linked Incentive Scheme (PLI) for large-scale electronics manufacturing was notified in April 2020.

As per the 2021-22 budgets, under the PLI scheme, the government allotted INR 1,970 billion for 13 sectors. However, the financial outlay for the auto sector was revised in September 2021, bringing the total allotment down to around INR 1,661.9 billion. Initially introduced in mobile phone production, this policy is being expanded to other sectors as well. The scheme is also extended to white goods (Air conditioners and LED lighting) and select few electronic/ technology products. It has different thresholds of investments required for domestic and international companies. Fully integrated manufacturers are going to be the biggest beneficiary of this scheme. This scheme will help India Inc. to be an integral part of the global supply chain.

**Chart 3.13: PLI scheme in 13 key sectors for enhancing India’s manufacturing capabilities and enhancing exports, Atmanirbhar Bharat, FY21-FY22**

Sectors	Implementing Ministry/Department	Approved financial outlay over a five-year period (INR billion)
Mobile manufacturing and specified electronic components	Ministry of Electronics and Information Technology	409.5
Critical key starting materials/ drugs intermediaries, APIs	Department of Pharmaceuticals	69.4
Manufacturing of medical devices	Department of Pharmaceuticals	34.2
Advance Chemistry Cell ACC Battery	NITI Aayog and Department of Heavy Industries	181.0
Electronic/Technology Products	Ministry of Electronics and Information Technology	50.0
Automobiles & Auto Components <sup>#</sup>	Department of Heavy Industries	259.4
Pharmaceuticals drugs	Department of Pharmaceuticals	150.0
Telecom & Networking Products	Department of Telecom	122.0
Textile Products	Ministry of Textiles	106.8
Food Products	Ministry of Food Processing Industries	109.0
High Efficiency Solar PV Modules	Ministry of New and Renewable Energy	45.0
White Goods (ACs & LED)	Department for Promotion of Industry and Internal Trade	62.4
Speciality Steel	Ministry of Steel	63.2
<b>Total</b>		<b>1,661.9</b>

# Financial outlay for Automobiles & auto components was revised on September 2021 from INR 570.4 billion to INR 259.4 billion

Source: MeitY (Ministry of Electronics and Information Technology), Invest India

**Chart 3.14 (a): PLI scheme for manufacturing of medical devices, August 2020**

**Target Segments Eligible under PLI Scheme**

- Target Segment 1 : Cancer care/Radiotherapy medical devices
- Target Segment 2: Radiology & Imaging medical devices (both ionizing & non-ionizing radiation products) and Nuclear Imaging Devices
- Target Segment 3: Anaesthetics & Cardio-Respiratory medical devices including Catheters of Cardiorespiratory Category & Renal Care Medical Devices
- Target Segment 4: All Implants including implantable electronic devices like Cochlear Implants and Pacemakers

Segment	Incentive Rate (on Incremental Sales of Manufactured Goods)	Threshold Minimum Investment	Threshold Minimum Incremental Sales of Manufactured Goods
All four segments of medical devices	Year 1: 5% Year 2: 5% Year 3: 5% Year 4: 5% Year 5: 5%	INR 180 Crore over 3 Years Cumulative Minimum (Crore): Year 1: 60 Year 2: 120 Year 3: 180	Year 1: INR 120 Crore Year 2: INR 240 Crore Year 3: INR 360 Crore Year 4: INR 460 Crore Year 5: INR 560 Crore

Year 1 means Financial Year 2021-22

Source: MeitY (Ministry of Chemicals and Fertilizers, Department of Pharmaceuticals)

**Chart 3.14 (b): PLI scheme for Telecom and Networking products manufacturing in India, February 2021**

**Target Segments Eligible under PLI Scheme**  
(Support under the Scheme will be provided to companies who will manufacture specified telecom and networking products in following 4 product categories in India)

- Target Segment 1 : Core transmission Equipment
- Target Segment 2: 4G/5G, Next Generation RAN and Wireless Equipment
- Target Segment 3: Access & CPE, IoT Access Devices and Other Wireless Equipment
- Target Segment 4: Enterprise Equipment: Switch and Router

Year	Proposed Incentive Rate on incremental sales	Cumulative Investment (other than land and building)	Minimum Incremental Sales of Manufactured Goods Net of Taxes over the Base Year	Maximum Eligible Sales of Manufactured Goods Net of Taxes over the Base year
<b>MSMEs- Minimum Threshold of Investment Rs. 10 Crores</b>				
1	7%	Greater than or equal to 20% of X	3*(20% of X)	20*(20% of X)
3	7%	Greater than or equal to 40% of X	3*(40% of X)	20*(40% of X)
3	6%	Greater than or equal to 70% of X	3*(70% of X)	20*(70% of X)
4	5%	Greater than or equal to X	3*X	20*X
5	4%		3*X	20*X
<b>Other than MSMEs- Minimum Threshold of Investment Rs. 100 Crores</b>				
1	6%	Greater than or equal to 20% of X	3*(20% of X)	20*(20% of X)
3	6%	Greater than or equal to 40% of X	3*(40% of X)	20*(40% of X)
3	5%	Greater than or equal to 70% of X	3*(70% of X)	20*(70% of X)
4	5%	Greater than or equal to X	3*X	20*X
5	4%		3*X	20*X

Where X = Committed Total Investment by the Company / entity over a period of four years starting from year 2021-22 (minimum Rs. 10 Crores for MSMEs and Rs. 100 Crores for others)

Source: MeitY (Ministry of Communications, Department of Telecommunications)

**BIS Certification:** Importing electronics and IT products without BIS registration is now currently prohibited in India. India is tightening the quality controls for electronic products to restrain the rising import of cheap electronic items, particularly from China, and boost local manufacturing under its Make in India initiative. According to the DGFT (Directorate General of Foreign Trade) notification, every business importing and selling electronic products such as mobile phones, LED lights, etc. in India is required to register with the BIS for government clearance; failing to do so the imported goods would be re-exported back to its origin.

Earlier, the government had started the Electronics & Information Technology Goods Order in the year 2012 and mandated 15 electronic products under this category to have BIS certification. These incorporated laptops, televisions, and notebooks among others. The order now encompasses each imported electronic & IT product up for sale in the open market. New rules have got wider implications for the future imports of electronic items to India – which imports close to 50% of its entire electronic products sold in the market. Given India’s enormous appetite for imported electronic products, it is very important for importers and foreign manufacturers to get every aspect of compliance right. Failing to do so can prove to be very expensive and can also damage the business’s credibility.

### India for India and India for Global

**Exports:** The export market is expected to grow substantially in the next five years at a CAGR of 47.8%, owing to various government initiatives. such as the PLI scheme, Atmanirbhar Bharat, etc. which facilitates domestic manufacturing. Cost-effectiveness, a talented and affordable workforce, a burgeoning domestic electronics market, and export opportunities will drive the market for EMS/ODM in India. An increase in design and manufacturing capabilities has led to export opportunities for some products and is a key driver for other segments as well.

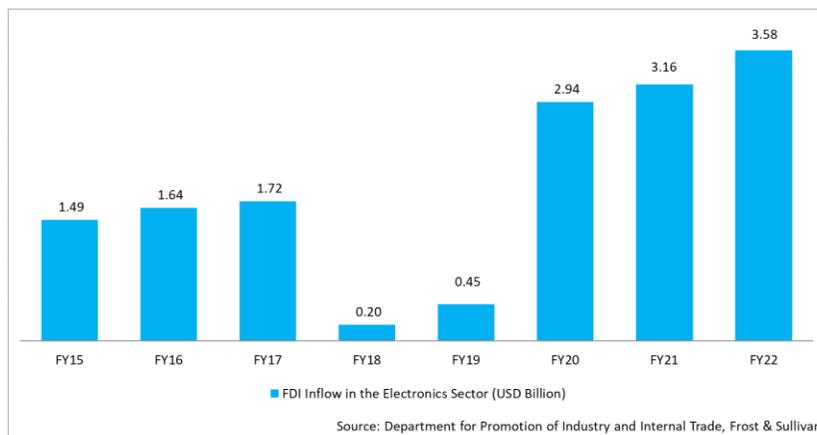
**Constantly improving local assembly of components:** Global players use domestic manufacturers for EMS services as they have in-house manufacturing facilities, as well as R&D and testing facilities. However, many components like LCDs, relays, communication modules, PCBs, passive components, and microcontrollers are imported. Components like mechanical components, terminals, brass terminals, and screws are locally sourced. Sub-assembly modules and finished goods assemblies are happening currently in India and are very lucrative opportunities given in the Indian ecosystem. Even though component manufacturing is currently being dominated by China, Japan, and South Korea, India has showcased strong potential in this part and is on the path to developing a strong component manufacturing base. Frost & Sullivan expects Cyient DLM’s enhanced capabilities to enable them to meet the potential demand and leverage India for India and India for global opportunities.

**Ease of doing business in India:** India’s business environment can be improved by simplifying the procedures involved in setting up and conducting business. To position India as an attractive business destination, various incentives such as reducing the burden of additional taxes on start-ups and strengthening the IP protection framework are being provided.

India is evolving as an innovation-driven R&D destination for global companies. The government, academia, industry players, and industry associations are making concerted and coordinated efforts to help the industry reach its potential. Investment-based Incentives are offered to industries to attract investment and enhance exports. The government provides a 20-25% CAPEX subsidy and a grant-in-aid of 50-75% project cost to companies that meet the requirements. The opportunities in India surpass the challenges, which are evident from the World Bank report's improvement in rank of ease of doing business in India, which has risen from 142nd rank in 2015 to 63rd rank in 2020.

**Increasing FDI inflow in the Electronics sector:** The increased demand for electronic goods such as mobile phones and consumer electronics has resulted in the segment attracting the greatest amount of foreign direct investment (FDI) in recent years. The significant increase in FDI was primarily due to the establishment of manufacturing and development centres by electronic companies, as well as the government's approval of 100% FDI. However, the introduction of the new tax regime, Goods and Services Tax (GST) in India in FY17 resulted in many manufacturers and foreign players delaying their investments in India between FY18 and FY19 to prepare for this new tax regime. As a result, investments were low in the fiscal year during the period, and it gradually increased from the end of the fiscal year 2019.

**Chart 3.15: FDI inflow in the Electronics sector, value in USD billion, FY15-FY22**



The Indian manufacturing sector's contribution has increased from 16% to over 18% in the last 10 years (Source: IBEF), which has been driven by initiatives like "Make in India" and other sector-specific initiatives. Cyient DLM Ltd. aims to benefit from such incentives through its expansion into electronics manufacturing. The Government of India is also focused on building the semiconductor manufacturing industry in India, including with the Atmanirbhar Bharat scheme, which is aimed at providing financial support to companies in electronics manufacturing and semiconductor manufacturing, and which in turn is also expected to give a further impetus to electronics manufacturing in India.

### Key challenges for the electronics industry in India

**Import substitution:** India's import of electronics products systematically declined between FY'15 and FY'20 however increased sharply in FY'22 owing to a slowdown in domestic production due to a shortage of semiconductors globally. The long-run mission of the Govt. is to reduce dependency on imported electronics products and services through 'Atmanirbhar Bharat' and develop a local electronics manufacturing ecosystem.

**Supply chain realignment:** Local availability of components and chip fabrication are primary activities that determine the strength of a country's electronics manufacturing ecosystem. India has a very limited component supplier base; a majority of the high-value and critical components are imported. Components that are predominantly imported include ICs, PCBs, and other active components. As supply-chain resilience and localization are becoming more significant, India has had to take the necessary steps to improve the domestic value chain capability for long-term benefits.

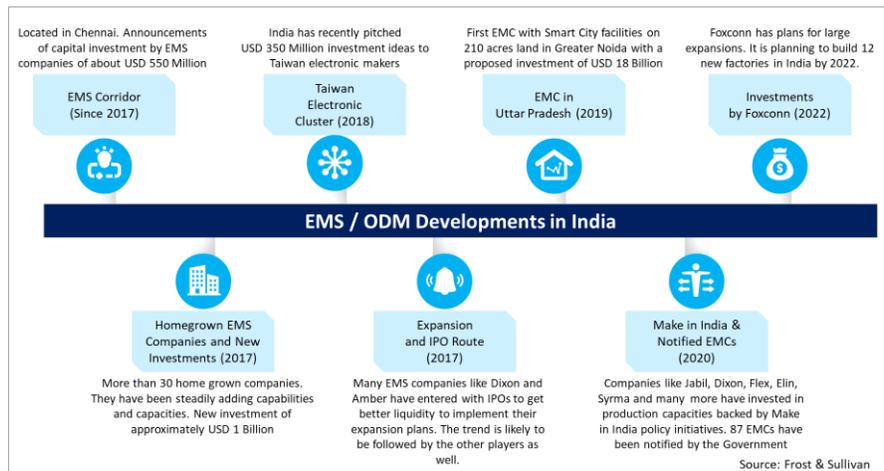
**Component manufacturing:** India lacks a robust ecosystem of companies that manufacture electronic components locally. Hence, the companies must bear the brunt of importing high-cost components. India levies a very high tariff on import of components used for electronics products compared to its Asian competitors in China, Thailand, and Vietnam. Companies in the electronics industry should work together to obtain a minimum number of crucial components now imported (fully or partially). Such an arrangement should have minimal quality and sourcing pricing criteria. This will aid component manufacturers in planning and upgrading.

# CHAPTER 4 - INDIAN ELECTRONICS MANUFACTURING SERVICES (EMS) INDUSTRY OVERVIEW

## India EMS Industry Outlook

### Introduction to the EMS industry in India

Chart 4.1: Evolution of the EMS industry in India



The Indian EMS industry is relatively young, with nearly three decades of experience. The EMS industry has grown in prominence over the last decade, particularly in the last five years. The industry, which was traditionally a domain of the PSUs, has seen the participation of a few MNCs and many private sectors Indian companies' post-liberalization of the Indian economy. These companies were addressing the requirements of Consumer Electronics OEMs and some of them were manufacturing for their global requirement. The Indian market opportunity is driven by the expected geographical diversification by global OEMs of their manufacturing needs to reduce dependence on China and the availability of government incentives and other schemes, among others.

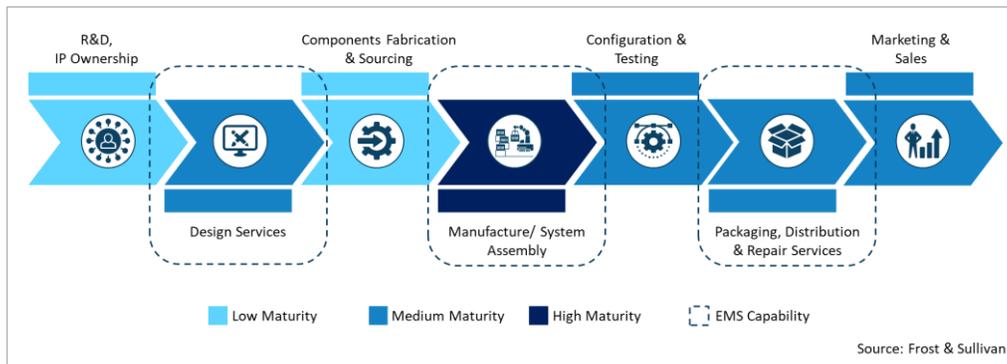
The period of 2005-07 saw the first big-ticket investment in EMS operations in India with the entry of Jabil Circuits and Nokia. This triggered a series of large / medium-scale investments in the Indian EMS sector. The period of 2013-14 was a dampener as Nokia wound up its India operation however, this was short-lived. Now, global EMS giants have started showing interest in India. Indian EMS industry has embarked on an upward journey. Since 2015, many global and domestic players have announced investments in India, which includes key players such as Foxconn, Dixon, Flex, Jabil, Vedanta, etc. As most of the global players and their supply chain partners are investing in manufacturing, the Indian EMS industry is well poised to unlock its true potential in the coming years.

There are more than 30 players in the organized market ranging from large, medium to small. Major players are Cyient DLM, Flex, Jabil, SFO, Elin Electronics, NTL, Syrma, and Foxconn. Many EMS providers are slowly evolving to offer complete design services apart from contract manufacturing/original equipment manufacturing. This acts as a win-win situation for both EMS players as well as OEMs; EMS players obtain higher margins through this model, and OEMs benefit by outsourcing manufacturing and design activities, enabling them to focus on other expansion activities. Embracing the ODM model of partnership with EMS partners, coupled with venturing into new product segments, is propelling the brands to pursue EMS engagement. High volumes will influence EMS to bring in the component ecosystem locally and enhance domestic capabilities for component sourcing, thus making the electronics ecosystem stronger.

Ambitious expansion plans and capacity augmentation of indigenous EMS players to capitalize on favourable policy initiatives ensure that the EMS sector in India shall witness heightened growth in the coming days. Also, India has done well in Electronics design and is slowly establishing itself as a design hub of the world. The next phase of growth in the design sector is characterized by the growth of indigenous design companies creating their own IPs as against the erstwhile growth of outsourced captive design services companies. This, together with impressive, expected growth in the EMS market, presents an opportunity for Design-led manufacturing.

## Indian EMS Industry Value Chain Analysis

Chart 4.2: Value Chain of the EMS Industry in India

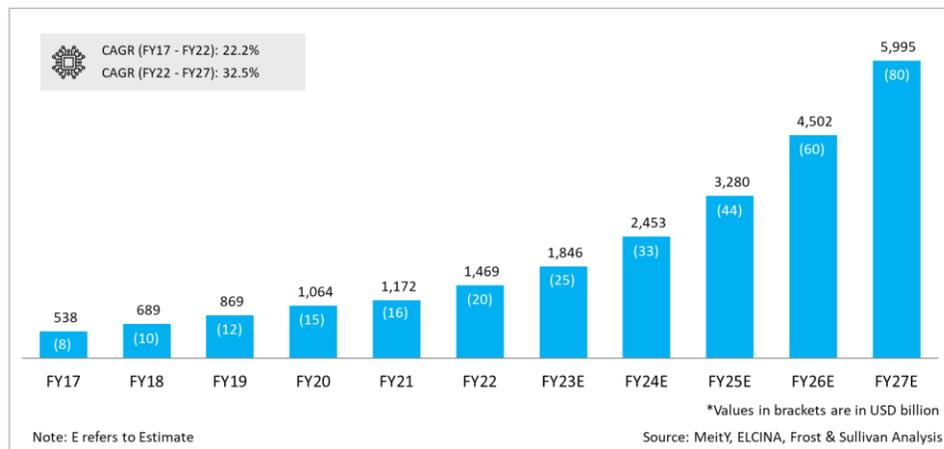


Electronic manufacturers in India lack mature R&D set-ups due to large Capex investments and long gestation periods. Europe and the US continue to dominate R&D and IP ownership of related work. This has also been a factor that has restrained EMS providers from investing. Most MNCs hold their IP in the headquarters location (mostly located in the USA and Europe). Although India has a competitive edge in design services, most such work is outsourced to cost-effective destinations (China, South Korea, Thailand). However, in terms of manufacturing/ system assembly, India has an established setup. Many EMS providers are slowly evolving to offer complete design services apart from contract manufacturing. EMS players obtain higher margins through this model.

The country also has high maturity levels in packaging, distribution, repair, sales, and marketing functions to meet geographical standards and cater to local requirements. After-sales services which include repair and maintenance are important for the Indian buyer as the use-and-throw perception is still not acceptable in the Indian electronics ecosystem. Many players like Dixon, Flex, etc. are offering after-market services like repair, refurbishment, logistics, vendor management, etc. Cyient DLM leverages the design capabilities of its promoter Cyient Ltd., a leading engineering services provider with over three decades of domain expertise providing engineering and design solutions globally with a focus on multiple industries.

## Indian EMS Industry Size and Growth Outlook

Chart 4.3: Indian EMS market, value in INR billion, USD billion, growth in %, FY17-FY27E

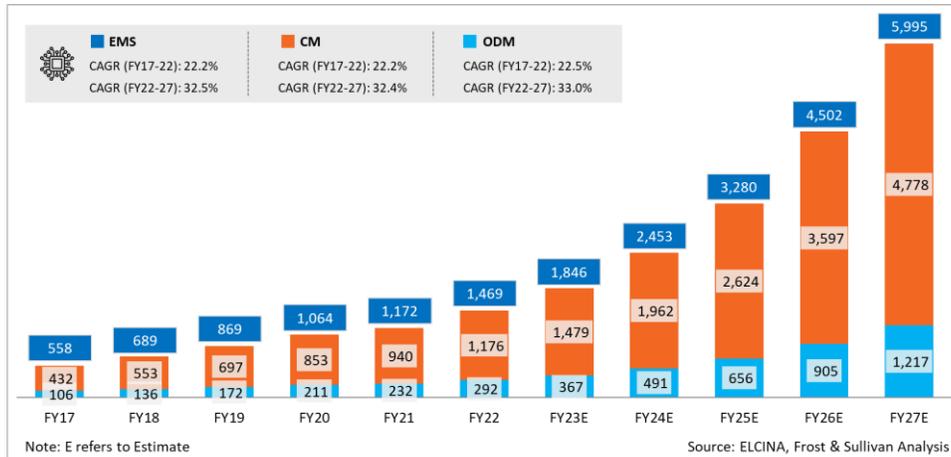


Indian EMS industry is part of the larger Electronics ecosystem of the country. A systematic approach has been followed to separate various components of the Indian Electronics market and derive the size and potential for the EMS business in India. The Indian EMS market comprises various tiers of companies, including global EMS companies with operations in India and large, midsized, and small Indian EMS companies. The company faces competition from Indian EMS providers such as Centum, SFO Technologies, Bharat FIH Ltd., Kaynes Technology India Ltd., and Syrma SGS Technology Ltd., as well as international players such as Flex, Celestica, Pixels, Jabil, and Avalon Technologies Ltd. The EMS market is

witnessing strong tailwinds. Cyient DLM Ltd. is well positioned to take advantage of these tailwinds on the back of its solutions-oriented approach, client-focused service, and track record of reliability. Being a wholly owned subsidiary of Cyient Ltd., its relationship with its promoter allows them to benefit from its reputation, customer relationships, global salesforce, network, and technical expertise, making it one of the industry’s leading integrated EMS and solutions providers in India.

### Indian EMS market segmentation by ODM vs CM

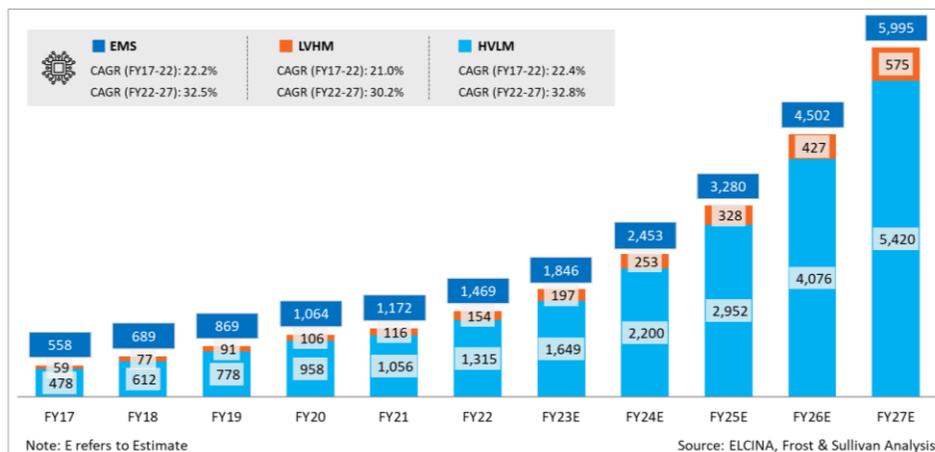
**Chart 4.4: Indian EMS market segmentation by ODM vs CM, value in INR billion, USD billion, growth in %, FY17-FY27E**



In the total EMS market, contract manufacturing (CM) accounts for approximately 80%, while original design manufacturing (ODM) accounts for the remaining 20%. As reference designs and specifications are provided primarily by the OEMs to EMS providers, there is not much scope for product differentiation. EMS companies are steadily shifting towards ODM models, giving full turnkey solutions for items from design, product development to reverse logistics. Also, due to increased competition, EMS companies are striving to diversify their product offerings. EMS providers have the expertise to procure and manufacture at faster turnaround times. Moreover, they are able to leverage their global footprint and easy access to local markets to deliver their customer products ahead of competitors. In the ODM industry, innovation is critical to success. While cost reduction remains the major driver of EMS outsourcing, other factors such as improved design skills have contributed to ODM capabilities. Cyient DLM is one of the leading integrated Electronic Manufacturing Services and solutions providers with strong capabilities across the value chain and the entire life cycle of a product.

### Indian EMS market segmentation by HVLM vs LVHM

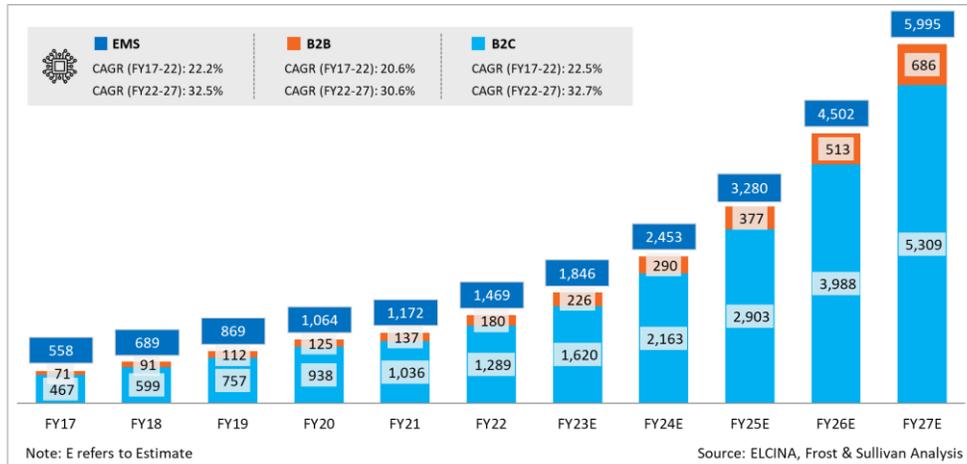
**Chart 4.5: Indian EMS market Segmentation by HVLM vs LVHM, value in INR billion, USD billion, growth in %, FY17-FY27E**



Most Indian-originated EMS firms and MSME EMS firms working in the LVHM space cater to the needs of industrial, medical, and A&D applications. However, the operation scale is limited, and the industry requires additional accommodations, facilities, etc., which translates to higher overhead. There is stiff competition from firms catering to the HVLM category due to the fact they are dominated by international EMS firms, which have their operations at a global level and have much better leverage.

### Indian EMS market segmentation by B2B vs B2C

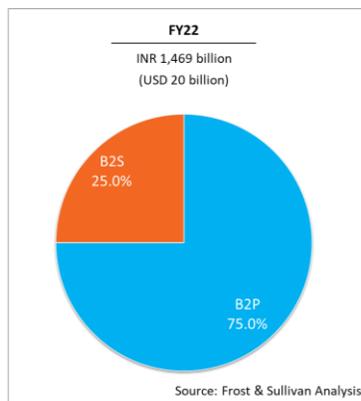
**Chart 4.6: Indian EMS market Segmentation by B2B vs B2C, value in INR billion, USD billion, growth in %, FY17-FY27E**



In India, the B2C market was valued at INR 1,289 billion in FY22 and is expected to maintain its dominance, reaching INR 5,309 billion in FY27, while the B2B market is far behind. In FY22, the B2B market was valued at INR 180 billion, and it is expected to grow to INR 686 billion by FY27.

### Indian EMS market segmentation by B2P Vs B2S

**Chart 4.7: EMS Market break-up by B2P vs B2S, India, by Value in %, FY22**



Build to print is a type of contract manufacturing which refers to the process of building products to client work instructions. This is generally used to manufacture components or pieces of equipment.

In the build-to-print (B2P) process, a client shares the EMS provider, a detailed product specification/ drawing that has been created its internal team. The design will also outline the essential materials needed to create the product, and then the product is created. The EMS manufacturer is then accountable for producing the product according to those drawings. The Indian EMS market is predominantly following B2P process and accounts for 75% of the total EMS market, as the design and specifications are shared by the clients/ OEMs, who in turn own the IP.

Build to specification (B2S) refers to the process of building products from scratch, as per the client's need, function, or size requirements. EMS providers help clients develop solutions for the required needs. After discussing the EMS

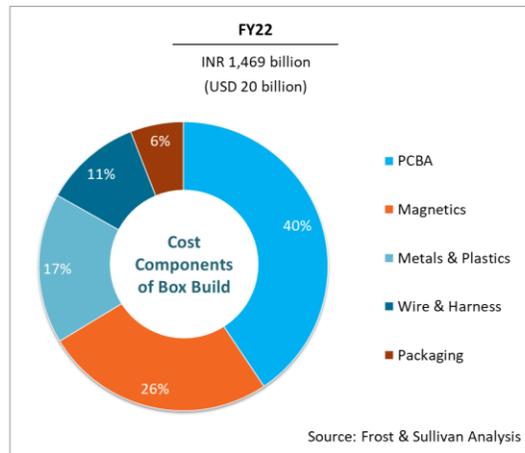
manufacturer will support in designing and creating a product to the given specification. In the B2S process, manufacturers help clients see a project through from start to end. Only very few players are involved in B2S process contributing to around 25% of the total EMS market in India.

Cyient DLM’s plans to set up its own design competency and continue to build upon its engineering competency will enable it to increase its current mix of B2S services and retain its position as one of the leading Indian EMS companies with the breadth of capabilities operating in the contract manufacturing space for high mix safety-critical electronics.

### Size of the Box-build split by cost components

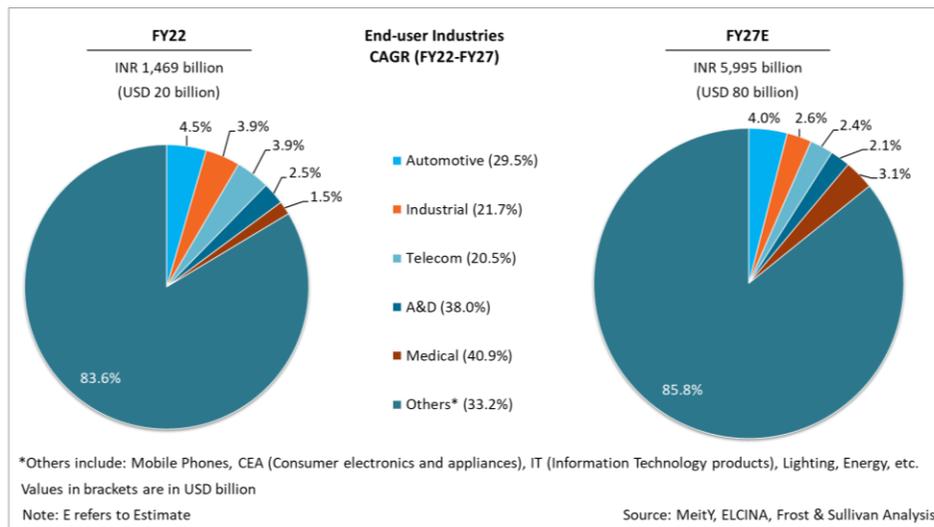
PCBA contributes the largest share of the total box build, estimated at around 40% in FY22. Building PCBA manufacturing capabilities is going to be key to India’s desire to become the world’s premier electronics manufacturing hub. Investing in PCBA is crucial not only for maintaining the domestic manufacturing momentum, but also for India’s efforts to reduce its dependence and trade deficit on China. Local demand for magnetics, which primarily consist of passive components, appears to be increasing, primarily due to the adoption of high-end technology devices. Technological advances such as the deployment of 5G/4G/LTE networks and the Internet of Things (IoT), as well as government policies and incentives, will propel the growth of the overall electromechanical components market in India.

**Chart 4.8: Box-build split by components, by Value in %, FY22**



### Indian EMS market segmentation by end-user industries

**Chart 4.9: Indian EMS market - Segmentation by end-user industries (segment of interest), value in INR billion, USD billion, growth in %, FY22 and FY27E**



The expansion of India's EMS industry is being fuelled by a variety of factors. Significant reasons driving the growth are raising labour costs in other parts of the world and a trend among large OEMs to outsource manufacturing rather than invest in their own infrastructure. Due to the size, complexity, and high level of competition in the Indian market, OEMs are focusing more on marketing and aftermarket activities, leaving the production to contract manufacturers. EMS companies are better positioned to adapt to frequent technology changes, and economies of scale allow for stringer pricing negotiations with raw material suppliers. Cyient DLM's customers belong to a diverse range of high-entry-barrier industries that have stringent qualification requirements. Frost & Sullivan believes that with changing global trends, there are opportunities to diversify product range within the industry in which Cyient DLM operates. The company is well-positioned to service such changes and increases in customer requirements on account of its advanced design and manufacturing capabilities.

**Aerospace and Defence:** The Aerospace and Defence sector in India is at a point where modernization and indigenization programs are being undertaken. The Ministry of Defence has major plans for the modernization of obsolete equipment through long-term plans, capability plans, capability roadmaps, and capital acquisition plans. The Government of India had also identified the Aerospace and Defence sector as one of the major focus areas for the 'Make in India' (i.e., 'Atmanirbhar Bharat') program and has taken considerable steps to push forth the establishment of indigenous manufacturing infrastructure supported by requisite research and development ecosystem. Within the defence sector, defence electronics has emerged as a key market. IESA, along with the National Association of Software and Services Companies (NASSCOM) have put together draft recommendations on a "Defence Electronics Policy" in order to enhance the development of the sector.

**Automotive:** Automotive electronics sales are expected to go up, driven by rising income levels, and an increasing level of in-vehicle digital experience. Passenger vehicles are expected to capture nearly two-thirds of the Indian automotive electronics market driven by the rising use of telematics control units, infotainment units, and other electronic components such as on-board diagnostics, electronic control units, anti-lock braking systems, and ADAS functions. Rising awareness among people about advanced safety and communication services, coupled with more embedded connectivity service offerings by automakers, is also one of the drivers for this market. In terms of sales, the Indian Electric Vehicles market is still in its nascent stage, but there have been a number of developments in recent years. Various government initiatives, stringent emission norms and increasing awareness and adoption of EV vehicles, is driving the EV market in India.

**Medical:** The Indian medical electronics sector comprises large, mid-sized, and small companies, which have multiple opportunities to meet the demand from domestic as well as global markets. Government policies & regulations play an important role in creating an enabling environment for any industry. The Government of India has taken several initiatives to support the medical electronics sector and help realize its potential in the near future. The Indian government has also planned more medical technology parks to stimulate domestic medical equipment manufacturing. These initiatives are likely to help increase the inflow of foreign direct investments, promote research & development and production advances, boosting the market for medical electronic devices.

**Industrial:** Industrial electronics play a vital role in improving the efficiency and productivity of industries and are anticipated to grow in industries like energy, transportation, petroleum, chemical, semiconductor, mining, agriculture, and others. Current emphasis is also placed on a branch of power conditioning dealing with power electronic switches, sensors, actuators, meters, intelligent electronic devices (IEDs), automation equipment, semiconductors, nanotechnology, etc., using power semiconductor devices in modernizing industry technology.

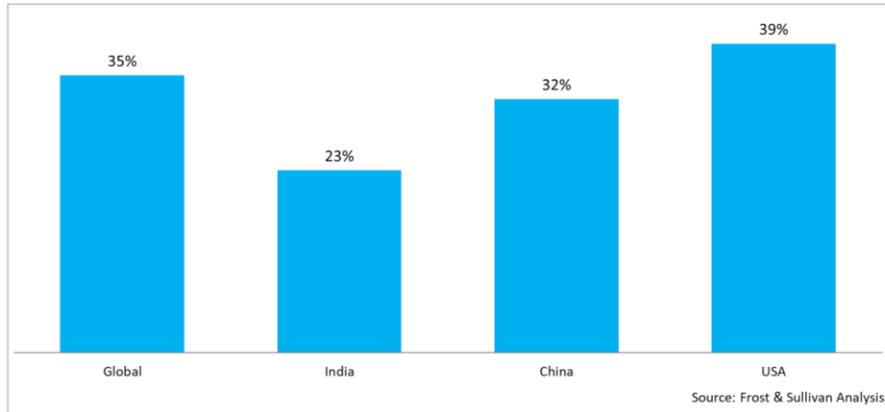
**Telecom:** This segment includes telecom infrastructure and networking equipment. The Indian Telecom Tower industry has grown significantly in the last six years. The number of mobile towers increased from 400,000 in 2014 to 660,000 in 2021. Similarly, the number of Mobile Base Transceiver Stations has grown rapidly by 187% and increased from 800,000 in 2014 to 2.3 million in 2021. To further expedite digital connectivity, the Government has approved the auction of IMT/5G spectrum for the deployment of 5G services within the country. There are rapid expansions in mobile network coverage which has managed to reach even the remotest of areas. There is also an increase in demand which has eventually led to decreasing in charges incurred for using data much more than in the global scenario.

### **Electronics outsourcing – comparison between India and other key economies**

India has a well-established EMS base; however, it is currently under penetrated compared to the global giants such as US and China. Although India has a competitive edge in design services along with high maturity levels in packaging,

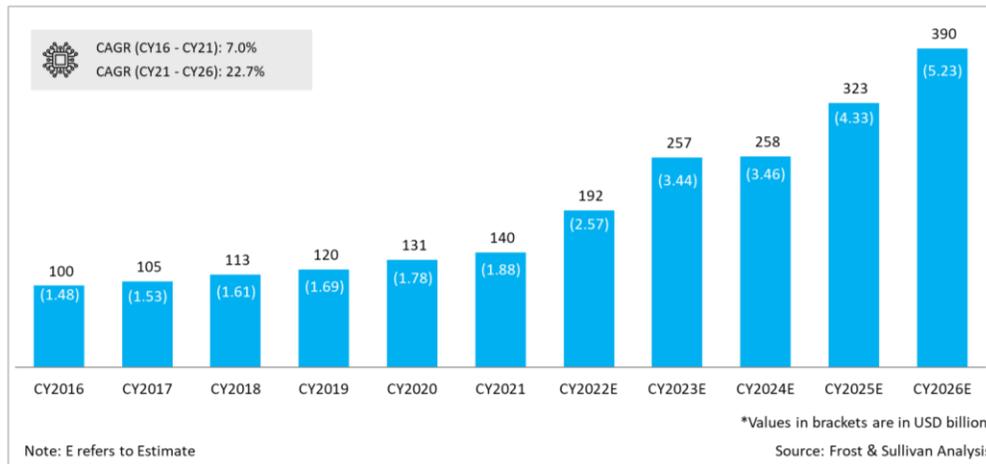
distribution, repair, sales, and marketing functions, it still is lacking in terms of limited component ecosystem. Due to various government initiatives and programs, India will evolve into strategic growth areas for EMS providers due to the extent of network deployments coupled with its low-cost manufacturing capabilities.

**Chart 4.10: Contribution of EMS to Total Electronics Market by key economies, by Value in %, FY22**



### Indian Defence Electronics Market

**Chart 4.11: Defence Electronics Market, India, by value in INR billion, USD billion, FY17-FY27E**



The Indian Defence Electronics segment will witness large-scale indigenization efforts over the next decade leading to improved manufacturing and quality standards. This will further increase the presence of Indian components in global supply chains which are already being used in Israeli, USA, and European combat aircraft. At present Defence Electronics make up only 25-35% of the cost of platforms used by the Indian armed forces, which is expected to increase in the future. However, at present over 60% of the electronic components used are supplied by foreign OEMs. As indigenization efforts continue, future procurement will see a large portion of defence electronics sourced locally, and as such platform recapitalization programs across all three forces such as new combat aircraft acquisition, submarine building, and T-72 replacement will be key contributors to future market valuation of this product segment. Some of the key OEMs in the defence sector include Hindustan Aeronautics Ltd. (HAL), Bharat Electronics Ltd. (BEL), Mahindra Aerospace, ISRO, Thales, Honeywell, Boeing, Lockheed Martin India, etc.

The Defence Electronics market was cumulatively worth ~ INR 570 billion (USD 8.1 billion) from CY2016-CY2020 and grew at a CAGR of 4.5% during the period. At present, the market is evaluated to be worth approximately ~ INR 140 billion (USD 1.9 billion) in 2021 and is expected to grow to ~ INR 390 billion (USD 5.2 billion) in CY2026 with a cumulative market opportunity for this segment in the order of ~ INR 1,420 billion (USD 19.1 billion) and a CAGR of 22.7% during the period.

## Advantage India: A favourable destination for Electronic Manufacturing

The manufacturing scenario in India has changed a lot in the last few years. Among 190 countries, India ranked 63rd in 'Ease of Doing Business in 2021, an improvement of 79 positions in the five years between 2014 and 2020. With the recognition of the electronics sector as one of the key growth drivers for the Indian economy, the sector has received significant attention from the government in the last 6–7 years through various policies, schemes, and incentives. The National Policy on Electronics (NPE) emphasized local value addition and created an enabling environment. The government's focus on manufacturing through Make-in-India policies attracted the interest of both global and domestic companies. The following factors will contribute to India becoming the next Electronics manufacturing hub of the world.

- Stable political government that assures global investors on consistency in policies
- Rising cost of labour in China while India is still at a lower end of this cost
- Creation of National Manufacturing Zones (NMZ), Electronics Manufacturing Clusters (EMC), close coordination between centre and states for investment promotion
- High domestic demand for products and services; local needs
- Investment by EMS companies in capabilities and capacities.
- Duties and tariffs to discourage imports and encourage domestic value addition
- Digitalization that accentuates demand for select products

## Increasing contribution of India to the global EMS industry

At a broad level the market share of India in the global EMS industry is expected to increase from 2.2% in 2022 to 7.0% in 2026; while the share of China is expected to reduce from 46.7% in 2022 to 44.4% in 2026 (refer chart 2.13). One of the key reasons is attributed to China+1 strategy. As the Chinese electronics contract manufacturing cost structure continues to be on the rise, along with changing geo-political landscape, so has the OEM customer interest amplified in moving the electronics production to the other countries having similar price, quality, and receptiveness. OEMs are considering India, Vietnam, Indonesia, and other South East Asian countries as potential manufacturing locations. India, as a developing economy that provides infrastructure as well as a platform for cost-cutting, has a distinct advantage.

## Key growth drivers for the industry

**A strong push towards Make in India:** India is witnessing a major drive by the government of India to push for the domestic manufacturing of Electronics, especially in segments such as Mobile Phones, Televisions, and Medical & Strategic Electronics. The Government of India's "Atmanirbhar Bharat Abhiyaan" or Self-Reliant India campaign provides an increasing range of incentives to attract and localize manufacturing and production in India. These incentives promote manufacturing and exporting products in various industries.

**Influx of new electronic applications going forward:** New emerging opportunities like Electric Vehicles, Internet of things and Electronic Security system (Cameras or Storage) are opening up new electronic market for India and these industries will also be driven by the Make in India thrust.

**Strong regulatory push and GOI initiatives to drive electronics usage in India:** New regulations like BS VI for Auto, Digital India program, Digital payments and Smart Cities program is going to drive more usage of electronics in India and therefore will lead to a far greater thrust on Make in India than it was seen before.

**Changing geopolitical situation post COVID:** Post Covid, alignments in the global markets has shown that there is a far greater resistance to rely on China as their key manufacturing source. There are discussions in numerous forums to diversify their manufacturing operations to counties other than China. India is seen as one of the possible diversification areas along with Vietnam and other SE Asian nations.

## Investment by Global and Domestic EMS players in India

The higher growth rate in India vis-à-vis the global market is because of multiple factors: consistent local demand for electronic products, the government's focus on domestic manufacturing, and programmes like Make in India and Digital India, which have led to increasing manufacturing investment in the country. The Make in India initiative, tax and duty support, and government support through policies, most notably, have been instrumental in encouraging new investment from EMS companies. Dixon Technologies, a provider of electronic manufacturing services, has invested more than INR 6 billion in new capacity in India to serve the domestic and global markets in the mobile devices, laptops and tablets, telecom equipment, and LED components segments in the coming year.

European Telecom and Networking Products dealers Ericsson and Nokia have conveyed their intention to increase existing manufacturing operations in India to support their worldwide supply chain. Local telecom component manufacturers VVDN Technologies, HFCL, Dixon, Coral Telecom, and Sterlite Technologies have also expressed interest in the PLI scheme of the government. India is expected to run a widespread outreach programme with the support of the "Invest India team" for the Production Linked Incentive scheme. Nokia and Ericsson are also going to target the BSNL big ticket 4G contract expansions after GOI dropped a few clauses which earlier prohibited them from participating.

As the cost structure of Chinese electronics contract manufacturing keeps going up, especially with the changing geopolitical situation, OEMs are becoming more interested in moving electronics production to other countries with similar costs, quality, and openness. Given the tariff issues and the supply chain disruption, there is an urgency to investigate realistic alternatives to manufacturing in China. However, transferring manufacturing decisions is not an easy task. The integration of sub-tier vendors for metal fabrication, plastics, and other mechanical components in China reduces product cost, efficiency, and time-to-market. Due to the above factors, OEMs are considering adding another country for increased production rather than replacing China entirely, and are looking into production locations like India, Vietnam, and Indonesia.

Some of the notable expansions announced recently:

- In 2022, Reliance Strategic Business Ventures Ltd (RSBVL), a subsidiary of Reliance Industries Ltd (RIL), has entered into a joint venture with Sanmina Corporation for INR 16.7 billion, with a 50.1% stake. According to reports, the JV will focus on telecom infrastructure (5G), medical and healthcare systems, industrial and cleantech, defence and aerospace, and also plans to establish a manufacturing technology centre of excellence that will serve as incubation for the product development and hardware start-up ecosystem.
- In 2021, TATA Electronics (TATA Group) stated that it will invest INR 57 billion (USD 790 million) as part of its phase 1 investment in an industrial complex in Tamil Nadu, India, to construct a phone component manufacturing facility.
- In 2021, Jabil announced they are going to invest INR 20 billion (USD 275 million) in Pune and plans to venture into smartphones, home appliances, mobile spare parts, and food packaging.
- Dixon Technologies, a provider of electronic manufacturing services, announced in 2021 that it would invest approximately INR 6 billion (USD 80 million) to build new capacity in India in the mobile devices, laptops and tablets, telecom equipment, and LED components.
- Flex, a US-based manufacturer of electronic components, announced in 2020 that it is considering increasing its investment in India to ~ USD 12 billion to expand its manufacturing capabilities and boost exports from India.

## Key restraints for the industry

**The inefficient supply chain for the required electronics:** India has a limited component supplier base; a majority of high-value and critical components are imported. Components that are predominantly imported include ICs, PCBs, and other active components. As supply-chain resilience and localization are becoming more significant, India has to take the necessary steps to improve the domestic value chain capability for long-term benefits. The introduction of the PLI scheme to promote component sourcing; FDI policies relaxing companies' ability to set up bases in India; and the establishment of dedicated freight corridors that help in the advancement of transportation technology and increase in productivity are some of these steps.

**Lack of manufacturing ecosystem:** In India, there is lack of a stable component ecosystem. Moreover, FTAs with ASEAN countries make imports less expensive than domestic production, thereby intensifying the situation. Tax disputes, a scarcity of skilled engineers, and a sparse network of local component manufacturers are all significant factors impeding the growth of India's mobile component manufacturing industry.

**Skilled labour shortage:** There is substantial competition for R&D personnel, qualified technical experts, sales and marketing professionals and post-sales services providers.

## CHAPTER 5 - GLOBAL AND INDIA EMS - DEEP DIVE INTO FOCUS INDUSTRIES AND PRODUCTS

Chart 5.1 Summation of opportunities from select segments for Cyient DLM's EMS business in India

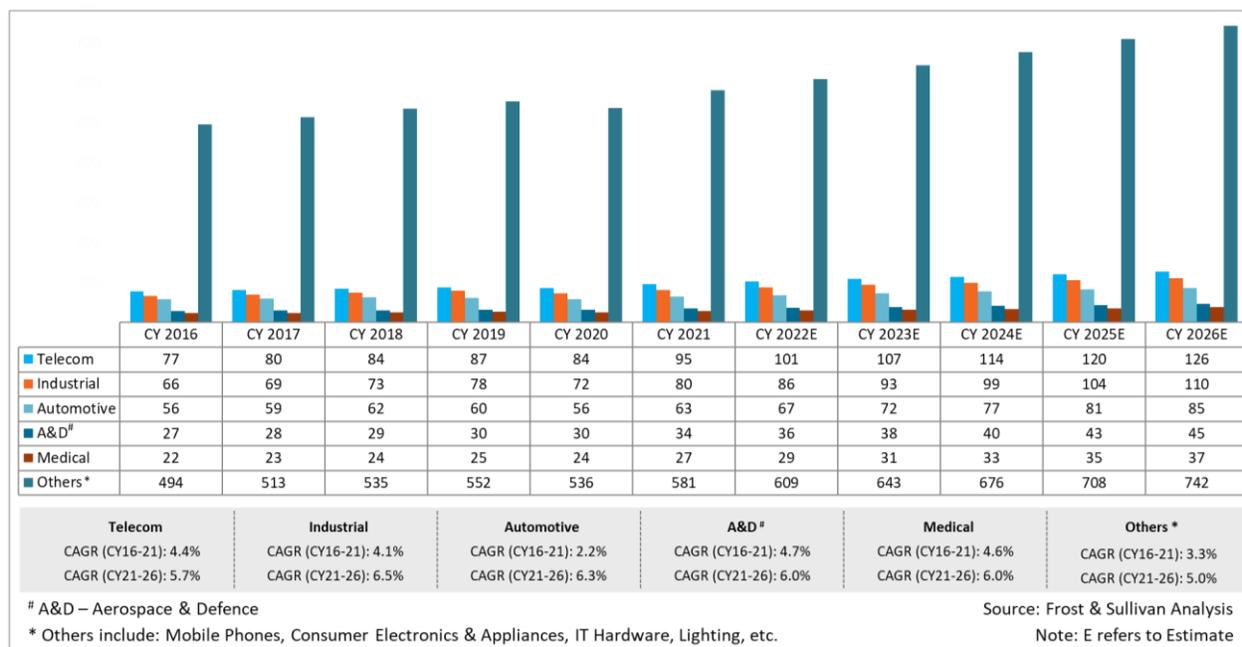
Industry	Market dynamics	Global EMS market size (USD billion)			India EMS* market size (INR billion)		
		2021	2026	CAGR	FY22	FY27E	CAGR
<b>A&amp;D</b>	<ul style="list-style-type: none"> <li>A&amp;D is one of the most complex and specialised industries in EMS</li> <li>India ranked 19th among the world's defence exporters in attracting the foreign investments</li> <li>Relaxation in FDI investment in the A&amp;D sector aids in collaborating with global players to have a competition edge in the market</li> </ul>	34	45	6.0%	37	186	38.0%
<b>Medical</b>	<ul style="list-style-type: none"> <li>Increased demand for healthcare and medical devices from rise in medical tourism. Need for high-speed analysis is also driving growth of the medical equipment's market</li> <li>It is backed by government's commitment to facilitate growth</li> <li>Development of 'medical device parks' across States create a robust ecosystem for manufacturing in India</li> </ul>	27	37	6.0%	23	125	40.9%
<b>Industrial</b>	<ul style="list-style-type: none"> <li>India is gradually progressing towards Industry 4.0 through government initiatives</li> <li>The rapid adoption of modern technology, backed by cost-saving features, is driving growth in this market</li> </ul>	80	110	6.5%	58	155	21.7%
<b>Telecom</b>	<ul style="list-style-type: none"> <li>India is one of the largest exporters of telecom equipment and this trend expected to increase</li> <li>Increased outsourcing to companies with design, logistics and after sales support</li> <li>Data centre storage solutions, BTS, GPON, IP PBX, Network infra (4G and 5G) related solutions are the key offerings of the EMS companies</li> </ul>	95	126	5.7%	57	145	20.5%
<b>Automotive</b>	<ul style="list-style-type: none"> <li>Themes such as Connected, Autonomous, Shared and Electric are driving digitalization and requirement for EMS in this space</li> <li>Significantly higher usage of electronics and controls in EV</li> <li>ADAS, EV and Safety are fast-emerging segments</li> </ul>	63	85	6.3%	66	240	29.5%

\* Size of the Indian EMS market is defined as the total value of production of electronics components and assemblies in India, outsourced by the OEMs to the India based global or local EMS companies. These components and assemblies would then be consumed locally for manufacturing finished products (both for domestic consumption and for exports) or will be exported as components/assemblies to the global OEMs.

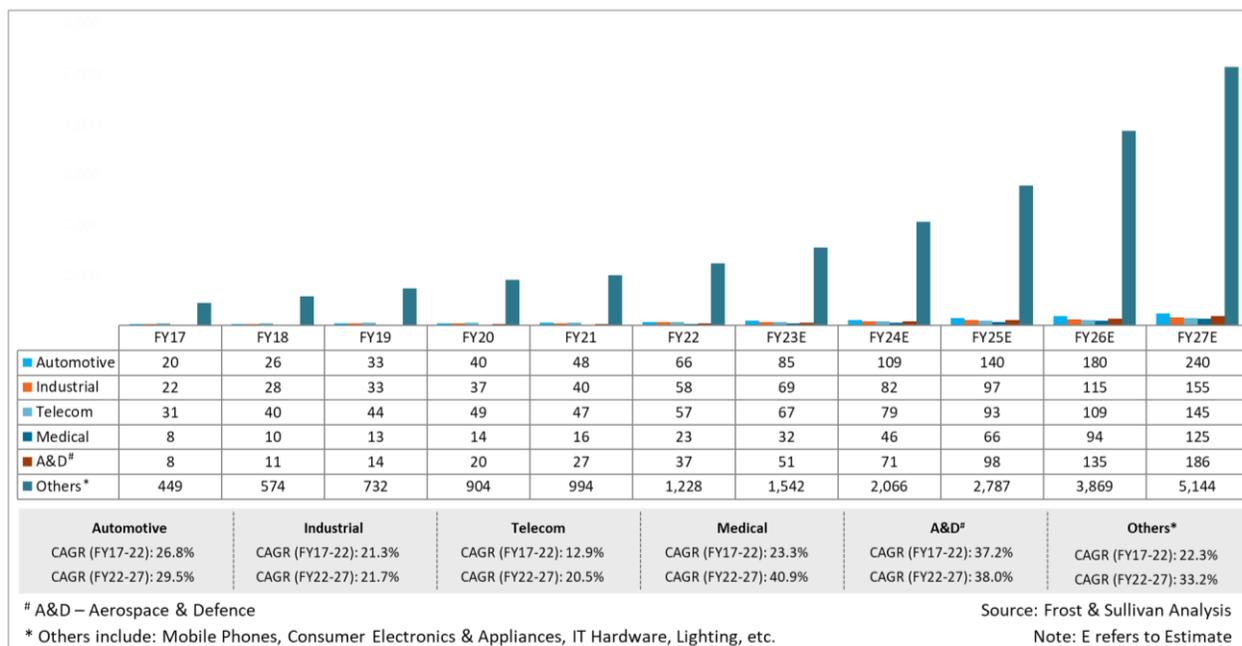
Indian EMS market for the target segments are poised to grow at a much faster pace than the global EMS market because of the following reasons:

1. A favourable manufacturing ecosystem (already elaborated in the previous chapters) will help India to garner higher share in the global electronics production in each of the target segments. India will be considered as one of the global electronics manufacturing hubs in the coming years.
2. Outsourcing of electronics manufacturing to the EMS companies is expected to increase significantly in the coming years as OEMs will continue to increase their focus on the core activities.
3. Indian EMS companies will export EMS services to the global OEMs for their global production facilities

**Chart 5.2: Global EMS market - Segmentation by end-user industries, value in USD billion, 2021-2026**



**Chart 5.3: Indian EMS market - Segmentation by end-user industries, value in INR billion, FY2017-FY2027E**



## A. Aerospace and Defence Electronics

### Aerospace & Defence Industry Overview

The A&D industry typically encompasses civil aviation, defence aviation and defence equipment. 2021 was a partial recovery year for the global A&D industry, following the most challenging year ever resulting from the collapse of commercial aviation amidst the COVID-19 pandemic. The industry experienced more than a decade of robust growth, but the pandemic had been more tenacious than originally expected. Despite many headwinds, domestic travel partially recovered in 2021, allowing the commercial aviation sector to report significant improvement over 2020. Additionally, M&A deals (in value) in the sector set a record, surpassing USD 100 billion for the first time and more than doubling over 2020, with SPAC transactions contributing to much of this activity. The global A&D industry, which is sized at USD 720 Bn in 2021, is expected to grow at 5.9% CAGR to become USD 960 Bn market by 2026 (source: BRC). Leading commercial aerospace companies such as Boeing, Raytheon, Collins, and SpaceX, as well as emerging drone start-ups, will also provide growth in the mid-to-long term.

Meanwhile, the defence sector was steady, reporting modest growth in the US and significant growth in Europe, with global military expenditures hitting an all-time high of USD 2.1 trillion in 2021. Unlike commercial aviation, the defence end markets were unaffected by the pandemic. In February 2022, Russia's invasion of Ukraine resounded throughout the global defence sector. The full implications of this event are still unfolding but are already influencing future defence budgets globally in terms of funding and priorities.

India's defence capital expenditure is constantly growing, which is evident from the annual defence budget, which has increased to INR 5.25 lakh crore for FY23 from INR 4.78 lakh crore for FY22. Besides, there is increased demand for large aircraft from Indian carriers like Indigo, SpiceJet, Tata etc. There are major initiatives from the government of India promoting a steady flow of foreign investment in this sector. This offers opportunities for start-ups as well as further expansion for the existing players. Certain companies that have played a big role in moving this industry forward be it defence or civil sector include Hindustan Aeronautics Ltd. (HAL), Bharat Electronics Ltd. (BEL), Mahindra Aerospace, ISRO, Thales, Honeywell, Boeing, Lockheed Martin India, etc. BEL, Thales, and Honeywell are the long-term customers of Cyient DLM.

### Aerospace and Defence Electronics Production Market landscape

A&D OEMs are aware of the upward trend and are expanding their product offerings through in-house development or strategic partnerships. Across the globe, these OEMs are adopting various digital technologies such as advanced electronics for surveillance, communications, and cyber warfare that are supported by AI technology. Aerospace guidance production will continue to grow, especially in imaging, signal processing, and smart weapons as military budgets rise. The size of the global A&D Electronics market is USD 100 Bn in 2021 and is expected to grow at 5.9% CAGR to reach USD 133 Bn by 2026.

In India, the aerospace and defence (A&D) industry is growing at a brisk pace. India's Defence production in FY 2021-22 stood at INR 92,708 crore (USD 11.85 billion). The Indian government has set the defence production target at USD 25 billion by 2025 (including USD 5 billion from exports by 2025). The government is taking numerous initiatives to encourage local manufacturing and reduce its external dependence on defence procurement. Advancements in sophisticated equipment such as avionics systems, radar systems, flight management system (FMS), cockpit control units, etc. will further drive the A&D Electronics market in India. The size of the Indian A&D Electronics market is INR 83 Bn in FY'22 (approximately 1.1% of the global market) and is expected to grow by 32.5% CAGR to reach INR 339 billion by FY'27, this will contribute to 3.4% share of the global A&D electronics production.

### Aerospace & Defence Electronics EMS Market Landscape

Aerospace and defence are one of the most complex and specialised industries in electronics manufacturing. These applications are safety-critical with a negligible margin for error and thus require superior technical expertise and engineering capabilities from EMS players. Increased research and development expenditure, quick approval on clearances, better public-private partnerships (PPP) models, and higher customer acceptance rates are furthering the EMS market to achieve its full potential. Most of the orders are in the LVHM category because of the critical nature of the products which requires a high degree of technical expertise. Also, the industry has very high barriers to entry and requires high standards of quality with multiple certifications. North American top-tier EMS firms Flex, and Jabil are the primary suppliers to this sector, followed by second-tier suppliers like Plexus, Celestica, Benchmark, and Sanmina.

European suppliers like éolane, Citron, TT Electronics, and Zollner are also very active in this sector but did not make the top ten list. The global EMS market for the A&D Electronics segment is valued at USD 34 Bn in 2021 and is expected to grow at 6% CAGR to reach USD 45 Bn by 2026. The A&D Electronics segment accounts for 3.8% share of the Global EMS market.

Indian EMS market for the A&D Electronics segment is valued at INR 37 Bn in FY'22 and is expected to grow at 38% CAGR to reach INR 186 Bn by FY'27. The A&D Electronics segment accounts for 2.5% share of the Indian EMS market. The reasons for such high growth of the Indian A&D Electronics EMS market are the following:

- India's share in global A&D electronics production is likely to increase from 1.1% in FY'22 to 3.4% by FY'27
- India's share in the global A&D electronics EMS is expected to increase from 1.5% in FY'22 to 5.6% by FY'27.
- Share of outsourced services for A&D electronics production in India is expected to increase from 45% in FY'22 to 55% by FY'27

Some of the prominent EMS players operating in the Indian A&D segment include Jabil Circuit, Cyient DLM, Data Patterns, SCI Technology, SFO Technologies, Centum Electronics, Kaynes Technology, Hical Technologies, Smile Electronics, etc. Cyient DLM is one of the few EMS companies in India catering to highly regulated industries and the largest supplier of EMS services to the aerospace and defence industry by value in India. The company primarily focuses on segments such as defence and commercial aviation, and defence equipment. Their key focus is on products such as cockpit display units, flight management systems, surveillance radar systems, communication/navigation systems

### Snapshot on Cyient DLM's key offerings in the A&D segment

- **Cockpit Display units:** Aircraft cockpit display units are used in flight instrument systems and typically used to show flight data. Advances in technology has certainly seen a spike in demand for cockpit display units as it helps in enhancing the human-machine interface. This segment is anticipated to expand at a rapid pace due to an increase in use of connectivity solutions for commercial aircraft. Various factors such as growing need and emphasis on safety and increasing focus on automated flight control will continue to drive this market in the coming years.
- **Flight Management Systems:** A flight management system, or FMS, is an air craft computer that has multiple functions right from pre-engine offset to take off landing to engine shut down. An FMS is made up of four basic components such as a flight management computer (FMC), an electronic flight instrument system (EFIS), an Automatic Flight Control, and an Aircraft Navigation System. The rapid expansion of the aviation sector in India along with other benefits such as enhanced navigation, lower power consumption and reduced weight are also driving the growth in this market.
- **Surveillance Radar Systems:** The surveillance radar systems are designed typically to provide details on the location of aircraft over long or short ranges. India's growing effort towards tactical superiority is one of the key drivers for demand for next-generation combat aircraft which will drive this market forward. Another key reason that is propelling the growth of the Radar System Market can be attributed to an increase in the use of radars for unmanned vehicles.
- **Communication/ Navigation systems:** In today's day and age where there are multiple aircraft aloft at the same time, communication and navigation systems are key to safe and successful flights. An increasing number of flight retrofitting and new flight deliveries are driving the market for communication and navigation systems. This is also responsible for the procurement of aircraft antenna, etc.

### Outlook of A&D EMS business in India

- The global A&D EMS market is expected to grow to approximately USD 39 billion at a CAGR of 3.2% by CY2026. Indian A&D EMS market in the aerospace and defence sector is expected to grow to approximately INR 186 billion at a CAGR of 38.0% by FY2027.
- Economic recovery for the aerospace and defence industry gained momentum in the year 2022 on the heels of rising demand for the air travel. As passenger traffic slowly returns to the pre-pandemic levels, increases in new aircraft and military orders signal continued growth in the forthcoming year. But optimism is held in check by ongoing risks, from inflation to talent shortages to supply chain disruptions.

- Emerging markets such as space, supersonics/hypersonic, and Advanced Air Mobility are poised to change the industry landscape and capabilities in the coming years. 2023 will likely be an important year for these emerging markets in terms of investments, technology evolution, and regulation. According to industry outlook, organizations are most likely to invest in space-related technologies and AAM in 2023.
- Multichip modules will have a big impact on the aviation/defence and aerospace industries over the next five years. Applications are like those expected in the automotive industry, but have additional value in maintenance, safety, manufacturing, fuel management, electromagnetic radiation shielding, antennas, radar, and metamaterials. For example, there are market applications that involve mechanical/nonelectronic solutions such as structural and tensile frames, filtration and water purification, intelligent materials, and wearable clothing technologies.
- Players in the A&D space have focused their attention on leveraging industry 4.0 technologies. The aerospace industry is expected to grow at a rapid rate owing to the rising demand for aircrafts and components alike.
- A&D companies are increasingly expected to be more agile with production capabilities to handle future disruptions. The digital thread is something that connects engineering, supply chain, manufacturing, and aftermarket, and is expected to play an even more prominent role in building agility in 2023. Technologies such as cloud, big data, IoT may help companies in taking care of day-to-day operational challenges
- Initiatives are likely to be taken by the Indian government to give an impetus to the domestic manufacturing such as 'Aero India', promoting R&D under the 'Atmanirbhar Mission', 'Make in India' initiatives
- There are aggressive efforts to modernize infrastructure in the aerospace and defence sector, which is estimated to consume approx. USD 70 billion in the coming decade.
- According to the Ministry of Defence, 57 offset contracts have been signed till March 2022, with a total offset obligation of USD 13.5 billion to be discharged between 2008 and 2033.
- As India is speedily modernises its military segment, the A&D industry is anticipated to consume electronics worth INR 70-72 billion over the coming decade.
- As we move ahead, technology trends such as aerial ride sharing, and autonomous vehicles is expected to help realize benefits that were never heard of before.
- AI will play a very significant role in product design, which will help significantly streamline manufacturing systems in a considerably short time frame.

### **Growth drivers and key trends in the sub-segments of focus:**

#### **i) Commercial Aerospace**

The commercial aviation industry experienced excellent growth over the last few years, but in 2020, due to the pandemic, there was a freezing of personal and business travel, plunging airlines into near bankruptcy. Revenue stayed flat for 2021. For the future, the market for travel, entertainment, and connectivity services will keep this industry strong for EMS over the next few years. This is because there is great demand for fast travel and all forms of connection to the Internet, and entertainment that are charged as a premium. Digitalization is a ubiquitous strategy essential to sustain business and growth in a post-pandemic economy. Similarly, one can expect to see increased development of safety hardware in the flight navigation, surveillance, and security systems that are so critical to the success and maintenance of this industry.

In India, the Commercial aviation industry is seeing a surge on the back of rise in middle income households over the last decade, increasing number of low-cost carriers, modernization of leading airports in the country. This is certainly expected to boost the commercial aviation sector in the future. The cargo sector in particular, during the pandemic has come to the fore as one of the most promising areas for the Indian commercial aviation sector. India saw rapid evolution in the air cargo industry during pandemic growing from just 7 to 28 cargo freighters in the past three years. Owing to these efforts, India is the 7th largest commercial aviation in the world and is expected to jump to 3rd position in the coming decade.

## Growth Drivers

- Almost all global airlines are focus on investing in digital transformation. Airlines have identified the importance of adopting digital solutions to improve their operations and increase their revenue. Digitalization will be a key differentiator in airlines revenue, as they return to post-pandemic normal.
- Next-generation aircraft are built to integrate easily in an aviation industry powered by digital solutions. Advanced propulsion systems and sensors with capable supporting solutions (fuel reduction, efficient maintenance management) will generate further demand.
- In terms of region, regional connectivity and international popularity give North America a strong demand and supply equation for new aircraft. North American airlines are more financially stable than those of other regions, so they can satisfy demand for new aircraft.
- The IATA's carbon emission reduction timelines are already prompting airlines to opt for new-generation aircraft to replace older aircraft in their fleets. New-generation aircraft (such as A220, A321neo, and B787-9) are significantly more fuel efficient. Increasing jet fuel prices are also encouraging airlines toward new, fuel-efficient aircraft and sustainable aviation fuels to effectively manage costs and environmental commitments.
- The total closure of aviation services during COVID-19-induced lockdowns created strong pent-up demand for air travel. As per IATA predictions, passenger numbers will reach almost 83% of 2019 passenger numbers by the end of 2022. The trend of early retirements and conversions of passenger aircraft to freighters for revenue maximization during the peak lockdown period led to a dearth of aircraft available for active service. Because passenger travel demand is directly proportional to aircraft demand, the quick recovery in air travel has led to an increase in aircraft demand.
- While the entire European region is reeling from the negative impact of the Russo-Ukrainian War, air travel will progressively recover. Airspace closures around Ukraine will affect some flights to and from APAC, but the high demand for transatlantic flights will drive the region's recovery.
- A very strong increase in air passenger traffic especially after the pandemic and it continue recover to go past the pre pandemic levels will definitely drive this market forward
- The fundamental driver for the growth of the commercial aviation segment is from the rising middle class, emphasis of tourism and a higher disposable income.
- Favourable policies are being developed by the government which will give a boost to the aviation sector. Schemes like the UDAN-RCS have been launched by the government to increase air connectivity, affordability, and profitability.
- In 2022, a budget of INR 90,000 crore has been set aside by Airports Authority of India (AAI) and other operators, to expand or modernise the existing infrastructure of the airports.
- In 2020, the Indian government has committed an investment of INR 1 trillion, to open 100 new airports in the next 5 years, to meet the increasing air passenger traffic.

## Key Trends

- The aviation industry is increasingly focused on climate change, encouraging aircraft operators to intensify emission reduction efforts.
- IATA implemented the Fly Net Zero 2050 commitment with the help of partner airlines to achieve net-zero emissions by 2050.
- The decreased risk of COVID-19 is inspiring air travel demand, and aircraft demand will follow similar trends.
- There are indications of the commercial and defence aviation industry being one of the fastest growing industries in the country today. In 2021, the commercial aviation industry contributed nearly USD 30 billion to the GDP of India. This is indicating towards India becoming the third largest aviation market by 2024.

- To address some of the top challenges by the industry, the aerospace companies are using technologies such as cloud, mobility, and big data. These technologies allow companies across the value chain to connect with each other which aid in giving decision makers the right information.
- Replacement of existing aircraft with sustainable ones is seen as a trend that is catching up fast which is expected to generate demand for passenger aircrafts in the near future.
- Rapid adoption is seen in the Narrow body aircraft as it helps reduce the airlines operating costs.

## ii) Defence Aerospace

The defence aerospace sector is expected to be a pillar for India's future economic growth. Indian defence spending due to efforts for modernization and increased threat perception is increasing the potential for the Indian defence manufacturing sector. This sector is emerging as one of the fastest growing industries in the country in the last few years. India is slowly emerging as a critical market for defence aircrafts as India continues to improve its aerial capabilities and modernizing its existing fleet of aircrafts. In its efforts to protect its borders, India is also taking giant strides towards indigenously developing military aircraft.

HAL which is one of the most prominent companies in India produces BAE Hawk Trainers and Sukhoi as well as indigenous aircrafts such as Tejas LCA, Dhruv and Cheetah. Along with this, HAL is also working towards developing fifth-generation Advanced Medium Combat Aircraft under the Make in India initiative.

### Growth Drivers

- In 2020, Leidos, a fortune 500 company, completed purchase of Dynetics, a leading provider of high-technology, mission-critical services, and solutions to the U.S. Government, for USD1.65 billion and make it a wholly owned subsidiary within the defence technology area.
- India's vision to be self-reliant in defence sector is witnessing a substantial growth of over 10% year on year. Substantial changes introduced in the defence policy framework is aiding towards indigenizing content to levels of at least 50%. These endeavours will aid India in securing its make in India ambition.
- Transfer of technology and encouraging private sector to participate in defence aerospace to be aligned with industry needs. India is also working towards building an ecosystem for research, design, and development in academia. An approximate 25% of the total budget is allocated for this.
- Relaxation in foreign direct investment (FDI) is continuing to see further relaxations to nearly 75% under the automatic route which permits companies to set up manufacturing plants.

### Key Trends

- Canadian-US defence cooperation includes official government-to-government agreements, interdepartmental memoranda, defence industry agreements, and service-to-service understandings. The two countries have a bilateral agreement to maintain North American Aerospace Defence Command (NORAD), which provides aerospace early warning and air sovereignty defence for North America.
- The Indian defence aerospace industry is expected to witness a healthy rise in demand for defence aircrafts and components. Rising trend in Indians defence spends in FY22 witnessing a near 10% higher spend than FY2021.
- Tata Advanced Systems Ltd and Airbus Defence and Space signed a deal worth INR 20,000 crore to make military aircraft in India and opened a facility in Gujarat in 2022, which will be utilised for manufacturing 40 C-295 aircrafts for the Indian Air Force. It will enable to build a robust aerospace ecosystem in the subcontinent by encouraging MSMEs to produce aircraft components and spares.
- In 2021, Defence Ministry, has approved the launch of Defence Testing Infrastructure Scheme (DTIS) with an outlay of INR 400 crore to create state-of-the-art testing infrastructure and boost domestic A&D manufacturing.
- In 2021, Hindustan Aeronautics Ltd. (HAL) received a request for proposal (RFP) from the Indian Air Force for their 70 HTT-40 Basic Trainer Aircraft requirement at Aero India 2021 in Bengaluru.
- The Defence Ministry at 'Aero India 2021' announced to reduce defence imports by USD 2 billion in 2022.

- India is reportedly planning to develop an air-launched swarm drone system to equip itself against forces like China, giving the Indian fighter jets an edge during potential conflicts in the future. State-owned A&D manufacturing company, HAL is partnering with two start-ups to work on the project.

### iii) Defence Equipments

The defence sector has been a strong contributor to the EMS industry over the years, yet growth has been very slow for the last several years as the US military attempts to reduce its costs and capital expenditures on equipment. Most product assemblies in this sector are low in volume and not commodity-like or price sensitive, so OEMs may have little motivation or requirement to outsource production assembly. In contrast, project managers of established programs like C3 (command, control, and communications) constantly look for ways to save money on COTS (commercial off-the-shelf) commodities, and EMS suppliers (including verticals such as Ducommun, NEO Tech, Sypris, or DRS Laurel Technologies) are the preferred companies to service these design and production needs. The United States dominates the world in military spending, and thus overall demand for EMS services in this segment in the Americas will be good for both domestic EMS companies and vertical ODMs. However, because it is a niche industry, suppliers tend to specialize in military certifications to meet specifications. Once well established with an OEM customer, EMS subcontractors usually do well, but it often takes years of acquiring knowledge and certifications and perfecting the necessary organizational systems to succeed in this business.

The defence equipment industry is an important sector for the economy. Defence production in FY 22 stood at INR 92,708 (USD 11 billion) crore (Source: IBEF). Countries like India are increasing their defence spends owing to rising concerns arising over national security. In the last couple of years, India was one of the top importers of defence equipment's in the battle to gain technological supremacy over neighbouring countries such as China and Pakistan. Military fixed wing, naval vessels and surface combatants, and missiles and missile defence systems are the largest market segments for the Indian defence sector. Military rotorcraft, submarines, artillery, tactical communications, electronic warfare, and military land vehicles are some of the other key segments. Major defence manufacturing companies in India include Bharat Earth Movers Ltd. (BEML), Bharat Electronics Ltd. (BEL), and Hindustan Aeronautics Ltd. (HAL). The Government of India is taking various initiatives to reduce important dependence for procurement of defence equipment's. The Indian government is working towards achieving production targets of USD 25 billion by FY25.

#### Growth Drivers

- Major drivers within the defence industry are the arms race between the United States, Russia, and China, as well as the looming threats that China and Russia are perceived to pose. The tripartite arms race is predominantly central to the development of hypersonic technology, with both Russia and China claiming to have functioning weapons in production. The threat from Russia will continue to be the major driver of the defence spending of NATO, especially amongst the Eastern European nations
- China has embarked on a massive trade and infrastructure project with an estimated total spending of approximately USD 1 trillion by 2027. The "belt and road" initiative has been the driver behind China's foreign policy in recent years since its proposal in 2013. Under the plan, rail, pipelines, and maritime installations are amongst several infrastructure investments in Bangladesh, Malaysia, Sri Lanka, Pakistan, and Kenya, to name a few
- The ongoing border disputes with China and Pakistan will certainly add to the demand for defence equipment in India. Enhanced security measures are taken by the government on strengthening border infrastructure.
- Along the same lines, India introduced 63 bridges, established by Border Roads Organisation (BRO), in six states and two union territories in 2021.
- To encourage the local manufacturing of defence equipment's, the Indian defence industry has kept aside a capital spend budget of USD 130 billion between 2021 and 2026. Also, the government has established defence corridors in Uttar Pradesh and Tamil Nadu to encourage indigenous production of A&D related equipments.
- India is also on its way to establishing a skill development centre with focus on promoting research for development of materials used in defence equipment's.

## Key Trends

- U.S.A. defence spending will remain the largest globally, thus making the country the most attractive market. Canada's ability to increase its defence spending further is unlikely to be sustainable.
- U.S.A. DoD official documents show an increase from USD 718.3 billion in 2020 to approximately USD 747 billion in 2024 at a CAGR of 1.0%.
- Japan will steadily improve its defence capabilities through the Medium-Term Defence Programme (FY2019 – FY2023).
- The Ministry of Finance in Germany forecasts a decrease in defence spending to USD 48.8 billion in 2023, putting equipment programmes at risk
- A USD 2 billion increase in the 2019 defence budget is part of a structured growth plan to meet the 2% GDP target on defence spending by 2025 in Germany.
- Italy has committed to reach the 2% of GDP target by 2024 though the downward trend in its budget indicate that this may not be achieved.
- Turkey's defence budget exhibits a high growth rate and is on track to reach the NATO mandated spending by 2024
- In 2020, the Union Ministry of Defence formulated the Defence Production & Export Promotion Policy 2020 as an essential guidance document to fast-track the government's commitment for the 'Atmanirbhar Bharat' and provide a streamlined, and significant boost to country's defence production capabilities for self-reliance and exports.
- There is a growing emphasis on supply chain management in defence. i.e., companies like HAL have introduced a public procurement policy for MSMEs. This has helped in achieving almost 25% procurement from MSME.
- IESA, along with the NASSCOM have put together draft recommendations on a "Defence Electronics Policy" and hope the GOI may implement in a well-timed manner to enhance the development of the sector. The policy references indicate that India not only needs to form world-class companies, but it is vital to bring them in the global value chain of the OEMs.
- In 2022, Defence Acquisition Council (DAC) boosted the 'Make in India' initiative accorded Acceptance of Necessity (AON) for capital acquisition proposals worth INR 8,357 crore for the purpose of modernisation and operational needs of the armed forces.
- Defence ministry plans to set aside 101 defence items under the import embargo to offer the potential military hardware manufacturing opportunities to the Indian defence sector.
- There is an increasing trend in promoting private companies, MSMEs and start-ups in the defence industry allocating a budget of nearly INR 21,000 crores in FY 23.
- According to recent data, there are close to 70 AI based projects planned until FY 2024 out of which 40 projects have already come to fruition.

## B. Medical Electronics

### Medical Equipment Industry Overview

As the healthcare sector adapts to the changes induced by the pandemic, it is undergoing a major transformation in terms of technology adoption, new product development, and care delivery approach. The global Medtech OEMs are investing heavily in R&D and launching new devices to cater to post-pandemic-related demands. Major demand generators include MRI, X-Ray, Ultrasounds, etc. and patient aids include hearing aids and pacemakers, etc. The global Medical Equipment industry, which is sized at USD 420 Bn in 2021, is expected to grow at 5.2% CAGR to become USD 540 Bn market by 2026 (source: Statista)

In line with the global trend, The Indian Healthcare sector is also incessantly growing due to its strengthening coverage, services, and growing expenditure by public and private players. The medical tourism and luxury healthcare markets are among India's fastest-growing industries, which create significant demand for specialized, high-tech medical equipment. The Indian medical equipment market is sized at USD 5.2 Bn in FY'22 and is expected to grow at 7.3% CAGR to become USD 7.4 Bn market by FY'27 (source: Statista). India has an overall 75-80% import dependency on medical devices. The export of medical devices from India stood at USD 2.53 billion in FY21. The US, Germany, China, Brazil, Iran, etc. are a few crucial countries that import Indian medical devices.

### Medical Electronics Production Market landscape

The digitalization of medical devices will continue, and OEMs are digitalizing their devices and operations to deliver value for Medtech service providers and patients. This is leading to the development of new business models such as platform approaches. The adoption of minimally invasive surgery techniques, the rising adoption of surgical robots, and the gradual shift of some procedures to outpatient settings will continue to drive the uptake of some medical device categories, including consumables. The size of the global Medical Electronics market is USD 100 Bn in 2021 and is expected to grow at 5.7% CAGR to reach USD 132 Bn by 2026.

There are vast opportunities for investment in healthcare infrastructure in both urban and rural India. The current demand and supply side dynamics provide a significant opportunity and rationale for manufacturing medical devices in the country. Increased demand for healthcare and medical products due to rising medical tourism will also act as a catalyst for domestic production. The government has come up with multiple initiatives to promote India's medical equipment manufacturing sector. It was recognized as a focus sector in 2014 by the government during the Make in India campaign. The size of the Indian Medical Electronics market is INR 140 Bn in FY'22 (approximately 1.9% of the global market) and is expected to grow by 22.6% CAGR to reach INR 388 billion by FY'27, this will contribute to 3.9% share of the global medical electronics production.

Nearly 65% of the manufacturers in India are domestic companies operating in the consumables segment and catering to local demand with limited exports. Large MNCs dominate the higher end of the market with widespread service networks. Domestic OEMs operate in the low-cost, high-volume market segments, whereas the global players operate in the high-tech device segment, which is mostly catered through imports. Some of the notable OEMs in this industry include global companies such as GE Healthcare, Johnson & Johnson, Siemens, Philips, etc., and domestic companies such as Molbio diagnostics, Opto Circuits, Allied Medical, Trivitron Healthcare, etc.

### Medical Electronics EMS Market Landscape

The global EMS market for the Medical Electronics segment is valued at USD 27 Bn in 2021 and is expected to grow at 6% CAGR to reach USD 37 Bn by 2026. The Medical Electronics segment accounts for 3.1% share of the Global EMS market.

At present, EMS companies are pursuing the hugely under-penetrated medical electronics market in India for substantial growth opportunities. A well-developed electronics component manufacturing ecosystem is a prerequisite for domestic medical electronics manufacturing. Reliability and faster product realization is the key to success in the medical electronics business. Most of the innovative start-ups are looking at EMS companies that are adequately certified with advanced infrastructure, to support them in the difficult stage of product realization and mass manufacturing.

Indian EMS market for the Medical Electronics segment is valued at INR 23 Bn in FY'22 and is expected to grow at 40.9% CAGR to reach INR 125 Bn by FY'27. The Medical Electronics segment accounts for 1.5% share of the Indian EMS market. The reasons for such high growth of the Indian Medical Electronics EMS market are the following:

- India's share in global medical electronics production is likely to increase from 1.9% in FY'22 to 3.9% by FY'27
- India's share in the global medical electronics EMS is expected to increase from 1.1% in FY'22 to 4.6% by FY'27.
- Share of outsourced services for medical electronics production in India is expected to increase from 16% in FY'22 to 32% by FY'27

The EMS providers are very much aligned to meet the expectations of the medical device manufacturers. Some of the key EMS players addressing the medical electronics market in India include Cyient DLM, Jabil, Dixon, Kaynes, SFO Technologies, Sanmina-SCI, Flex, Avalon, and Smile electronics. Existing EMS companies who are having design capabilities, are globally certified for manufacturing Medical Devices, and are having advanced infrastructure will benefit immensely in the years to come.

## Snapshot on Cyient DLM's key offerings in the Medical Electronics segment

- **Patient care monitoring equipment:** Patient monitoring involves the use of equipment to continually monitor a patient's vital indicators using a medical monitor and collect medical and other types of health data. It includes respiratory monitoring, hemodynamic monitoring, neuromonitoring, cardio monitoring, multi-parameter monitoring, etc. These equipments have significantly impacted the market by demonstrating the efficacy of therapeutic approaches through the monitoring of a patient's vital parameters. Considering its importance, companies are increasing their production of such monitoring equipment on a large scale. Rising occurrences of chronic diseases because of changes in lifestyle, a growing inclination for home and remote monitoring, and the convenience and portability of devices are the primary reasons driving the market.
- **Diagnostic equipment:** Equipment for diagnostic imaging include X-rays, MRI scans, CT scans, ultrasonography, and nuclear imaging, among others. This market is driven by the rising demand for early and accurate disease diagnosis, the expansion of imaging modalities' application profiles coupled with the rising prevalence of infectious diseases, ongoing technological advancements in diagnostic imaging, and the continued integration of imaging modalities with artificial intelligence and other digital tools. X-ray imaging systems dominate the market due to its widespread application and adoption within the healthcare industry.

## Outlook of Medical Electronics EMS production in India

- An influx of private equity capital—even in the regulated and reimbursed markets—is helping the provider space scale quickly; it is also defining some acquisitions. As health systems consolidate and the number of rural and middle-class hospitals declines, the concierge model of primary care, virtual/at-home care, and ambulatory surgery centres is gaining traction.
- The regulatory situation, especially in Europe, will be challenged by a lack of medical device regulations (MDRs) and a shortage of notified bodies. The US regulatory situation is also uncertain, especially in terms of emergency use authorization (EUA) and user fee amendments (UFAs).
- While digital is becoming the norm for medical device company operations (such as sales and marketing), it is also pushing medtech to deliver value for providers and patients with devices and digital data. New business models are emerging (platform approaches, for example), but this trend is exposing medtech companies to potential scrutiny in terms of cybersecurity.
- The Government of India's 'Make in India' initiative presents a platform for the sector to revisit the operating model, identify key imperatives for growth and explore possibilities for creating a step change in the medical devices sector. The department of pharmaceuticals launched the PLI scheme for domestic production of medical devices, with a total expenditure worth INR 34.2 billion for the period FY21-FY28, to increase domestic manufacturing of medical devices and attract significant investments in India.
- In 2021, the government approved a medical devices park in Oragadam (Tamil Nadu) which is expected to attract an estimated investment of INR 3,500 Crore and offer direct and indirect employment to nearly 10,000 people.
- In 2020, the government set up a National Medical Devices Promotion Council to promote the local manufacturing of high-end medical devices and attract the investments in the sector, which is expected to create more investments in next 5 years.
- In 2020, AiMeD (Association of Indian Manufacturers of Medical Devices) invited Japanese investors who were interested in setting-up a manufacturing base for the medical devices in India. As a part of the initiative, India is targeting 1200 technical collaborations with the Indian investors for USD 5,746 million and above, 200 JVs with the foreign investors for USD 1,903 million and above and 50 MNCs for USD 1,904 million and above.
- Hyderabad is emerging as the medical device's hub in the country. Establishment of the country's largest medical devices park in Sultanpur in 2017 has attracted more than 40 companies to set up units till 2020.

## Growth drivers and key trends in the sub-segments of focus:

### i) Laboratory Equipment

Laboratory equipment incorporates important aspects in healthcare, medical and pharmaceutical research study. These equipment's are getting smaller and smaller as new technologies are abolishing these equipments like series of pumps and valves which are required to store samples. New technologies include recent advancements in fluidic components which can integrate multiple laboratory functions into a single chip requiring smaller amounts of samples. According to World Health Organization, noncommunicable disease leads to cause of ~40 million deaths every year, which is equal to 70% of all deaths globally. Cardiovascular diseases account for most of noncommunicable disease mortality (~17.7 million) each year, followed by cancer (~8.8 million), respiratory disease (~3.9 million) and diabetes (~1.6 million).

Laboratory equipment, include mustimeter, oscilloscope, optics, analysers, precision tools, etc. A high demand for customised instrumentation from various applications has opened a huge potential for growth in the laboratory equipment's market in India. Regulations mandating quality assurance activities especially in the healthcare sector has further accelerated the market growth. Lab equipment manufacturers face a challenging scenario due to tight regulatory guidelines implemented currently and the lack of provision of adequate infrastructure. All laboratory equipment manufacturers and suppliers in India need to prudently employ all resources and materials to promote sustainable energy efficiency overall to save energy expenditure and enhance safety measures. Future growth projections in the laboratory equipment market are essentially dependent on expenditure on research and development. It is heartening to note that India's laboratory equipment manufacturing industry is recording rapid growth due to growing strategic alliances for increased investment in the healthcare sector.

#### Growth Drivers

- Increasing chronic diseases for example chronic respiratory diseases, cardiovascular diseases and diabetes, and growing incidence of lifestyle diseases like heart disease, atherosclerosis, obesity and hereditary disease like haemophilia, Down's syndrome, sickle cell anaemia and cystic fibrosis are leading to the swelling demand of laboratory equipment to bring innovative technologies in the market.
- The industry's growth is driven by the need for achieving keener accuracy in diagnosis with finer laboratory apparatus, reduced downtime, effectively meeting all quality control standards and cost-effectiveness.
- Focused efforts on the part of multiple domestic regulatory bodies to promote innovation and provide the necessary infrastructure will help elevate their image and performance.
- The industry's focus on high-speed analysis will result in the right selection of lab equipment's. Advanced packed columns result in faster, more accurate, and more reliable analysis than open tubular columns.
- An increasing awareness and demand for better wellness and healthcare, increasing expenditure on research and development projects in the pharmaceutical and biotechnology sectors, and the alarming rise in lifestyle diseases are some of the key drivers of this market. The government and investors are encouraging new vendors to establish high-quality labs.

#### Key Trends

- Key companies in the laboratory supplies market are launching new products with innovative features and technologies which ease the operation of samples. There is a trend for smaller and easy-to-use instruments with built-in connectivity.
- Technology trends are also enlightening laboratory competences. Innovative technologies and procedures allow laboratory technicians and scientists to work more precisely and competently than ever before
- The increase in real-time monitoring has resulted in an increased need for adapting analytical capabilities to support online process monitoring.
- A lot of demonstration for medical students which is required to provide them with requisite knowledge is driving factor for requirement of laboratory equipment

## ii) Medical Equipment

Given the broader industry dynamics, all the stakeholders in the medtech space predict a growing number of M&As and the consolidation of healthcare providers in some regions. Provider sector experts predict a few megamergers of health systems in the United States. Physician practice acquisitions are also being observed; however, a drive to acquire assets and build a continuity of care model to support all types of care delivery needs is being noticed.

By mid-2021, most parts of the world began to witness a gradual release of the pent-up demand for elective surgeries as coronavirus cases began to decline. This helped medtech companies make up for the lost revenues of 2020 and early 2021.

The medical equipment EMS market only increased by an estimated USD >200 million in 2020. Jabil, Flex, Plexus, and Sanmina are the leading suppliers in this category, all with revenue of over USD 1 billion. They are followed by second-tier providers such as Benchmark, Kimball Electronics, and Venture, which have strong positions also. The majority of outsourced medical product assemblies are performed by small to medium-sized EMS companies worldwide. ODM suppliers experienced a decrease of about USD 18 million in medical revenue for 2020, as customers focused on essential items.

Most new medical companies are like new communications equipment companies—they are disinclined to manufacture the products they design and prefer to partner with an EMS supplier—so this segment is usually very promising for EMS. Though, to protect themselves from product liability issues, OEMs that outsource tend to seek suppliers that will assemble only the PCB, with the box assembly being completed in-house. EMS suppliers do not perform the final or functional test, which often involves regulatory restrictions and performance requirements before release.

The Indian Medical Devices market is experiencing dynamic changes with the emergence of advanced technologies, evolving clinical and administrative needs, and the introduction of new policies and regulations, which is forcing industry participants to innovate to maintain their competitive edge. There has been an increased innovation in the handheld portable medical devices like blood pressure monitors, oximeter, glucometer, portable ECG monitors, etc. The innovations have prompted an increased demand for the medical electronics.

Continuously rising healthcare expenditure acting as a growth catalyst for the market in Indian economy. Medical infrastructure along with growing adoption rates of advanced equipment's, with a potential for strong domestic demand and other supporting factors, India is set to emerge as an ideal destination for the purpose of setting up manufacturing facilities, especially for the global companies looking to align their global manufacturing footprint with shifting consumption patterns. A shorter lead-time as well as the opportunity to significantly enhance service levels indicates well for increasing healthcare penetration in India.

### Growth Drivers

- The healthcare industry's focus is shifting to value-based, patient-centric remote monitoring solutions, which will necessitate the introduction and boost the adoption of non-contact patient monitoring technologies.
- Improvements in interoperability will drive market growth as hospitals shift to integrated monitoring solutions for enhanced patient data analysis and accessibility.
- The growing adoption of minimally invasive surgery techniques and surgical robots will continue.
- Technological advancements and an access to advanced equipment to address patient's needs, as well as increasing affordability of diagnostic devices by users is expected to dominate the market.
- Electronic medical devices are gaining appeal across all age groups. Advanced technology appeals to younger people and makes self-care easier for older patients. Increasing technology advancements such as advanced telemedicine, novel drug discovery methods, data-driven healthcare, and nanomedicine, among others, will propel the medical electronic devices market forward in the future years.
- There is introduction of new policies and regulations. As healthcare infrastructure improves, new policies and schemes will continue to enhance local medical device manufacturing capacity, eventually supporting medical device exports. Incentives for domestic manufacturing of medical equipment have the potential to attract substantial investments and a sizable total outlay in support of a market-encouraging strategy.

- Make in India initiative helps the sector to revisit the operating model, identify key imperatives for growth and explore possibilities. There is consistent demand for surgical instruments, cancer diagnostics, orthopaedic and prosthetic equipment, imaging, and electro medical equipment.

### Key Trends

- The gradual release of pent-up demand for elective surgeries-as COVID-19 cases reduced-helped medtech OEMs cope with the revenue lost in 2020/early 2021.
- The cardiology segment witnessed a significant boost of more than 75% in 2021 (growth rate over 2020) due to the increased uptake of technologically advanced cardiology devices.
- Patient monitoring devices, which have experienced significant growth during the pandemic, will not be able to maintain the same momentum in 2022 and forward due to market saturation. The segment will suffer a decline of more than 50% going forward.
- Government schemes focused on medical equipment manufacturing: The Indian government is focused on developing medical electronics as a popular manufacturing stream in the country through its initiatives like IIPME i.e., Industry Innovation Programme on Medical Electronics. Some of the clusters that have emerged in India include Bangalore & Mangalore (Karnataka) with companies like GE Healthcare, as well as Vishakhapatnam (Andhra Pradesh) with companies like B Braun, St. Jude Medical, and Medtronic. AMTZ (Andhra Pradesh MedTech Zone) is India's premier medical technology park with dedicated manufacturing and scientific facilities that include specialized laboratories, warehousing, and testing centres such as the Centre for Electromagnetic Compatibility and Safety Testing, Centre for Biomaterial Testing among others. It is one of the world's major medical technology manufacturing clusters, with over 100 companies engaged in the research, development, and manufacturing of medical devices.
- The digitalization of medical devices will continue, and OEMs are digitalizing their devices and operations. Advancements in configuration and connectivity have spurred new types of robotic surgeries, wherein surgeons use remote surgery tools.

### iii) In-Vitro Diagnostics

The change in reimbursement for diagnostic testing, pressure from Protecting Access to Medicare Act, regulatory trends in Europe, demand for large-scale testing, shift to precision diagnostics, emerging companies, and evolving business models demand assessing portfolio, evaluating competitor strategies, and exploring opportunities for business growth. The competitive nature of the In Vitro Diagnostics (IVD) industry has unfolded through the COVID-19 pandemic, as it continued to serve the healthcare domain and successfully reach a revenue of USD 85.91 billion in 2020. Clinical chemistry and immunoassays dominate the revenue share; molecular diagnostics and point-of-care-testing continue to grow at the highest rates; and tissue diagnostics and haemostasis will experience moderate growth followed by rest of the technology segments.

The top-10 companies serving the IVD industry together accounted for 65.2% of the global revenue in 2020, while the top-20 companies together made up 78.8% of the global proceeds. The NA region, primarily with contributions from the US, leads the market, maintaining its stronghold on the IVD industry. APAC, primarily driven by Japan, China, and India, along with the other growing economies will experience the highest growth rate, while Europe will continue to grow at a slower pace

### Growth Drivers

- Rising awareness of personalized medicine is driving the integration of liquid biopsy Next Generation Sequencing (NGS) based Companion Diagnostics (CDx) in standard cancer care.
- Developing multiplex assays that integrate the separate IVDs enabling lower testing cost and support data generation (e.g., POCT) has provided growth opportunity for existing participants and entry of new players.
- Advanced automation, coupled with Internet of Things (IoT) for connected instruments as well as AI and analytics for improving process flow and efficiency, will become a differentiator for participating companies.
- Cost-effective automated IHC and ISH instruments for tissue diagnostics will act as a key driver on account of declining number of pathologists

- With consistent increase in chronic and infectious diseases, diagnostic laboratories in India are under immense pressure to deliver accurate results in a faster and cost-effective manner. This makes the laboratory diagnostics market well poised for tremendous growth. Also, the government is setting up innovation centres for medical diagnostics products.
- Increasing incidence of chronic and infectious diseases is likely to boost IVD test volume and create better opportunities for growth. The competition between labs is increasing, resulting in faster delivery of accurate data in a cost-effective manner, which is the current need. Hence there is an increase in demand for automated and semi-automated IVD equipments.
- New clinical regulations enforcing new standards may increase consumable demand. Manufacturers are upgrading their instruments to be IVDR (In Vitro Diagnostic Regulation)-compliant to sell in the European market. This compliance requirement will improve the need for advanced clinical consumables, including caps, vials, inserts, and mats, for efficient separation requirements in clinical applications.

### Key Trends

- APAC is witnessing a rapid growth in the uptake of innovative technologies. Companies focused primarily on the US and EU member states in the last decade; however, the present trends signify an early ingress into Asia. The burgeoning number of clinical trials and the plethora of pharmaceutical companies that have established R&D centres in Asia are key contributors for such transformation.
- Manufacturers focusing on Clinical Laboratory Improvement Amendments -waived platforms have enabled smaller physician practices to adopt Point-of-care testing to increase revenue at their facility, the trend is bound to continue over the forecast period. Further the direct-to-patient approach has intensified since the pandemic that will provide growth to the segment.
- Rapid growth and demand in remote diagnostics and patient monitoring.
- Molecular diagnostics is becoming increasingly popular among tier-I and tier-II cities in India, as the results are comparatively faster and more accurate than routine diagnostics tests.
- Manufacturers across segments are launching newer products with better technologies such as multitasking reagents and wider range application equipment.

## C. Industrial Electronics

### Industrial Equipment Industry Overview

Industrial electronics generally refers to the use of electronics for power and control systems, outside of the field of communications. The industrial electronics plays important role in improving efficiency and productivity of multiple industries such as manufacturing, energy, transportation, chemicals, mining, and agriculture. The industry manufactures various electronics products and components such as drives, sensors, switches, actuators, meters, PLCs, and robotics. The global Industrial Machinery and Equipment industry, which is sized at USD 720 Bn in 2021, is expected to grow at 5.7% CAGR to become USD 950 Bn market by 2026 (source: Frost & Sullivan Analysis)

The industrial equipment segment in India has grown significantly over the last decade due to growing demand for reliable and cost-effective manufacturing. The rapid adoption of modern technology, backed by cost optimization features, is driving the growth of this market. The demand for factory automation solutions in India is anticipated to surge with an increase in domestic manufacturing and an emphasis on increased process efficiency. Industrial Automation is currently focused on promoting Industry 4.0, or the digitization of industry, with IIoT-based solutions for smart manufacturing.

The Indian government has taken a number of steps to create a healthy environment for the growth of the country's industrial sector, that include promoting FDI and Ease of doing business, National Infrastructure Pipeline, Make in India initiative, Trade policy measures, Constitution of Investment and Project Development Cells, One District One Product,

and PLI Scheme. The Government of India has also taken up numerous Industrial Corridor Projects as part of National Industrial Corridor Programme which is aimed at development of the greenfield industrial regions which can compete with the best manufacturing and investment destinations in the world.

### Industrial Electronics Production Market landscape

Industrial electronics can be broadly classified into power electronics and industrial automation. (a) Power electronics play a crucial role in electrified vehicle applications that require compact and highly efficient power conversion solutions. One of the major factors driving the demand for power electronics products is the increasing demand for energy-efficient products. (b) The Industrial Automation industry on the other hand, presents numerous opportunities for innovative technology companies that support multiple other industries. It is becoming an integral part of manufacturing companies that utilize cutting-edge technologies. The size of the global Industrial Electronics market is USD 249 Bn in 2021 and is expected to grow at 5.8% CAGR to reach USD 330 Bn by 2026.

A globally competitive manufacturing sector is India's most promising source of economic growth and job creation in this decade. Several factors contribute to India's potential to participate in global markets. First, the value chain is well-positioned to benefit from India's advantages in terms of raw materials, industrial expertise, and entrepreneurship. Followed by the required skilled and semi-skilled labour in the manufacturing sector, and finally a strong push and support from the government. The size of the Indian Industrial Electronics market is INR 797 Bn in FY'22 (approximately 4.3% of the global market) and is expected to grow by 15.4% CAGR to reach INR 1,630 billion by FY'27 - this will contribute to 6.6% share of the global Industrial electronics production.

Some of the key OEMs in the industrial electronics market includes GE, Rockwell, Siemens, Schneider, Honeywell, ABB, L&T, etc. The industrial players utilise India's cost advantages. In addition to the local market, leading firms such as Schneider Electric, Honeywell, and ABB have had remarkable growth on the export market.

### Industrial Electronics EMS Market Landscape

The global EMS market for the Industrial Electronics segment is valued at USD 80 Bn in 2021 and is expected to grow at 6.5% CAGR to reach USD 110 Bn by 2026. The Industrial Electronics segment accounts for 9.1% share of the Global EMS market.

Most of the large manufacturing companies are investing heavily in the technological up-gradation of their facilities by adopting digitization and industry 4.0 concepts. This will increase demand for Industrial electronics products which in turn will boost the EMS industry. The Make in India initiative is designed to strengthen India's manufacturing sector, boosting essential industries including power, metals and minerals, and chemicals.

Indian EMS market for the Industrial Electronics segment is valued at INR 58 Bn in FY'22 and is expected to grow at 21.7% CAGR to reach INR 155 Bn by FY'27. The Industrial Electronics segment accounts for 3.9% share of the Indian EMS market. The reasons for the comparatively higher growth of the Indian Industrial Electronics EMS market are the following:

- India's share in global Industrial electronics production is likely to increase from 4.3% in FY'22 to 6.6% by FY'27
- India's share in the global Industrial electronics EMS is expected to increase from 1.0% in FY'22 to 1.9% by FY'27.
- Share of outsourced services for Industrial electronics production in India is expected to increase from 7% in FY'22 to 10% by FY'27

Some of the key EMS players operating in the Industrial EMS space include Kaynes, Amber, Cyient DLM, SFO Technologies, Syrma SGS, Avalon, and VVDN Technologies among others.

### Snapshot on Cyient DLM's key offerings in the Industrial segment

- **Building Technology / clean energy products:** The phrase building technology refers to the methods and technical processes used in a building's construction. Architects are gradually moving away from creating different variations of a standard building and shifting toward building consistently original prototypes. With this emerging trend comes much more demanding building performance requirements and a greater amount of distinctive products and specialist suppliers. India is well poised to incorporate the latest construction techniques and technologies within building ecosystem in the coming days.

Indian renewable energy sector is the 4th most attractive renewable energy market in the world with 4th in wind power and 5th in solar power. Recently, India had 101.53 GW of renewable energy capacity and represent

about 38% of the overall installed power capacity. The wind energy potential would be about 70 GW of offshore and expect to add 10 GW of solar PV manufacturing capacity over the next five years. India is targeting initially approximately 1 million tonnes of annual green hydrogen production by 2030.

- **Flow measurement and analysis units:** Flow Measurement is the process of assessing fluid in plant or industry. The flow can be measured through a variety of different devices like Coriolis, vortex, differential pressure, magnetic, ultrasonic, turbine and positive displacement meters. With huge capacity expansions planned for the refining and the infrastructure in India, it is estimated that the flowmeter market will get started on a robust growth track during the forecast period. Furthermore, new projects as well as the refurbishment opportunities will open up new opportunities for suppliers.
- **Room and plant controllers:** The control room is where the operators perform plant operations using control systems every day, and a safe, comfortable, and functional environment helps operators to run the plant more competently. The control room must therefore be designed accordingly to fulfil the plant requirement.

## Outlook of Industrial EMS business in India

- Organised manufacturing is the biggest private sector employer in India. The manufacturing sector of India has the potential to reach USD 1 trillion by 2025 (Source: IBEF).
- With an allocation of INR 1.97 lakh Crore for the next five years starting FY22, the production-linked incentive (PLI) was established to build global manufacturing hub across 13 industries.
- India is an attractive hub for foreign investments in the manufacturing sector. Several brands have set up or are looking to establish their manufacturing bases in the country. Some of the large investments announced in last 2 years include:
  - In 2021, the UP government announced the introduction of GN RTP (Greater Noida Robotics Technology Park) at a total project cost of USD 365 million.
  - In 2021, Optimus Electronics Limited (OEL) announced an investment of INR 1,350 crores for manufacturing telecom products and mobile phones.
  - In 2021, Samsung completed construction of its display production plant in Noida, Uttar Pradesh as part of the company's goal to move manufacturing capacity away from China.
  - In 2021, Amazon India intends to begin production of electronic products with contract manufacturer Cloud Network Technology (a subsidiary of Foxconn in Chennai).

## Growth drivers and key trends in the sub-segments of focus:

### i) Field control devices

Field control devices are products that connect any building management system to its physical environment. They provide the system with the means to continually adjust a building's environment to make it more energy efficient, comfortable, and safe for its occupants. The energy-efficient operation of any facility is dependent on the precise and reliable operation of field devices, such as sensors, valves, and actuators.

There is heavy reliance on industry sensors for factory automation and industry 4.0. To monitor the health of the equipment, sensors such as motion, environmental, and vibration sensors are used. These sensors range from linear or angular positioning to tilt sensing, levelling to fall detection. The Indian industries are more than capable of developing their operations economically and demographically considering both domestic interests and export opportunities that are expected to increase soon.

### Growth Drivers

- The increasing demand for valve diagnostics and remote condition monitoring services is expected to minimize the costs and amount of downtime and improve efficiency.
- Increased investment in the process industry will drive the growth of valves and valve services, especially in emerging markets. There is an increase in demand for digital technologies and smart solutions from process industries.

- Enhanced safety regulations and stricter emission norms are driving the need to upgrade existing manufacturing facilities; thereby, increasing the demand for valves.
- Owing to exposure to severe conditions, the rate of replacement and repair of valves and their accessories for existing plants has increased.
- Demand for automation is expanding in government-designated essential industries like food and beverage, manufacturing, and pharmaceutical, due to a lack of labour and the need for remote monitoring and working, which has driven the demand for various sensors.

#### Key Trends

- The deployment of IoT technology in the industrial field has resulted in the Industrial IoT becoming the development direction and trend.
- Gas flow sensors are extensively utilized in industrial automation, natural gas, metallurgy, mining, petroleum, aviation, industrial packaging, and industrial cleaning, among other fields.
- Additionally, the requirement for the flow measurement in oil and gas in response to rigorous rules related to controlling harmful gas emissions from the power plants is driving the adoption of flow sensors.
- AI-based Sensors for Valve Performance Management: Sensors embedded in valves must be efficient, intelligent, context-aware, dependable, accurate, and linked, in order to accomplish the high level of automation necessary in today's smart IoT applications.

#### ii) Actuators

Broadly industrial actuators are classified as hydraulic, pneumatic, and electric. There is a sudden surge in demand for actuators with an ever-increasing utilization of automated machinery/systems. These actuators play a vital role in the automation process. Actuators are typically responsible for moving, controlling, or positioning a mechanism or system, to make the working of automated equipment seamless and easy. The past few years has seen an exponential requirement for actuator with the surge in application across various sectors such as industrial automation and transportation. The demand for actuator in the industrial automation is expected to continue to grow over the next five years driven by need for increased performance in industrial automation, consumer electronics, Internet of Things (IoT), and implantable electronic applications.

#### Growth Drivers

- Linear actuators are a kind of electric actuator used for applications like material handling, robotics, window automation, and solar panels. Electric linear actuators with integrated controller for automation of the industrial machinery or agricultural vehicles not only offers easy installation but also provides movement precision along with simple maintenance. Rising industrial automation will act as a growth catalyst for actuators going forward.
- Miniaturization has been driving the sensors and actuators market, supported by the growth of new sensor and actuator modalities by leveraging the semiconductor expertise.
- The electrical actuator segment is estimated to record exponential growth in the actuators market. Electrical actuation systems find applications which are safe to use, easy to reconfigure, and require low maintenance when compared with the hydraulic and pneumatic actuation systems. This has led to soaring demand for the electrical actuator solutions and is anticipated to be a major driver boosting growth of actuator market

#### Key Trends

- Sensors and actuators are an essential part of the industrial automation system as they help accomplish precision and efficiency. The need for the motion control technologies using sensors and actuators plays a major role in the factory and industrial automation systems.
- Emergence of Automation and Industry 4.0 will further push the rising automation in industrial space in the country

- India is fast tracking the deployment of numerous emerging sensors, actuators and IoT technologies. The country provides an opportunity to install these technologies at a larger scale to bring economies of scale. Advanced IoT-based opportunities and ecosystems are emerging steadily. The Indian Government is taking steps to push the implementation of emerging technologies with innovative proposals, including Make in India, Digital India, Smart Cities, etc. These plans are expected to further boost the actuators market in the country.

### iii) Building Tech

Building tech or building automation solutions is being revolutionized by increasing industry convergence and the emergence of innovative technologies. This has led to a rapid increase in the digitalization of buildings, resulting in a spurt in demand for smart buildings and BMS systems. These technologies are causing significant disruptions and influencing how buildings are managed and shifting roles away from traditional skills towards technological expertise and collaborative efforts. The building tech sector can be segmented into Electronic Security and Safety, HVAC Control Systems, Lighting Control Systems, and Building Energy Management System.

One of the key drivers for growth of this market is Smart cities in India. As more and more cities turn smart, the adoption of Building tech and Building Management Systems is on the rise. By the year 2020, there were more than 2,000 projects (valued at approx. USD 5 billion) that reached completion under India's smart cities initiative. This program was launched in 2015, where 100 cities were selected for infrastructure improvements with advanced technologies.

#### Growth Drivers

- The COVID-19 pandemic has accelerated the adoption of digital solutions in buildings and created several opportunities essential to the growth of the building technologies market.
- New business models, particularly resilient and outcome-linked ones, are attracting new customers, significantly expanding the customer base for building solutions.
- Increasing demand for energy-efficient and sustainable buildings is acting as a market growth catalyst. Industry participants have been trying to include environment-friendly practices in the design, construction, and operations of buildings. One of the easiest ways to reduce energy usage is through BMS deployment.
- Simplified and effective building operation and maintenance are emerging as market growth accelerators. BMSs help to automate building equipment, such as HVAC and lighting systems, saving 5%–30% of total energy consumption.

#### Key Trends

- The two technologies that are at the juncture in the building construction segment are Augmented Reality and Virtual Reality.
- Digital twin, which is a virtual representation of a build tech system combined with a smart building platform, will become the fourth-generation solution for the homes & buildings industry in the operations and maintenance phase of building life cycle management.
- Building Information Modelling is another hot trending construction technology. It can be proved to be a game-changer for the building construction industry as it can signify project development and highly collaborative surroundings in a 3D format.
- The Covid-19 pandemic has encouraged investments and financing mechanisms for sustainable buildings through many recovery plans for the building sector. Top companies increasingly see sustainability as a responsibility and an opportunity for competitive advantage.

### iv) Intelligent Field modules

Smart transmitters are intelligent field instruments that are either purely loop-fed or in addition supplied with auxiliary energy. A smart transmitter makes use of a microprocessor containing the software needed to make a transmitter smart. The intelligence of a field instrument does not have to be stored exclusively in the microcontroller software. Diagnostics and other safety features can also be unified into other semiconductor modules so that the microcontroller can comprise additional processing software. Smart transmitters usually use the standard 4 mA to 20 mA current loop, which impedes

the maximum power consumption of a transmitter. The consumption of the respective components must hence be greatly limited. If a so-called 3.2 mA low alarm current is used, this limit is 3.2 mA.

#### Growth Drivers

- In these times of constantly rising industrial demand, machine downtime is costly. A networked factory facilitates planning and hence helps prevent interruptions in production. Rising adoption of smart transmitters pushing the IFM market in growth path

#### Key Trends

- Trends in smart transmitters include low power consumption, low space requirement, better functionality, better performance, safety considerations, and preventive maintenance

## D. Telecom Electronics

### Telecom Equipment Industry Overview

The telecom sector is undergoing a massive transformation globally. Increasing competition from non-telecom service providers, abridged network investments, and the rise of digital media and mobile technology is forcing telecom operators to drastically change their business models and service offerings to survive. With ever-expanding options for high-quality communication and internet services from telecom, cable, wireless, and satellite internet providers, consumers are expected to enjoy improved flexibility in purchasing and consuming services in the upcoming years. However, these trends may also lead to a more competitive environment in 2023 and going forward. The global Telecom Equipment industry, which is sized at USD 510 Bn in 2021, is expected to grow at 5.0% CAGR to become USD 650 Bn market by 2026 (source: Statista)

India is currently the world's second-largest telecommunications market. Indian telecom industry's exponential growth over the last couple of years is primarily driven by affordable tariffs, roll-out of Mobile Number Portability, wider availability, expanding 3G & 4G coverage, evolving consumption patterns of subscribers, and a conducive regulatory environment. The Government has eased the market access for telecom equipment and provided a fair and proactive regulatory environment to ensure consumer access to affordable telecom services. Over the next five years, increased mobile phone penetration and reduced data prices will add 500 million additional internet users in India. There is a need for deep penetration of broadband networks to propel the telecom and networking products sector in India. It is also estimated that 5G technology is going to contribute nearly USD 450 billion to the Indian Economy in the period of 2023-2040.

### Telecom Electronics Production Market landscape

The global telecom industry is witnessing a massive technological transformation - faster 5G networks, 5G fixed wireless access, and satellite services will create more consumer options for connecting to the internet. Next-generation applications arising from the confluence of faster and more reliable 5G connectivity, distributed computing, and AI will spark growing interest in multi-access edge computing and private cellular networks. These new networks, services, and applications will create opportunities for telecom electronics products like GPON, IP PBX, and Media Gateway as well as Router and Modems. Routers, GPONs, and modems are going to remain key revenue contributors within the Telecom and Networking Products business in the forecast period. Global players like Ericsson, Nokia, Samsung, ZTE, and Huawei dominate the telecom equipment market. The size of the global Telecom Electronics market is USD 249 Bn in 2021 and is expected to grow at 5.2% CAGR to reach USD 322 Bn by 2026.

In India, the Union Cabinet approved INR 12,195 crore (USD 1.65 billion) production-linked incentive scheme for telecom and networking products under the Department of Telecom. On October 14, 2021, 31 companies comprising 16 MSMEs and 15 Non-MSMEs (eight domestic and seven global companies) have been approved under the Production-linked Incentive Scheme. In October 2021, the government notified 100% foreign direct investment through the automatic route from the previous 49% in the telecommunications sector. The PLI scheme in telecom and networking products aims to make India a global hub of manufacturing telecom equipment. The size of the Indian Telecom Electronics market is INR 261 Bn in FY'22 (approximately 1.4% of the global market) and is expected to grow by 18.9% CAGR to reach INR 621 billion by FY'27, this will contribute to 2.6% share of the global telecom electronics production.

## Telecom Electronics EMS Market Landscape

The OEMs' requirements in this industry are technical expertise in the manufacturing of large and complex PCBAs and quick ramp-up capabilities. EMS companies provide a variety of core manufacturing and ancillary activities, allowing OEMs to focus on their core competencies while improving overall efficiencies. While Foxconn remained the overall industry leader, Pegatron, Jabil, USI, Sanmina, and New Kinpo Group increased their revenue in this sector, while companies like Flex and Celestica experienced a fall. The global EMS market for the Telecom segment is valued at USD 95 Bn in 2021 and is expected to grow at 5.7% CAGR to reach USD 126 Bn by 2026. The Telecom Electronics segment accounts for 10.8% share of the Global EMS market.

The technologies allow for the efficient manufacturing of telecom equipment as India aspires to become a major manufacturing hub. So far, the domestic EMS sector has been unable to meet demand because it is majorly driven by government entities. As a deeper value unlocking is happening steadily in this sector, large EMS participation can also be seen. Going forward, an increasing trend of outsourcing design, R&D, and manufacturing will open opportunities for EMS players. Indian EMS market for the Telecom Electronics segment is valued at INR 57 Bn in FY'22 and is expected to grow at 20.5% CAGR to reach INR 145 Bn by FY'27. The Telecom Electronics segment accounts for 3.9% share of the Indian EMS market. The reasons for the relatively higher growth of the Indian Telecom Electronics EMS market are the following:

- India's share in global telecom electronics production is likely to increase from 1.4% in FY'22 to 2.6% by FY'27
- India's share in the global telecom electronics EMS is expected to increase from 0.8% in FY'22 to 1.5% by FY'27.
- Share of outsourced services for telecom electronics production in India is expected to increase slightly from 22% in FY'22 to 23% by FY'27

India aspires to be a major original equipment manufacturer of telecommunications and networking products. Syrotech, Netlink, Alcatel Lucent, Bharat FIH, Syrma SGS, Tejas Networks, Speech & Software Technologies, and Alphon India are key telecom OEMs and EMS players.

## Outlook of Telecom EMS business in India

- While the extensive adoption of 5G offers many benefits, it also creates new security concerns and challenges. As operators have taken steps to gauge and minimize threats arising from the 5G and software-centric networks in their own organizations, they are in a distinctive position to offer 5G security services to enterprises pursuing to deploy their own cutting-edge wireless networks.
- The enterprise market for private cellular networks and edge computing is gaining momentum. The market is still nascent but promises to be competitive, with many different players vying for their share. Network operators will have to compete against other players, who may prove key partners in delivering their solutions. Ecosystem players will likely begin to stake out and define their role in this emerging but rapidly evolving market in the coming year.
- As the importance of coverage and capacity grows, telecom infrastructure service providers have expanded potential to assist Telco's. Services are becoming crucial for everything from network deployment to network benchmarking and optimization.
- In 2021, The Department of Telecommunications (DoT) had announced PLI scheme for Telecom and Networking. The government has granted approval to 42 companies including 38 MSMEs under this scheme. The companies have committed investment of INR 4,115 crores and is expected to generate additional sales of INR 2.45 Lakh crores over next five years.
- Some of the notable investments by large Telcos, OEMs and EMS players include:
  - In 2021, Dixon Technologies announced plans to invest INR 200 crore under the telecom PLI scheme; this investment will include the acquisition cost of the Bharti Group's manufacturing unit.
  - In 2021, Bharti Airtel announced an investment of INR 50 billion in expanding its data centre business to meet the customer demand in and around India.
  - In 2021, Bharti Enterprises Ltd. and Dixon Technologies Ltd. created a joint venture to take advantage of the government's PLI plan for telecom and networking device manufacture.

## Growth drivers and key trends in the sub-segments of focus:

### i) Network Infrastructure

The rapid development and deployment of the 5th-generation (5G) wireless ecosystem will lead to the overhaul of the legacy network infrastructure. Concurrently, network operators will embrace cloud-based network infrastructure, services, and solutions. Sixth generation (6G) is the next big thing in the telecom business, and its development will run at the same time with the standardization and eventual deployment of 5G. The post-pandemic normal will advance the development of smart cities with seamless connectivity and network infrastructure. In 2020, the United States placed sanctions on multiple Chinese companies, including Huawei and ZTE, which are 2 of the leading companies in the 5G space. In 2021, the sharp surge in pent-up demand from sectors such as 5G infrastructure, automotive, and cloud led to a supply-demand imbalance for network equipment and related industries, such as semiconductors, and their customers.

Implementing cloud-native solutions for network testing that can help overcome the limitations of legacy solutions and support network operators' digital transformation objectives will become table stakes in the global telecommunications industry.

The Indian Telecom market has grown at a breakneck pace over the last decade. While much of this development has been driven by voice, the next wave of growth will be data-driven. Increased potential will result from a focus on customer experience and network quality, as well as growing demand for wireless data services, 4G, and broadband wireless access networks. As the importance of coverage and capacity grows, telecom infrastructure service providers have expanded potential to assist Telco's. Services are becoming crucial for everything from network deployment to network benchmarking and optimization.

Over the last seven years, the Indian Telecom Tower industry has grown significantly by 65%. The number of mobile towers increased from 400,000 in 2014 to 660,000 in 2021. Similarly, the number of Mobile Base Transceiver Stations have grown rapidly by 187% and increased from 800,000 in 2014 to 2.3 mn in 2021. The DoT is targeting a combination of 100% broadband connectivity in the villages, 55% fiberisation of mobile towers, average broadband speeds of 25 mbps and 30 lakh kms of optic fibre rollouts by December 2022.

#### Growth Drivers

- Rapid commercialization of 5G networks to drive the market for wireless network test equipment
- Move toward virtualization, Self-Organizing Networks, and centralized RAN in the network infrastructure to auger demand for software-based testing solutions.
- Deployment of private cellular wireless networks by enterprises to aid market growth.
- Demand for data analytics and revenue assurance among network operators enhances need for efficient network monitoring solutions.
- Spend on Capex in the Telecom and Networking Products industry is very high. Nearly 40 % to 60 % of the Capex is being utilized for setting up and managing the telecom infrastructure. As revenue per tower and ARPU is declining over a period of time, sharing of the telecom tower and other types of infrastructure is imminent. By sharing the infrastructure, operators can actually optimize their capex, and focus more on providing new and advanced services to their subscribers.
- There is an increased telecom coverage and capacity. Having innovation at the core, Indian telecom tower business has carved a world-wide niche in terms of infrastructure sharing. By focusing on right mix of competencies & business opportunities, the tower industry is expected to drive the next infrastructure revolution & recognize the vision of broadband for all in India. The telecom tower business has remained a pivotal force in routing the connectivity revolution in India.
- Major European telecom equipment suppliers Ericsson and Nokia along with US based firm CISCO and home-grown company Tejas networks are the first set of telecom equipment vendors who have received the trusted sources approval from the National cyber security co-ordinator.

## Key Trends

- Network function virtualization and the deployment of Software-Defined Networking are important trends driving the segment. The trends will need network monitoring probes that are compatible with a virtualized network infrastructure. The proliferation of IoT and connected devices enhances the re-engineering of the probes; combined with 5G, this calls for an overhaul of the existing network infrastructure to a more automated one comprised of small cells and femtocells located closer to the end user.
- Major trends that will positively influence the Self-Organizing Networks testing equipment market include LTE proliferation and rapid 5G deployment, the incorporation of SON capabilities into legacy-based network infrastructures, enhanced customer experience management, and global adoption of SON technology
- While 4G-LTE and IoT continue to be important revenue sources for most participants, the move to 5G is a trend that participants are relying on; they are, therefore, re-engineering their portfolios to suit testing requirements.
- India is one of the world's largest and fastest growing telecom markets. Optical fibre connectivity is fast growing in the global market. India's current market penetration in optical fibre connectivity approximately 30% of the mobile towers and 7% of the total households. Significant fabrication and infrastructural improvements are being carried out to bring in 5G and high-speed connection, and this has been a key focus area from 2021 and beyond.
- Industrial Internet of Things (IoT), smart homes, connected mobility and autonomous appliances and gadgets are all deeply reliant on the hyper connectivity. This trend is expected to continue to rule in 2022 and beyond as smart cities would also need a robust digital neural network for the purpose of functioning seamlessly.
- The year 2022 and beyond can be seen as an era of hyper connectivity (anything, anywhere and at any time). This is going to create huge security challenges, and henceforth, there is tremendous emphasis on security. There will be imminent threats, and henceforth, the complete device, application, and the network infrastructure eco-system are being developed as part of mitigating security challenges.

## ii) Data Centre

Data centres represent the backbone of the digital economy. Enterprises and governments need to rely on best-in-class data centres and digital infrastructure in today's digital world. Enterprises increasingly outsource their data operations to third-party colocation services providers specializing in data centre operations. The potential of colocation service providers to build scale in terms of physical space, satisfactory power supply, and cooling systems for servers and network connectivity backed by effective operations to ensure high SLAs boost enterprise confidence in outsourcing services.

Demand for data centre colocation services is forecast to be fuelled by the growing need for hyperscale capacity from public cloud providers, OTT content, and media segments. COVID-19 is accelerating the digital adoption journey of enterprises further, creating higher demand for storage and compute capabilities. While data centre providers invest heavily to build new capacity to address demand, implementation of emerging technologies like AI and ML also encourages service providers to invest in new data centre designs to boost efficiencies. Competition in the industry is intensifying to address global demand from carrier-neutral and telecom service providers. While it is critical for service providers to invest in favourable locations, optimize energy costs, and provide best-in-class services, they also need to develop strategic differentiation in highly competitive markets and align with global trends to enhance customer value.

India is amongst the key players in the data centre sector in the APAC region. Data centres are crucial for national security, internet infrastructure, and economic output. In India, data centre infrastructure is increasing exponentially, with a growing preference for the Cloud and increased data consumption and generation by more than half a billion digital users. The Indian data centre market is likely to add 3,900-4,100 MW of capacity with INR 1.05-Rs 1.20 lakh crore as investment in the coming five years. Larger hyper-scaler companies like Amazon Web Services, Google, Microsoft, Facebook, IBM, Uber, and Dropbox etc are outsourcing their storage requirements to third-party data centre providers.

### Growth Drivers

- The growth of data center colocation services is forecast to be fueled by the growing need for hyperscale capacity from public cloud providers and OTT content and media segments.

- Enterprise digital transformation and the migration of IT workloads to third-party data centers continue to drive the retail growth of data center colocation services.
- 5G networks will accelerate the deployment of new AI/ML and Big Data technologies, creating a need for best-in-class digital infrastructure.
- Emerging market segments like crypto mining and cryptocurrency exchanges are forecast to generate demand for colocation services in the medium to long terms.
- To cater to the ever-increasing demand, Indian corporates like the Hiranandani Group, Adani Group; foreign investors viz. Amazon, Edge Connex, CapitaLand, Microsoft, and Mantra Group have started investing in the Indian data centres. Existing players like NTT, CtrlS, Nxtra and STT India are also increasing their capacities.
- The favourable regulatory support, fast growing cloud computing, rising internet penetration, government effort on the digital economy, adoption of new technologies (IoT, 5G etc), growing needs of the hyper-scalers are some of the key factors driving the demand for the data centres in India
- Other drivers for data centres (both cloud and colocation) in India include Government measures intended at driving digital infrastructure growth such as the Digital India initiative; classification of the data centres as infrastructure assets, and recommending new data localization laws etc.
- The Government of India and several state governments are modifying their data centre policies to support the infrastructural growth of data centres in India through the tax subsidies. Under a national policy framework for data centres, the IT ministry aims to provide up to INR 15,000 crore as incentives. As per industry policy, the government plans to invest up to INR 3 lakh crore in the data centre ecosystem, over the next five years.

#### Key Trends

- Enterprises increasingly seek high-density colocation capabilities to support AI-related workloads in storing, processing, analysing, and disseminating data rapidly and at scale. As enterprises adopt AI strategies, high-density colocation capabilities will emerge as an important prerequisite in selecting a data centre colocation service provider.
- Facilities with a forward-looking design philosophy cater to the next evolution of hardware improvements, future-proofing customers' current footprint for planned and unplanned density changes. High-density colocation facility operators can offer customers a window into how an enterprise's future storage requirements may evolve.
- The industry revenues are anticipated to increase at a CAGR of just about 18-19% during FY2022-FY2024, supported by the increase in rack capacity utilisation and ramp-up of the new data centres.
- Between the two main services provided by the DC players, co-location services account for over 62-65% of revenues as compared to managed services which account for 28-30% of revenues

## E. Automotive Electronics

### Automotive Industry overview

The Automobile industry has always been a yardstick against which the growth of the overall economy is measured against. Broadly the industry comprises of products such as commercial vehicles, passenger, three-wheeler, and two-wheeler. Rebounding from the pandemic-related disruptions of 2020, the global automotive industry registered a healthy 5.3% increase in sales, with 81 million in unit sales in 2021. Despite the positive recovery trends in the global economy and vehicle sales, the Russo-Ukrainian conflict has disrupted the automotive supply chain, raising the cost of auto components and raw materials. Several leading OEMs are planning to shift to in-house chip production through strategic alliances with leading semiconductor manufacturers. Chip manufacturers are also actively expanding their production capacity to meet the surging demand in the automotive space. Technology companies are deepening their presence in the automotive industry by serving as future mobility enablers. Many are entering the EV space and plan to launch smart vehicles. Automotive OS, autonomous mobility-as-a-service, and purpose-built vehicles are forecast to gain

prominence in the coming years. Non-traditional automotive players, including Foxconn and Baidu, have entered the automotive space by showcasing electric, connected, and autonomous software capabilities through product offerings and innovative business models.

The top 5 global markets have seen a combined sales increase of 3% in 2021 compared with 2019. India led post-pandemic global auto recovery in 2021, where light vehicle (LV) sales recorded an impressive rebound, increasing by 20% YoY. Toyota led in global OEM sales registering a growth rate of 13.9%, selling 9.9 million units. Global EV sales reached 6.7 million units (more than twice the sales in 2020), a 108% YoY growth. China remained the market leader, with Tesla remaining the global leader. Combined, Tesla and VW Group held 25.1% of the global EV market in 2021. The global Automotive industry, which is sized at USD 2.86 Tn in 2021, is expected to grow at 5.5% CAGR to become USD 3.73 Tn market by 2026 (source: Statista)

In India, Government Initiatives such as the 'Automotive Mission Plan' target production of 940 million vehicles by FY26 with an annual output value of INR 19.7 Lakh Crore bodes well for the market. Statutory requirements on emissions and safety are expected to generate significant demand for locally manufactured products. Maruti Suzuki and Hyundai Motors account for more than 50% of the passenger vehicles market. Maruti Suzuki continues its dominance and holds a leadership position in the market. Some of the other leading players in the passenger vehicle segment include Mahindra & Mahindra Ltd., Tata Motors, Honda India, etc. In terms of volume, the two-wheeler segment dominates the Indian automobile market with nearly 77% of the market share. Post-pandemic, the industry is making a strong recovery on the back of positive movement in the electric two-wheeler segment. By value, the Indian Automotive industry is sized at USD 222 Bn in 2021 and is expected to grow at 6.2% CAGR to become USD 300 Bn market by 2026 (source: Invest India)

### **Automotive Electronics Production Market Landscape**

In the Automotive Electronics industry, the top 5 products, namely, Engine Control Unit (ECU), EV/HV, HVAC, Infotainment, and Lighting account for 95% of the demand. ECU contributes to a major portion of the overall automotive electronics. The growing concern among end-users about vehicle performance and fuel consumption are the primary drivers of ECU. Adoption of various safety features such as ABS, ADAS, Air bags, etc. is expected to increase in the coming years. As the automakers are expected to ramp up safety services, the industry will see the deployment of vehicles with cellular vehicle-to-everything (C-V2X) technologies that enable use cases such as road safety, traffic efficiency, and hazard and road construction warnings.

Over the last decade, various global economies have implemented stricter emission standards, especially for private cars. The Electric vehicle (EV) industry is witnessing a substantial proliferation and supremacy within the automotive industry. Automakers and Tier 1 suppliers are also expected to boost their investment in digital cockpits with enhanced capabilities and use cases because of increased customer demand for comfort and convenience features. The size of the global Automotive Electronics market is USD 299 Bn in 2021 and is expected to grow at 5.7% CAGR to reach USD 395 Bn by 2026.

Even though there is a significant level of local value additions in the Indian automotive electronics industry, the industry is still highly reliant on imported components. In FY20, overall automotive electronics imports accounted for 9% of total imports, adding up to around INR 16,000 crore. There is a presence of many domestic electronics suppliers for the Indian automotive industry. Auto OEMs are being pushed to enhance their localization of auto electronics, focusing on procuring components from domestic suppliers to avoid high import duties and save on logistics costs. Suppliers intend to increase the scale and quality of their products, as well as to establish a long-term value chain. Some of the key OEMs in automotive electronics include Bosch, Continental, Delphi, Denso, Wabco, etc. These OEMs manufacture ADAS, ECU, ABS, etc., and are expected to show rapid progress in the future. The size of the Indian Automotive Electronics market is INR 287 Bn in FY'22 (approximately 1.3% of the global market) and is expected to grow by 18.1% CAGR to reach INR 660 billion by FY'27, this will contribute to 2.2% share of the global automotive electronics production.

### **Automotive Electronics EMS Market Landscape**

In its efforts to move to electrification, automotive manufacturers are progressively matching the pace of technological growth. This has certainly resulted in making electronics in the automotive industry more reliable and cost-effective. Due to the introduction of electric and hybrid vehicles, the automotive EMS industry is predicted to gain further momentum. The global EMS market for the Automotive Electronics segment is valued at USD 63 Bn in 2021 and is expected to grow at 6.3% CAGR to reach USD 85 Bn by 2026. The Automotive Electronics segment accounts for 7.5% share of the Global EMS market.

Indian EMS market for the Automotive Electronics segment is valued at INR 66 Bn in FY'22 and is expected to grow at 29.5% CAGR to reach INR 240 Bn by FY'27. The Automotive Electronics segment accounts for 4.5% share of the Indian EMS market. The reasons for such high growth of the Indian Automotive Electronics EMS market are the following:

- India's share in global automotive electronics production is likely to increase from 1.3% in FY'22 to 2.2% by FY'27
- India's share in the global Automotive electronics EMS is expected to increase from 1.4% in FY'22 to 3.8% by FY'27.
- Share of outsourced services for Automotive electronics production in India is expected to increase from 23% in FY'22 to 36% by FY'27

The Auto OEMs are interested in collaborating with Indian EMS providers to offer solutions that demonstrate their capabilities while also improving system-level understanding. Some of the prominent EMS players operating in Indian automobile space include Jabil, Sanmina, Kaynes, Syrma SGS, Digital circuits, SFO technologies, Amar Raja, etc.

### Outlook of Automotive EMS business in India

- The government of India has announced various incentive packages such as the semiconductor manufacturing scheme, the FAME -II scheme extended until 2024, PLI scheme for auto and auto component sectors, and PLI for various other cell technologies are expected to provide an enormous impetus to the sector as it endeavours to implement various innovative technologies.
- India is expected to become one of the leaders in the shared mobility space by 2030. This opens up big opportunities for both electric and autonomous vehicles
- Automotive is one of the key growth opportunity verticals for EMS providers in the next 5 years, due to the technological transformation currently underway with autonomous cars development and electric car commercialization activities. Moreover, the rapidly growing electronics content will accelerate the growth of EMS revenue from this vertical.
- In 2021, the Indian government announced the PLI plan for automobiles and auto components totalling INR 25,000 Crore. This scheme is expected to attract investments of more than INR 40,000 Crore by 2026.
- The government intends to make India a worldwide manufacturing centre as well as a research and development (R&D) powerhouse. The Government of India intends to establish R&D centres under NATRiP (National Automotive Testing and R&D Infrastructure Project) at a total expenditure of US\$ 388.5 million in order to bring the sector up to global standards.

### Growth drivers and key trends in the sub-segments of focus:

#### i) Advanced Driver Assist System (ADAS)

The automotive industry value chain is transitioning from its traditional pyramidal form to one that is flat. Technology companies working with original equipment manufacturers (OEMs) and tiered suppliers to develop, validate, supply, and integrate advanced driver-assist technologies to enhance the comfort and convenience of the driver in the vehicle.

#### Growth Drivers

- Driven by regulation, consumer acceptance, and rapid strides in active safety system technology, the penetration of Advanced Driver Assist Systems (ADAS) in LV has grown at a blistering pace.
- The advanced driver assistance system (ADAS) market was initially driven by emerging OEMs offering features such as hands-off highway driving assist systems in the US market. The competitive intensity has compelled traditional OEMs to introduce ADAS features by offering hands-off driving features in their L2+ vehicles.
- The ADAS market is currently driven by premium and mass-market OEMs, especially their expensive and flagship vehicles that feature ADAS systems such as adaptive cruise control (ACC) and lane-keep assist (LKA). These offerings are expected to be updated to L2+ hands-free assists over the three to five years.

#### Key Trends

- L0 – No Assistance: Single sensor-based ADAS warning systems such as BSD, FCW, and RCTA are likely to grow in 'A' segment vehicles in developed markets and A, B, and C segments in emerging markets

- L1 – Feet off: The L1 ADAS market penetration is forecasted to grow exponentially in North America and Europe by 2025 due to GSR regulation and voluntary fitment
- L2 – Hands off: L2 and L2+ will capture the largest market share worldwide, with over 20 million vehicles in the next few years
- L3 – Eyes off: ALKS regulations will promote the increased L3 feature adoption in flagship vehicles of premium OEMs, closely followed by mass-market OEMs in select countries
- L4 – Mind off: Robotaxis and autonomous parking features will open the L4 market by 2025
- L5 – Passenger: L5 AD introduction in the market will depend on technology maturity and L4's success; thus, expected after 2035

## ii) Electric Vehicle (EV)

In 2021, of 6.7 million units sold, 70.7% were BEVs, and 29.1% were PHEVs. Global EV penetration increased from 4.4% in 2020 to 8.8% in 2021. APAC recorded a 151.7% YoY growth, the highest among others, helping it widen the gap between itself and Europe in 2021. Tesla retained the leadership with sales of 936,172 units, followed by the VW Group with 762,717 units. Tesla (13.8%) and VW Group (11.3%) held 25.1% of the market. A total of 641,000 MWh of units have been delivered globally in the last 11 years, with 2021 delivering 251,400 MWh, 80% higher than in 2020. EV charging point installations surpassed 1.5 million points compared to 1.1 million in 2020, with China (accounting for 65%) having the maximum number. CHAdeMO is the first prominent format to be phased out by 2024. China's upcoming ChaoJi format is expected to grow in the next decade as it is compatible with AC and DC (like CCS) and with current and old connector formats. Advanced features, such as V2G services, business intelligence, blockchain technology, and suggestive charging pattern, will be available and preferred by network operators in the next 5 years of management/aggregator cloud platforms. Leading battery manufacturers (BYD, CATL, and LG Chem) and OEMs (for example, BYD, Daimler, and VW) are now looking at next-generation battery technology. It focuses on module-less battery pack technology, integrating cells directly into the pack without packing them into modules.

### Growth Drivers

- The global push towards electrification and fuel economy has led to ever-stringent emission norms. This has resulted in some regions already committing to ICE bans.
- Countries across the global are working towards ambitious plans such as 'Net Zero' emissions by 2050 and ICE vehicle ban from 2030 in some regions
- Global developed economies are aiming towards a 'Low Emission Society'. This strategy is supported by investing in infrastructure, green transport solutions and transitioning to a circular economy.
- Battery electric vehicles with longer ranges are comparatively priced than ICE vehicles. An increasing number of fast charging stations will reduce the range anxiety and charging capability
- By 2030, EVs are expected to constitute approximately 27% of the overall passenger car market
- In India, NITI Aayog is currently targeting a commercial EV penetration of nearly 70%, a two-wheeler, and three-wheeler EV penetration of 80% by 2030. Robust government policies and programs by the government are all contributing to the growth of EV market in the country. Some of the policy support initiatives launched by the government to increase EV adoption include FAME 1 and FAME 2 India scheme, PLI scheme, Battery swapping policy, tax exemptions and many such initiatives.

### Key Trends

- Global emergence of Giga factories: Approximately 86 battery manufacturers will hold 95% of the market share, of which 50% will be from China by 2030. Over 118 Gigafactories are likely to emerge by 2025
- Charging infrastructure development: OEMs will now shift to advanced charging systems, such as bi-directional charging, which enables functions such as V2G.
- Next generation battery technology: Transformation towards alternate battery structure (cell to pack) and chemistry (solid-state, hybrid chemistry, such as LFP and NMC)

- Wireless Battery Management System (WBMS): WBMS aims to reduce possible mechanical failures due to cables, harnesses, and connectors by eliminating 90% of all wiring and cabling
- Transition to Silicon Carbide (SiC) based Power Electronics: SiC based PE architecture (along with the Powertrain-based Domain Control Unit) becoming the most powerful features than OEMs require. Leading semiconductor manufacturers and OEMs are rapidly moving towards SiC.
- The technological shift to 800V architecture will disrupt the market as the charging dynamics transform from 400V to 800V. It is expected that post 2025, majority of the OEMs will shift towards the 800V architecture.

### iii) Safety

Active and passive safety systems are crucial in terms of getting a vehicle approved to be sold in a particular market. Active safety systems include antilock braking system (ABS), electrical brakeforce distribution (EBD) and electronic stability control (ESC). Airbags and seat belts are also known as passive safety systems. ABS and EBD are known by their standard terminologies across the industry, while ESC systems have proprietary names from the OEMs providing the feature on their vehicles. The revenue for these systems is usually from the OEMs to the tier suppliers who integrate the hardware, and the software is integrated by the OEMs themselves.

#### Growth Drivers and Trends

- With increasing levels of autonomy and differing seating arrangements, safety features are now looked at from a different perspective than earlier. Safety features on a vehicle are increasing, with more focus towards ADAS features.
- Many active safety features have been mandated across the world and OEMs are exploring other ways to make vehicle safer as a part of their goal to achieve zero fatalities towards the end of the decade. Safety requirements set by institutions such as NCAP becoming more and more stringent. India has recently proposed the introduction of the Bharat new vehicle safety assessment program (BNVSAP) which is very much like the NCAP (New car assessment program) for India.
- Advancements in the safety field have brought about new features that enhance the safety of the occupants inside the car. Some of these features include centre airbags and seatbelt airbags
- It is expected that the safety features that were limited to the premium segment of the passenger vehicle market will trickle to the mass-market segments as well. In Premium segments, many vehicles are also equipped with side airbags in the rear seat, which was unheard of earlier
- OEMs have started providing value-added features at lower additional costs to please more customers. For example, providing ECS together with ABS and EBD provides more value for customers than just ABS and EBD alone.

## CHAPTER 6 - COMPETITION OVERVIEW

### Global EMS Industry

The global EMS market accounts for 35% of the total electronics industry. The EMS market has grown steadily over the last few years, owing to increased sales of mobile phones, consumer electronics, and IT products. OEMs' widespread use of contractual services is fuelling this growth.

### Industry structure

The global EMS market traditionally comprised of companies that manufacture electronic products, predominantly assembling components on PCBs and box builds for OEMs. The global EMS market is addressed by more than 1,000 players. However, the top 10 players contribute to 53% of the market. Hon Hai Technology (Foxconn Group) is the market leader, accounting for nearly 24% of the market in 2020 and 4.8x times larger than the nearest competitor. Pegatron, Quanta, Compal Wistron, Jabil and Flex are some of the leading players in the EMS market. Apart from the top 10 players, Continental, Wabtec (Faiveley), TMEIC, Cummins, Robert Bosch, Trimble Mobility Solutions, Kyosan, and Collins Aerospace are major OEM's who outsource manufacturing to EMS players in their respective industry segments. The entire universe of peers (both Indian & Global) has been included in this report and some of them might not be directly comparable to Cyient DLM in terms of Business Model.

**Chart 6.1: Industry structure of EMS market, Global, 2021**



### Business analysis of key Global companies

**Chart 6.2: Company background of key EMS companies, Global, 2021**

Name of the EMS Company	Head Office	Year of Inc.	Company Background
Jabil Inc.	St. Petersburg, Florida, USA	1966	• Jabil Inc. is an American worldwide manufacturing services company headquartered in the Gateway area of St. Petersburg, Florida
Flex Ltd.	Singapore	1969	• Flex Ltd. is an American Singaporean-domiciled multinational diversified manufacturing company. Company delivers technology innovation, supply chain, and manufacturing solutions to various industries.
Sanmina Corp.	San Jose, California, USA	1980	• Sanmina Corporation is an American electronics manufacturing services provider headquartered in San Jose, California that serves OEMs in communications and computer hardware fields
Celestica Inc.	Toronto, Canada	1994	• Celestica Inc. is a Canadian multinational electronics manufacturing services company headquartered in Toronto, Ontario.
Plexus Corp.	Neenah, Wisconsin, USA	1979	• Plexus Corp is an electronic manufacturing services provider. The company provides support in the areas of design and development, supply chain, launch of new products, manufacturing, and aftermarket to companies with mid-to-low volume, higher complexity products
Team Precision Public Co. Ltd.	Thailand	1996	• Team Precision Public Company Limited is a leading Electronic Manufacturing Solutions provider in Thailand, with over a decade of experience.

Source: Company websites; Frost & Sullivan Analysis

**Chart 6.3: Market share, Service offered, Focus end-user segments, Strategy and Future outlook of key EMS companies, Global, 2021**

Name of the Company	Market Share	Services offered	Focus end-user segments	Strategy	Outlook
<b>Jabil Inc.</b>	3.3%	<ul style="list-style-type: none"> <li>* Precision Injection Molding and Tooling</li> <li>* Radio Frequency Identification Technology (RFID)</li> <li>* Rapid Prototyping Services</li> <li>* Offer Design Services</li> <li>* Sustainable Packaging</li> <li>* Others</li> </ul>	<ul style="list-style-type: none"> <li>* Appliances</li> <li>* Automotive</li> <li>* Defense &amp; Aerospace</li> <li>* Healthcare</li> <li>* Networking &amp; Telecommunication</li> <li>* Others</li> </ul>	<ul style="list-style-type: none"> <li>* Establish and maintain long-term customer relationships</li> <li>* Product diversification</li> <li>* Utilize customer-centric business units</li> <li>* Leverage Global Production</li> <li>* Offer Systems Assembly, Direct-Order Fulfillment and Configure-to-Order Services</li> <li>* Pursue Acquisition Opportunities Selectively</li> </ul>	<ul style="list-style-type: none"> <li>* Jabil is expected to maintain continued solid operating performance, driven by the continuation of outsourcing and increasing electronics content across a diversified set of end markets.</li> </ul>
<b>Flex Ltd.</b>	2.7%	<ul style="list-style-type: none"> <li>* Industrial Design</li> <li>* System Architecture</li> <li>* Mechanical Design</li> <li>* Embedded System Design</li> <li>* Others</li> </ul>	<ul style="list-style-type: none"> <li>* Communications</li> <li>* Enterprise, and Cloud</li> <li>* Consumer Devices</li> <li>* Automotive</li> <li>* Health Solutions</li> <li>* Industrial</li> </ul>	<ul style="list-style-type: none"> <li>* Increasing company's technology capability and expand portfolio of higher-margin solutions</li> <li>* Continue investing in areas where company can differentiate and add value, whether through engineering and design services, product technologies or developing differentiated processes and business methods</li> </ul>	<ul style="list-style-type: none"> <li>* Company is expected to demonstrate strong financial discipline and execution, and continue to invest in businesses for sustainable growth and margin expansion</li> </ul>
<b>Sanmina Corp.</b>	0.8%	<ul style="list-style-type: none"> <li>* Design &amp; Engineering</li> <li>* New Product Development</li> <li>* Systems Manufacturing</li> <li>* Global Services and Logistics</li> <li>* PCB Assembly &amp; SMT</li> </ul>	<ul style="list-style-type: none"> <li>* Communications networks</li> <li>* Computing and storage</li> <li>* Healthcare</li> <li>* Aerospace &amp; Defence</li> <li>* Industrial &amp; Automotive</li> </ul>	<ul style="list-style-type: none"> <li>* Capitalizing on comprehensive Solutions</li> <li>* Extending Technology Capabilities</li> <li>* Promoting New Product Introduction (NPI) and Joint Design Manufacturing (JDM) Solutions</li> <li>* Continuing to Penetrate Diverse End Markets</li> <li>* Pursuing Strategic Transactions</li> <li>* Continuing to Seek Cost Savings and Efficiency Improvements</li> </ul>	<ul style="list-style-type: none"> <li>* Penetrating diverse end markets that company believe can offer significant growth opportunities going forward</li> </ul>
<b>Celestica Inc.</b>	0.6%	<ul style="list-style-type: none"> <li>* Design and engineering</li> <li>* Hardware platform solutions</li> <li>* Aftermarket services</li> <li>* Supply chain</li> </ul>	<ul style="list-style-type: none"> <li>* Health tech</li> <li>* Communication</li> <li>* Aerospace &amp; Defense</li> <li>* Consumer</li> <li>* Robotics</li> </ul>	<ul style="list-style-type: none"> <li>* Increase penetration in company's End markets/ offerings</li> <li>* Selectively pursue acquisitions and strategic transactions</li> <li>* Continuous improve operational performance</li> <li>* Develop and grow trusted relationships</li> <li>* Invest in Developing New Technology, Quality Products, Supply Chain Solutions and Services</li> </ul>	<ul style="list-style-type: none"> <li>* Increased research and design activities with a very strong hardware patent portfolio will keep the growth momentum intact going forward</li> </ul>
<b>Plexus Corp.</b>	0.4%	<ul style="list-style-type: none"> <li>* Design and development</li> <li>* Supply chain solution</li> <li>* Aftermarket services</li> <li>* New product introduction</li> </ul>	<ul style="list-style-type: none"> <li>* Industrial</li> <li>* Healthcare &amp; life science</li> <li>* A&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>* Company's strategy includes focusing on engineering innovative solutions and partnering with disruptive global companies</li> </ul>	<ul style="list-style-type: none"> <li>* Maintain sustainable growth by providing value added solutions to customers</li> </ul>
<b>Team Precision Public Co. Ltd.</b>	0.01%	<ul style="list-style-type: none"> <li>* Design &amp; Prototyping</li> <li>* Mass Manufacturing</li> <li>* Logistics &amp; Warehousing services</li> </ul>	<ul style="list-style-type: none"> <li>* Industrial</li> <li>* Medical</li> <li>* Communication</li> <li>* Specialty</li> <li>* Consumer</li> </ul>	<ul style="list-style-type: none"> <li>* Balance the business by diversifying markets into multiple regions and serving multiple industries</li> <li>* Manage financial statements under changing economic conditions and maintain company growth</li> </ul>	<ul style="list-style-type: none"> <li>* The Company intends to create value and provide shareholders with good returns continuously while sustaining the Company's growth</li> </ul>

\*Market share based on operating revenue to the global EMS market

Source: Company websites; Frost & Sullivan Analysis

## Financial benchmarking of key Global companies

**Chart 6.4 (a): Profitability ratios – Revenue, Material Margin, EBITDA margin, Global, 2019-2021**

Name of the EMS Company	Operating Revenue <sup>1</sup> (%)			Material margin <sup>2</sup> (%)			EBITDA margin <sup>3</sup> (%)		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Jabil Inc.	27,266.0	29,285.0	33,478.0	7.1%	8.1%	7.9%	4.5%	6.7%	6.9%
Flex Ltd.	24,210.0	24,124.0	26,041.0	6.3%	7.4%	7.5%	3.3%	5.6%	6.9%
Sanmina Corp.	6,960.4	6,756.6	7,890.5	7.6%	8.2%	8.1%	4.9%	6.5%	5.7%
Celestica Inc.	5,748.1	5,634.7	5,207.4	7.6%	8.6%	8.6%	4.4%	5.2%	5.5%
Plexus Corp.	3,390.4	3,368.9	3,811.4	9.2%	9.6%	9.1%	6.1%	7.0%	6.2%
Team Precision Public Co. Ltd.	59.7	78.2	63.6	9.1%	13.5%	15.8%	2.0%	10.2%	10.8%

Source: Annual Reports of Companies published websites; Frost & Sullivan Analysis

<sup>1</sup> Operating Revenue = Net Sales (excluding other income); <sup>2</sup> Material margin = (Net Sales – Cost of Sales)/ Net Sales; <sup>3</sup>EBITDA Margin = (Income before income taxes + Depreciation & Amortization + Interest expense)/ Net Sales

**Chart 6.4 (b): Profitability ratios – Net Margin, RoE, RoCE, Global, 2019-2021**

Name of the EMS Company	Net margin <sup>4</sup> (%)			RoE <sup>5</sup> (%)			RoCE <sup>6</sup> (%)		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Jabil Inc.	0.2%	2.4%	3.0%	3.1%	35.2%	43.4%	19.0%	41.7%	42.0%
Flex Ltd.	0.4%	2.5%	3.6%	3.0%	19.6%	24.9%	4.5%	10.2%	12.5%
Sanmina Corp.	2.0%	4.0%	3.2%	8.5%	15.3%	13.7%	11.3%	14.4%	15.1%
Celestica Inc.	1.1%	1.8%	2.0%	4.4%	7.2%	6.8%	6.4%	7.4%	7.7%
Plexus Corp.	3.5%	4.1%	3.6%	12.7%	13.9%	13.0%	10.9%	12.7%	10.6%
Team Precision Public Co. Ltd.	-0.9%	8.1%	8.8%	-2.1%	23.5%	19.7%	-1.7%	19.1%	14.8%

Source: Annual Reports of Companies published websites; Frost & Sullivan Analysis

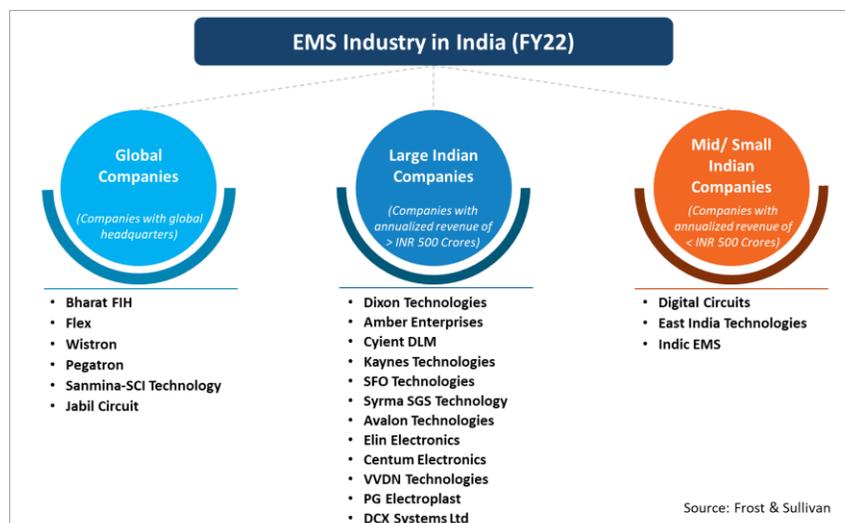
<sup>4</sup> Net Margin = Net income/ Net sales; <sup>5</sup> RoE = Net income/ Average of beginning and closing period of Total shareholders Equity; <sup>6</sup> RoCE = (EBIT + Other income)/ Capital employed [EBIT = (Profit Before Tax + Interest Expense – Other income); Capital employed = Total shareholders' equity + Long-term borrowings + Short-term borrowings + Non-current lease liabilities + Current lease liabilities]

## Indian EMS Industry

The Indian EMS industry is relatively young, with nearly three decades of experience. The EMS industry has grown in prominence over the last decade, particularly in the last five years. The Indian market opportunity is driven by the expected geographical diversification by global OEMs of their manufacturing needs to reduce dependence on China and the availability of government incentives and other schemes, among others.

## Industry structure

**Chart 6.5: Industry structure of EMS market in India, FY22**



There are more than 30 organized companies in the EMS industry ranging from large, medium-sized, to small players and categorized by global and domestic players. Major global companies are Bharat FIH, Flex, Wistron, Pegatron, Jabil; large Indian companies include Dixon, Amber, Cyient DLM, SFO Technologies, Syrma, Elin, Avalon Technologies etc. The competition concentration is moderate as the top 3 companies account for ~ 30% of the market. EMS companies in India have matured from being mere contract manufacturers to end-to-end support partners today. Ambitious expansion plans and capacity augmentation of indigenous EMS players to capitalise on favourable policy initiatives ensure that the EMS sector in India will witness heightened growth in coming years. Cyient DLM has one of the highest margins in the Indian EMS industry. It also has an industry leading order book. Cyient DLM’s position as one of the few EMS companies in India offering electronics solutions for safety and mission-critical applications in highly regulated industries acts as a significant entry barrier to new entrants.

## Business analysis of key Indian companies

Chart 6.6: Company background of key EMS companies, India, FY22

Name of the EMS Company	Head Office	Company Background
Cyient DLM Ltd.	Hyderabad	• Cyient is a global engineering and technology solutions company. They engage with customers across their value chain helping to design, build, operate, and maintain the products and services that make them leaders and respected brands in their industries and markets
SFO Technologies Pvt. Ltd.	Kochi	• SFO Technologies, a subsidiary of the NeST Group of Companies, was founded in 1990. It has a diversified portfolio with a global footprint and multi-domain competence in EMS, ODM, SI, and ADM.
Centum Electronics Ltd.	Bangalore	• Centum Electronics Limited is an Indian electronics system design and manufacturing company. The company produces subsystems and microelectronics, and provides system integration services
Syrma SGS Technology Ltd.	Chennai	• Syrma SGS, founded in 1978 by industry pioneers (Tandon family), is a leading exporter of electronic products, providing high-value integrated design and production solution for globally recognized OEMs.
Avalon Technologies Ltd.	Chennai	• Avalon, incorporated in 1999, is a fully vertically integrated design and manufacturing services company that caters to a wide range of industry segments. They are a leader in high mix, flexible volume production.
Kaynes Technology India Ltd.	Mysore	• Kaynes Technology, is a prominent player in the Electronics System & Design Manufacturing Services, having a strong worldwide presence.
VVDN Technologies Pvt. Ltd.	Gurugram	• VVDN is a global leader in product engineering and manufacturing with clients in a range of technical domains. Apart India, the company supports global customers across US, Canada, Europe, Vietnam and Japan.
DCX Systems Ltd.	Bangalore	• Established in the year 2011 DCX Systems Ltd formerly known as DCX Cable Assemblies Pvt. Ltd. offers System Integration and interconnection solutions to the Defense & Aerospace sector.

Source: Company websites; Frost & Sullivan Analysis

Chart 6.7: Service offered, Focus end-user segments, Strategy and Future outlook of key EMS companies, India, FY22

Name of the Company	Market Share*	Services offered	Focus end-user segments	Strategy	Outlook
Cyient DLM Ltd.	0.5%	<ul style="list-style-type: none"> <li>* E2E manufacturing</li> <li>* Assembly and repair capabilities</li> <li>* Re-engineering services</li> </ul>	<ul style="list-style-type: none"> <li>* Aerospace &amp; Defence</li> <li>* Medical</li> <li>* Energy &amp; Industrial</li> <li>* Rail Transport</li> </ul>	<ul style="list-style-type: none"> <li>* Strategic buyout to accelerate ramp up for a strategic customer coupled with a long-term deal in the Automotive &amp; Mobility vertical</li> </ul>	<ul style="list-style-type: none"> <li>* Cyient DLM aims to create a niche in high mix industry</li> <li>* Opportunistic play in Communications and Automotive industry</li> </ul>
SFO Technologies Pvt. Ltd.	1.1%	<ul style="list-style-type: none"> <li>* Hardware Design Services</li> <li>* Hardware Testing &amp; certification</li> <li>* Software Services</li> <li>* Software Testing</li> <li>* Manufacturing Services</li> <li>* Testing &amp; Certification</li> <li>* After market support</li> </ul>	<ul style="list-style-type: none"> <li>* Healthcare/ Medical Diagnostics</li> <li>* Automobile/ Transportation</li> <li>* Communications</li> <li>* Aerospace &amp; Defence</li> <li>* Energy &amp; Industrial</li> </ul>	<ul style="list-style-type: none"> <li>* To transform SFO into a customer focused organization and achieve economies of scale in operations and Supply chain Management, company created a matrix of Strategic Business Units and Corporate Group Functional Units,</li> </ul>	<ul style="list-style-type: none"> <li>* SFO group will continue to benefit from its strong market position and healthy relationships with reputed clients</li> </ul>
Centum Electronics Ltd.	0.5%	<ul style="list-style-type: none"> <li>* Engineering Services</li> <li>* Manufacturing Services</li> <li>* Aftersales Services</li> </ul>	<ul style="list-style-type: none"> <li>* Aerospace</li> <li>* Space</li> <li>* Communications</li> <li>* Defence</li> <li>* Medical</li> <li>* Transportation</li> <li>* Automotive</li> </ul>	<ul style="list-style-type: none"> <li>* To focus on global markets in the high reliability segments of Strategic Electronics, Medical, Industrial and Mobility where entry barrier is very high</li> <li>* To become a one-stop-shop solution provider and to develop strong end-to-end capabilities to work with customers from concept to commissioning and lifecycle management.</li> </ul>	<ul style="list-style-type: none"> <li>* ESDM industry has been recognized as one of the 25 priority sectors in the Make in India initiative to contribute to economic growth. Centum is seeing the benefits of this trend in the form of new opportunities from existing and new customers.</li> </ul>
Syrma SGS Technology Ltd.	0.9%	<ul style="list-style-type: none"> <li>* Product Design</li> <li>* Prototyping</li> <li>* Product Assembly</li> <li>* Quality &amp; Testing</li> <li>* Supply &amp; Logistics</li> <li>* After market</li> </ul>	<ul style="list-style-type: none"> <li>* Industrial</li> <li>* Consumer Electronics</li> <li>* Automotive</li> <li>* Computer</li> <li>* Medical</li> <li>* Railways</li> </ul>	<ul style="list-style-type: none"> <li>* Maintaining strong relationships with key customers and to the growth of their business.</li> <li>* As part of company's business strategy, company intend to continue pursuing strategic acquisition opportunities in India and abroad</li> <li>* Company maintains high level of inventory of raw materials, work in progress and finished goods, in order to pursue their expansion strategy</li> </ul>	<ul style="list-style-type: none"> <li>* Increasing company's wallet share from existing customers, and catering to more end-use industries.</li> <li>* Syrma SGS Technology, has set an ambitious target to more than triple its current revenue of INR 1,000 crore in the next three years supported by its investment in capacity expansion,</li> </ul>

<b>Avalon Technologies Ltd.</b>	0.6%	<ul style="list-style-type: none"> <li>* PCBA Design &amp; Assembly</li> <li>* Wire Harnesses, Magnetics</li> <li>* Electro-Mechanical Integration (EMI)</li> <li>* Sheet Metal Fabrication</li> <li>* Injection Moulded Plastics</li> <li>* Complete system integration</li> <li>* Product testing</li> </ul>	<ul style="list-style-type: none"> <li>* Transportation</li> <li>* Aerospace</li> <li>* Power &amp; Energy</li> <li>* Communication</li> <li>* Healthcare</li> <li>* Automotive</li> <li>* Industrial</li> </ul>	<ul style="list-style-type: none"> <li>* Continue to consolidate company's position in well-established end-use industries including industrial, communications, mobility, and medical devices</li> <li>* To cross sell company's products to existing customers enable them to market their products with negligible expenditure on marketing</li> </ul>	<ul style="list-style-type: none"> <li>* The company will be benefitted over the medium term on the back of established presence in the industry for more than two decades</li> <li>* Company has adequate liquidity marked by moderate net cash accruals to meet its maturing debt obligations</li> </ul>
<b>Kaynes Technology India Ltd.</b>	0.5%	<ul style="list-style-type: none"> <li>* ODM</li> <li>* OEM Manufacturing</li> <li>* Systems Integration</li> <li>* Product Service Support</li> </ul>	<ul style="list-style-type: none"> <li>* Defense &amp; Aerospace</li> <li>* Railways &amp; other Transportation</li> <li>* Healthcare</li> <li>* Automotive</li> <li>* IT &amp; Telecom</li> <li>* Power &amp; Energy &amp; Industrial Automation &amp; Controls</li> </ul>	<ul style="list-style-type: none"> <li>* Diverse and global customer base with a low customer revenue concentration</li> <li>* Long standing relationships with customers, an opportunity for increased wallet share</li> </ul>	<ul style="list-style-type: none"> <li>* Deep connects with the start-up ecosystem that can help partner with the next generation companies very early</li> <li>* Growing through consolidation, acquire, and partnership models</li> </ul>
<b>VVDN Technologies Pvt. Ltd.</b>	0.5%	<ul style="list-style-type: none"> <li>* Embedded Product Design and Manufacturing</li> <li>* Hardware Design</li> <li>* Software Design</li> <li>* Mechanical Design</li> <li>* QA &amp; Testing</li> <li>* Prototyping and Manufacturing</li> </ul>	<ul style="list-style-type: none"> <li>* Communications (5G, Networking &amp; Wi-Fi, VISION, IoT, Clouds &amp; apps)</li> </ul>	<ul style="list-style-type: none"> <li>* VVDN entered into a strategic alliance with Blue Star for Co-Developing and Manufacturing new-generation controllers for Air Conditioners</li> </ul>	<ul style="list-style-type: none"> <li>* VVDN expands its operations in Europe, focusing on revenue of USD 500 Mn in next 3 years</li> <li>* VVDN to invest INR 500 crore in Tamilnadu plant</li> </ul>
<b>DCX Systems Ltd</b>	0.8%	<ul style="list-style-type: none"> <li>* Supplying Cable assemblies/ Harness assemblies and Electro-Mechanical Assemblies,</li> <li>* Subsystems, System integrations &amp; Testing,</li> <li>* Maintenance -Repair-Overhauling (MRO) &amp; Lifetime product support.</li> </ul>	<ul style="list-style-type: none"> <li>* Defence (Aerospace, Land &amp; Naval Defence systems, Satellites &amp; Civil Aviation)</li> </ul>	<ul style="list-style-type: none"> <li>* Company is embarking on a growth strategy that involves expansion of their operations through addition of new business verticals, expanding their customer base and international presence, and improving their operational efficiencies through backward integration, supply chain rationalization and effective resource planning</li> </ul>	<ul style="list-style-type: none"> <li>* DCX is well positioned to capture the growth in exports and increase operational efficiency going forward</li> </ul>

\*Market share based on operating revenue to the Indian EMS market

Source: Company websites; Frost & Sullivan Analysis

## Financial benchmarking of key Indian companies

Chart 6.8 (a): Profitability ratios – Operating Revenue, Material Margin, EBITDA margin, India, FY20-H1FY23

Name of the EMS Company	Operating Revenue <sup>1</sup> (%)				Material margin <sup>2</sup> (%)				EBITDA margin <sup>3</sup> (%)			
	FY20	FY21	FY22	H1FY23	FY20	FY21	FY22	H1FY23	FY20	FY21	FY22	H1FY23
Cyient DLM Ltd.	4,570.9	6,280.3	7,205.3	3,402.7	20.2%	21.1%	24.5%	22.2%	3.0%	7.3%	11.7%	10.4%
SFO Technologies Pvt. Ltd.	17,889.7	16,593.4	NA	NA	35.8%	38.2%	NA	NA	11.3%	9.5%	NA	NA
Centum Electronics Ltd.*	8,832.6	8,174.3	7,799.4	4,095.8	59.7%	57.7%	61.3%	55.9%	9.9%	10.8%	1.2%	10.4%
Syrma SGS Technology Ltd.*	3,970.8	4,383.0	10,197.2	8,562.4	43.5%	36.5%	29.7%	31.1%	15.6%	10.7%	9.3%	9.4%
Avalon Technologies Ltd.	6,418.7	6,904.7	8,407.2	NA	35.9%	34.0%	34.1%	NA	10.0%	9.6%	14.0%	NA
Kaynes Technology India Ltd.	3,682.4	4,206.3	7,062.5	NA	34.4%	32.0%	30.7%	NA	11.2%	9.7%	13.3%	NA
VVDN Technologies Pvt. Ltd.	3,090.9	6,659.8	NA	NA	66.6%	50.1%	NA	NA	-6.4%	11.7%	NA	NA
DCX Systems Ltd. *	4,492.6	6,411.6	11,022.7	NA	9.2%	3.5%	9.2%	NA	1.4%	1.6%	6.1%	NA

\* Listed companies; NA – Data not available

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

<sup>1</sup> Operating Revenue = Revenue from operations (excluding other income); <sup>2</sup> Material margin = (Revenue from operations – Cost of Goods Sold)/ Revenue from operations; <sup>3</sup>EBITDA Margin = (Profit before tax + Depreciation & Amortization + Finance Cost – Other income)/ Revenue from operations

**Chart 6.8 (b): Profitability ratios – Net Margin, RoE, RoCE, India, FY20-H1FY23**

Name of the EMS Company	Net margin <sup>4</sup> (%)				RoE <sup>5</sup> (%)				RoCE <sup>6</sup> (%)			
	FY20	FY21	FY22	H1FY23	FY20	FY21	FY22	H1FY23	FY20	FY21	FY22	H1FY23
Cyient DLM Ltd.	-1.5%	1.9%	5.5%	3.9%	-22.1%	37.3%	69.4%	10.5%	3.3%	11.5%	17.6%	6.3%
SFO Technologies Pvt. Ltd.	4.2%	2.3%	NA	NA	14.1%	6.4%	NA	NA	18.1%	13.0%	NA	NA
Centum Electronics Ltd.*	1.9%	1.5%	-6.9%	2.3%	7.1%	5.1%	-24.4%	4.9%	11.1%	8.0%	-5.0%	4.9%
Syrma SGS Technology Ltd.*	11.1%	7.3%	5.6%	5.4%	51.9%	18.7%	13.7%	4.5%	31.4%	13.5%	10.9%	4.3%
Avalon Technologies Ltd.	1.9%	3.3%	8.1%	NA	265.6%	145.8%	118.1%	NA	21.7%	16.2%	27.5%	NA
Kaynes Technology India Ltd.	2.5%	2.3%	5.9%	NA	9.5%	8.0%	24.3%	NA	13.6%	12.1%	21.5%	NA
VVDN Technologies Pvt. Ltd.	-5.4%	6.5%	NA	NA	-20.9%	45.6%	NA	NA	-5.6%	16.4%	NA	NA
DCX Systems Ltd. *	2.2%	4.6%	6.0%	NA	78.9%	92.4%	79.8%	NA	13.8%	27.1%	14.0%	NA

\* Listed companies; NA – Data not available

Source: Annual Reports of Companies published in RoC, MCA; Frost & Sullivan Analysis

<sup>4</sup> Net Margin = Profit after tax/ Net sales; <sup>5</sup> RoE = Profit after tax / Average of beginning and closing period of Total Equity; <sup>6</sup> RoCE = (EBIT + Other income)/ Capital employed [EBIT = (Profit Before Tax + Interest Expense – Other income); Capital employed = (Total Equity + Long Term Borrowings + Short Term Borrowings + Long Term Lease Liabilities + Short Term Lease Liabilities)]

Note: H1FY23 RoE and RoCE are not annualised