MARKET ASSESSMENT FOR INDIA EMS/ODM INDUSTRY

SUBMITTED TO

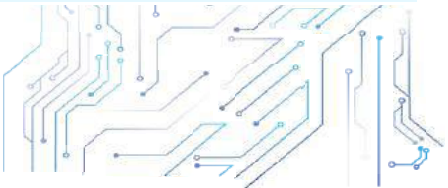
BHARAT FIH LTD.

JUNE 2022

FROST & SULLIVAN

ACRONYMS

Title	Abbreviations
ADB	Asian Development Bank
AGR	Adjusted Gross Revenue
AI	Artificial Intelligence
APAC	Asia Pacific
AR	Augmented Reality
ARPU	Average Revenue Per User
ATMP	Assembly, Testing, Marking and Packaging
BCD	Basic Custom Duty
BMS	Battery Management System
BTS	Base Transceiver Station
CAGR	Compound Annual Growth Rate
CCTV	Closed-circuit Television
CPU	Central processing unit
CY	Calendar Year
DTH	Direct-to-Home
ECU	Engine Control Unit
EDA	Electronic Design Automation
EDF	Electronics Development Fund
EDFC	Eastern Dedicated Freight Corridor
EMC 2.0	Modified Electronics Manufacturing Clusters
EMS	Electronic Manufacturing Services
EU	European Union
EV	Electric Vehicles
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
FDI	Foreign Direct Investment
FPD	Flat Panel Display
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GOI	Government of India
GPON	Gigabit Ethernet passive optical network
GVA	Gross Value Added
HEV	Hybrid Electric Vehicles
ICEV	Internal Combustion Engine Vehicle
IIoT	Industrial Internet of Things
IIP	Index of Industrial Production



IMF	International Monetary Fund
INR	Indian National Rupee
IoT	Internet of Things
KSA	Kingdom of Saudi Arabia
LATAM	Latin America
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LTE	Long-Term Evolution
MEIS	Merchandise Exports from India Scheme
MENA	Middle East and North Africa
MSME	Micro, Small, and Medium Enterprises
NFC	Near-field Communication
NMZ	National Manufacturing Zone
NPE	National Policy on Electronics
NSO	National Statistical Office
ODM	Original Design Manufacturer
OEM	Original Equipment Manufacturer
PBX	Private Branch exchange
PCB	Printed Circuit Boards
PCBA	Printed Circuit Board Assembly
PFCE	Private Final Consumption Expenditure
PHEV	Plug-in Hybrid Electric Vehicles
PLI	Production Linked Incentives
PMP	Phased Manufacturing Programme
QSTC	Quality, Services, Timeliness and Cost
RAM	Random-access memory
RBI	Reserve Bank of India
SME	Small and Medium Enterprise
SMT	Surface Mount Technology
SPECS	Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors
UHD	Ultra-high definition
USD[1]	United States Dollar
VAT	Value Added Tax
VOLTE	Voice over LTE

[1] *USD to INR - average exchange rate of 1 USD by financial year: FY17 (INR 67.1), FY18 (INR 68.4), FY19 (INR 70.4), FY20 (INR 70.9), FY21 to FY26 (INR 74.0)*

NOTE

Exchange rate considered (INR/$):

- FY'20: 70.9
- FY'21: 74.0
- FY'22: 74.5 (It was 74 in the November report)
- FY'23 to FY'26: 74.5 (It was 74 in the November report)

Revised estimates from MEITY for FY'21:

- MEITY has revised its estimates for FY'21 in the FY'22 annual report

Values in INR Billion	FY'21 Annual Report	FY'22 Annual Report	Change (in %)
Production of electronic goods	4,975	5,545	11%
Import of electronic goods	3,888	3,994	3%
Export of electronic goods	786	818	4%

Global organizations such as IMF and World Bank have also revised its CY2020 and CY2021 estimates in the recent update.

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 a electromechanical system
Components	It includes active, wound, electro-mechanical, passive, LED lighting components, bare PCB and other components
Electronic Manufacturing Services (EMS)	Companies that provide services such as design, manufacture, test, distribute and servicing in electronics sector for the OEMs
Feature phones	Feature phones run on a proprietary firmware, with third-party software support and have basic features like calling, camera, music player
Financial Year (FY)	The financial year in India is defined from April to March. For instance, FY20 refers to 1st April 2019 to 31st March 2020
Original Design Manufacturer (ODM)	EMS companies design products as per the specifications provided by the OEMs
Original Equipment Manufacturer (OEM)	Refers to the final end-user electronic products across application segments
Smart phones	Mobile phones that run on a mobile operating system offering a variety of features that allows advanced computing capability and connectivity
Share of wallet / Wallet share of mobile phones	It refers to the percentage of OEMs' mobile phone volume sales contributed by EMS companies. It helps to understand the amount of business an OEM receives from an EMS company.
Tier classification of cities	As per RBI, Indian cities are classified as tier 1, 2 and 3 based on the size of population. Tier 1 (> 100,000); Tier 2 (50,000-100,000); Tier 3(20,000-50,000)
Time-to-market	Time-to-market is defined as the time it takes from the conception of a new product design to its release in the market
Time-to-volume	Time-to-volume is defined as the time it takes from the conception of a new product design to launch and achievement of commercially relevant business volumes

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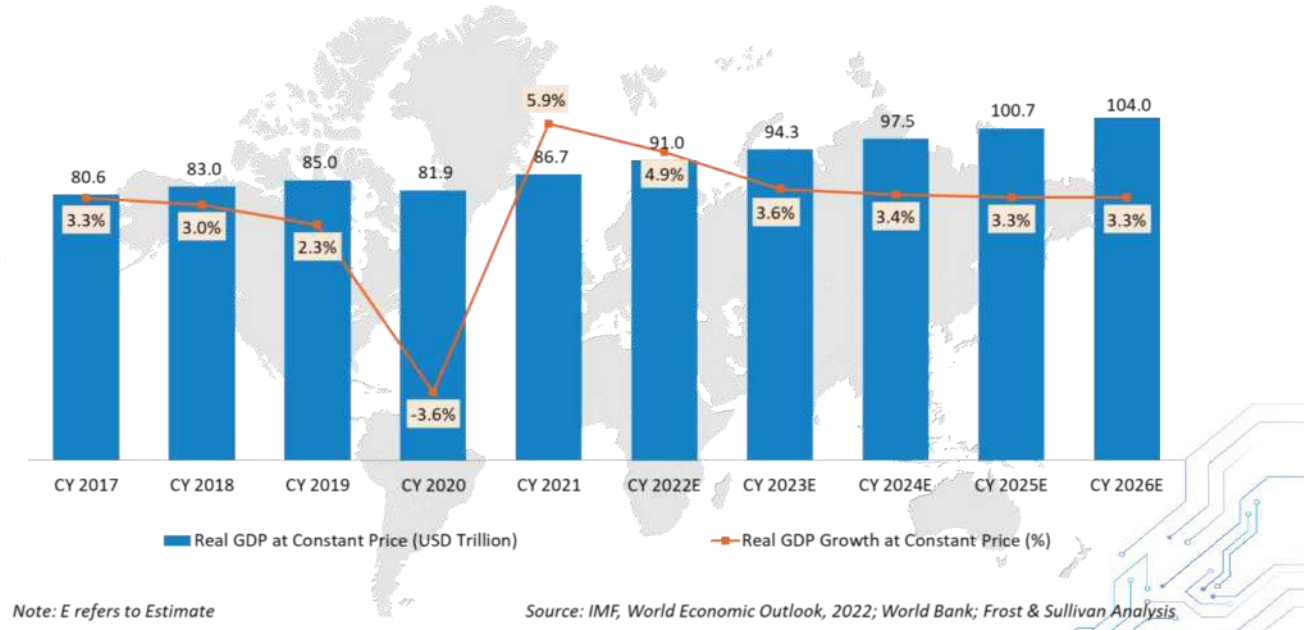
CHAPTER 1 - GLOBAL MACROECONOMIC OVERVIEW

Global[2] real GDP and growth outlook

The global economy (real GDP), has undergone significant 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 2018 and then entered into a recession in 2020 owing to the unprecedented crisis caused by COVID-19 pandemic. The pandemic started from China around December 2019 and then had spread across the continents with alarming speed, infecting millions and bringing economic activity to near standstill in Q2 and Q3 of CY2020 as many countries had to impose strict restrictions to curb the spread of the virus.

However, since the early months of CY2022, the global economy has been in a reasonably strong position, and the major economies—the United States, China, and Europe—have all managed to regain their pre-pandemic levels. After gaining experience from the pandemic, all governments have taken the steps they need to deal with similar events in the future. World now has vaccines to fight this disease and companies have developed innovative business models including adoption of digital measures to continue with their businesses. Pent up demand, caused by economic stagnation and relative improvement in the supply situation are now driving the recovery of global economy which is poised to stage its most robust post-recession recovery. The global GDP is expected to grow at a CAGR of 3.7% by CY2026.

Chart 1.1: Real GDP and real GDP growth (annual percentage change), Global, value in USD trillion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

[2] *Global includes various market regions such as North America, Latin America, Europe, Middle East and Africa, Asia Pacific and South East Asia*

The pandemic, in its peak, had created several issues for the manufacturing industries such as supply chain disruptions, labour issues, sluggish demand and fall in exports. In order to survive, companies across the globe had to adopt drastic measures such as employment and wage cuts. This had a circular effect on the global economy. Job losses coupled with salary reductions and delayed payments resulted into significant decline in consumer spending which in turn affected the economy and further job losses. Travel, hospitality, banking, construction and manufacturing were among the worst-affected industries.

Impact of the pandemic was severe among the weaker economies in 2020. Most of the African countries faced severe economic downturn especially the countries with large energy exports such as Algeria, Angola and Nigeria. Fluctuations in the oil prices, cold war among major Oil & Gas producers coupled with the impact of the global economic slowdown had affected the Middle Eastern economies adversely. The Latin American region, which has been grappling with many socio-economic issues such as poverty, inequality, debt crisis, low economic growth etc., the pandemic had further worsened the situation. Latin America was also one of the worst hit regions due to the COVID-19 pandemic.

The situation has been lot better since the beginning of 2021 and the global economy has made a strong recovery after a doom performance in CY2020. In CY 2021, the global economy grew by 5.9%, owing largely to the inherent strength of the major economies such as the United States, China, Japan, Germany, United Kingdom and India.

However, at the start of CY 2022, Russia invaded Ukraine, in an issue that faced steep escalation of the Russo-Ukrainian War that began in 2014. Even as the Ukraine war extends indefinitely, there is no anticipation of the global economy falling into recession this year or next. Nonetheless, the war is expected to weigh on growth, causing recessions in Ukraine, Russia, and potentially nearby regions.

Impact of COVID-19 pandemic on different economies in 2020 and 2021

The outbreak of COVID-19 pandemic threw the entire world into an unforeseen crisis in terms of both public health and economy. Protecting people's lives and supporting public health became the highest priorities for countries across the world. The global economy plunged into a deep depression in 2020 causing severe impact on spending and employment.

With increasing spread of the virus, most of the economies had to enforce desperate measures such as lockdowns, travel restrictions, social distancing etc. Various containment measures including closure of offices and factories, slowdown of public services etc. were taken which resulted in significant drop in investments during 2020.

Business scenario improved significantly since then and most of the economies have bounced back to 2019 levels by 2021 or beginning of 2022. Governments across the world have created necessary healthcare infrastructure to deal with any future outbreak, more than 12 billion vaccine doses have already been administered, and public at large have learnt to live with this menace.

Impact of the pandemic on the world economy has been softened significantly. Highly transmissible strain the 'Omicron' and its other mutations caused spike in the number of cases in the recent months and large economies especially China imposed strict lockdowns in order to curb the spread. This is turn has disrupted supply and demand for a variety of semiconductor companies amid broader challenges created by the on-

going global chip shortage. Governments across different parts of the world have taken timely precautionary measures and have been successful in minimizing its impact on economy.

United States of America - USA became the epicentre of the pandemic with highest number of reported casualties in the world with a devastating impact on the country's economy. As per U.S. Bureau of Labour Statistics, unemployment rate almost tripled between Q4 2019 to Q2 2020, from 3.6% to 13%. Over thirty million Americans had filed for unemployment benefits due to job losses during this period. However, unemployment rate fell to 6.7% by Q4 2020 due to slew of economic measure taken by the Government. The U.S. economy has been strengthened by massive fiscal support and widespread vaccination and the economy has grown by 6% in 2021. While small businesses are expected to have a longer road to recovery, the services sector, construction, retail trade, management companies & enterprises, real estate, technical services and healthcare are driving economic recovery in the country. The US economy's performance in the past few months of CY 2022 has been better than most people expected. While Omicron took infection rates to a new high, little trace appeared in economic data.

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 up economic activities.

Compared to the global economy, the Euro region suffered a bigger hit in 2020 and was expecting comparatively slower recovery in 2021. The real GDP was likely to reach pre-crisis levels only by mid-2022. Manufacturing industries were impacted by short-term supply shortages, but most of them recovered relatively quickly during Q3 2020. Sectors which thrive on human contact and interactions, such as the cultural and creative industries and the aerospace industry, have experienced substantial hits by the crisis, and were likely to have longer recovery path. Pharmaceuticals and Digital sectors were the least impacted sectors.

While the economic recovery was on track, the Delta strain caused fresh wave of COVID-19 cases in many European countries in 2021 and economists felt that economic recovery may take a little longer than initially thought. Governments across the EU region accelerated vaccination programs and adopted suitable containment measures, so that there could be no more restrictions on travel As a result, EU economy performed better than the expectation and has grown by 5.1% in 2021.

In 2022, the members of the European Union remain vigilant while transitioning out of the acute COVID-19 phase. The current lower levels of COVID-19 infection have given the Member States the opportunity to strengthen their surveillance, healthcare systems, and overall pandemic preparedness. Exceptional fiscal and monetary stimulus has been essential in supporting the on-going recovery of the euro area economy.

South East Asia – Even though health, economic and political impact of COVID-19 has been significant across South East Asian nations, the virus did not spread as rapidly in this region as compared to the other parts of the world. Although the region could not match fiscal incentives of many of the western world countries, fiscal policy in Southeast Asia was still generous and this played a crucial role in limiting the economic and social fallout from the pandemic.

Asian Development Bank (ADB), in one of its reports in mid-2021, predicted that the Southeast Asian economies will recover at "a much slower pace" than previously thought due to recurring waves of COVID-19. ADB downgraded economic growth projections for all Southeast Asian economies — except Singapore and the Philippines. Major Southeast Asian economies including Indonesia, Thailand, Malaysia and Vietnam all reported sharp rise in daily COVID-19 infections and deaths in the second half of 2021. The spike in cases and deaths was attributed to the highly infectious delta variant. Southeast Asia plays a major role in the global manufacturing supply chain. Lockdowns and social-distancing measures in the region during 2021, primarily in Taiwan, prolonged a global shortage of semiconductors, and constrained the supplies of goods such as coffee and clothing. South East Asian economy has grown by 4.5% in 2021.

Southeast Asian governments in 2022 have begun to shift their policies from treating Covid-19 as pandemic to endemic. Multiple governments, including the Philippines, Malaysia, Thailand, and Vietnam, have announced timelines to ease pandemic restrictions, normalize life with Covid-19, and revive their economies. Regional collaboration, including vaccinated travel lanes and mutual recognition of Covid-19 vaccine certifications, has so far taken precedence in facilitating recovery. Now, the region is looking toward targeting both international travellers and investors, to ramp up efforts toward post-pandemic recovery

China – COVID-19 outbreak started with China around November 2019 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 USA. Impact of the Pandemic was severe on the country's economy in Q1 2020. The government 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 next few months and was one of the leading suppliers of medical consumables and equipment globally in 2020. China's economy, which did not contract in 2020, has shown its resilience during the pandemic year and registered 8.0% GDP growth in 2021.

China's overall economy is not de-coupled from the global economy. While China continues to fight Covid struggling, it's not in serious trouble. There is a divided outlook for the Chinese economy as China continues to pursue a strict zero-Covid strategy that saw mass lockdowns imposed upon the discovery of infections. This is in sharp contrast to the approach taken by many other countries, which have largely eased restrictions and shifted toward a strategy of "living with Covid". The Chinese economy is faced with its most server Covid wave since the initial outbreak in 2020. But once that's dealt with, the Chinese economy should return to "reasonable" health.

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. India is the second most populous country and population density of the cities are one of the highest in the world. Due to this, the Indian government had to impose 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 and its economy contracted the most (-23.9 %) globally in Q2 2020.

However, as the government had taken various measures to counter the slowdown, created due to the COVID-19 pandemic, it has shown signs of recovery from mid of CY2021. The country has shown strong resilience since then. The Indian government had called for 'Atmanirbhar Bharat' or 'Self-Reliant' India and the industries have responded to that call. India has not only become self-reliant on medical supplies, it is now one of the largest producers of COVID-19 vaccines globally. The Delta strain which started from India and caused havoc during April and May 2021 could not make much impact on the economic recovery. The demand scenario has improved and Indian economy has grown by 9.5% in 2021 and is expected to grow by 8.5% in2022, owing to strong macroeconomic fundamentals such as moderate inflation, the implementation of key structural reforms, and improved fiscal and monetary policies. The Indian economy came out of the Omicron wave in January with little damage, in stark contrast with the two previous coronavirus waves. Manufacturing and services sectors showed only a slowdown in activity in January, well short of an outright decline as in previous occasions

Manufacturing has emerged one of focus area for the government with policies such as 'Make in India' and 'Atmanirbhar Bharat' and series of schemes such as Phased Manufacturing Plan (PMP), Production Linked Incentive (PLI) etc. India has 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, including the U.S and those in the Asia-Pacific region, showed Cushman & Wakefield's 2021 Global Manufacturing Risk Index.

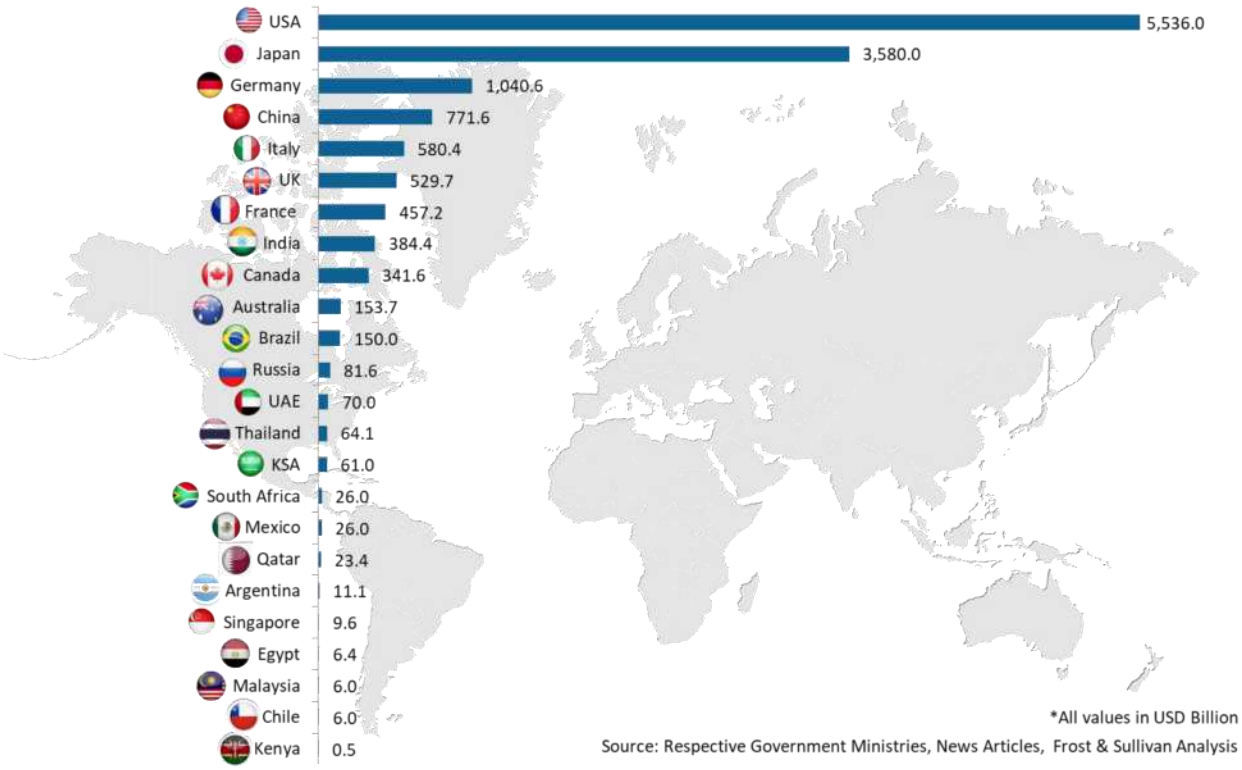
In 2022, amid a resurgence of COVID-19 cases in Southeast Asia and parts of Europe, India, given its high vaccination coverage and immunity due to natural infection, is very unlikely to face major impact of future waves in the country. The Indian Government has also relaxed the mask mandate across states. Taking the actual growth rate in 2021 and assuming growth rate in 2022 and beyond, India can expect to overcome from its Covid 19 losses over the next few years.

Other countries - The economic impact of the COVID-19 pandemic has been different across different countries. Iran had the highest number of COVID-19 cases in Middle East, followed by Iraq and UAE. Countries such as Saudi Arabia and UAE were conservative in allowing tourists, which has badly affected the region's tourism revenue. Tourism is one of the biggest revenue generators of the region especially for GCC countries like the UAE. GCC governments have taken swift measures to reduce the impact of the virus in the region. Africa was one of the most affected regions globally due to COVID-19 pandemic. It was 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, economic recovery is being driven by the private sector. 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.

Stimulus packages announced by different economies

Chart 1.2: Stimulus packages announced by countries, USD Billion, Global, (2020 + 2021)



The United States, one of the worst affected countries, has distributed a total of USD 5.5 trillion in three phases in order to revive the economy and bringing back normalcy to the country. These stimulus packages have been aimed towards aiding the process of reopening schools, empowering small businesses while also providing tax holidays and enabling cash inflow to American citizens.

The EU has outlined massive investments to support people and businesses across Europe as the region has battled a deep economic recession due to the COVID-19 outbreak. The European Commission has distributed USD 857 billion stimulus funds in the form of grants and loans to countries and sectors most impacted by the COVID-19 pandemic. In addition to this, each member country has announced huge sums as stimulus. For instance, Germany has designed a package of over USD 1.04 trillion to battle the economic crisis. The French government has worked on USD 457 billion Stimulus package for the local economy while the Italian government has allocated USD 580 billion as an economic stimulus for its ailing economy.

China has disbursed a stimulus worth USD 770 billion, ~3 % of country's GDP to save the economy. Banks had suspended interest collection and principal payments on loans till March 2021. Unemployed population were allowed to claim unemployment benefits.

Within LATAM, Mexico has announced a USD 26 billion stimulus package, 3.5 % of country's GDP which is widely discussed as one of the smallest in comparison to some of the other economic stimulus packages

that have been offered by other global economies in the developing regions. Similarly, Argentina and Chile has allocated USD 11.1 billion and USD 6 billion respectively as stimulus packages to rescue the sinking economy. Being one of the worst affected regions due to the pandemic, stimulus packages have played some role in the revival of economies in the LATAM region however; there are concerns that the current stimulus package would not be sufficient to bring the economies on track.

Within South Asia, Singapore and Malaysia have announced additional stimulus to the tune USD 6 billion in an attempt to revamp their economies. Singapore's third stimulus, which is worth USD 3.6 billion, along with the first two stimulus adds up to a total of about 12% of the city state's GDP. Indonesia has already announced a first round of measures worth USD 24.65 billion and there are plans to add more. Similarly, Thailand has also introduced a second stimulus package worth USD 51.29 billion on top of a first one worth USD 12.8 billion.

GCC governments have taken numerous initiatives in order to support the residents and companies financially. United Arab Emirates has doubled the size of its stimulus package from USD 34 billion initially to USD 70 billion. Similarly, KSA and Qatar have implemented stimulus package of USD 61 billion and USD 23.35 billion respectively. The objectives of these stimulus packages have been to reinforce liquidity and support business continuity of companies and to reduce the impact of COVID-19 on the economy.

African countries and Governments have also offered stimulus packages to support their citizens and businesses. Kenya has offered USD 503 million that includes credit guarantees, loans to small businesses and helping propping up tourist facilities. South Africa, one of the leading economies in the region has announced USD 26 billion or roughly 10 % of its GDP to jump start businesses and assist the weaker sections of the population. A large portion of this stimulus package has helped the informal sector to protect jobs through various credit guarantee schemes. Egypt has announced USD 6.4 billion stimulus package and offered credit repayment extensions for the SMEs. The country's Central Bank has also announced a rate cut to the extent of 3%. In addition, the package also included reduction in natural gas and electricity prices for the industry, funds allocation to healthcare services, tax exemptions and monthly cash subsidies for the affected workers.

The Indian Government, On May 12 2020, had announced a stimulus worth USD 295.8 billion (INR 20.97 Trillion), about 10 % of India's GDP to support and revive the Indian economy and make India self-reliant. In addition to that India announced an added USD 88.6 Billion in 2021. India bailout package is the eight largest among major economies in the World. A high level break-up of the bailout package has been mentioned below:

Chart 1.3 (a): Components of stimulus package announced by government of India, 2020

Item	Value (USD Billion)	Key Components
First Tranche	83.9	• Collateral free loans and equity infusion for MSMEs, Liquidity relief measures for NBFCs, HFCs, Power distribution companies etc.
Second Tranche	43.7	• 'One nation one ration card' schemes for migrant workers, credit facility for street vendors, Kisan credit cards etc.
Third Tranche	21.2	• Fund for development of Agriculture and Animal Husbandry infrastructure, funding of schemes such as PMMSY, formalization of micro food enterprises etc.
Fourth & Fifth Tranches	6.8	• Reforms for sectors including coal, minerals, defence production, air space management, airports, MRO, distribution companies in UTs, space sector, and atomic energy
Earlier measures including PMGKP	27.2	• Comprehensive relief package for the poor so that they can buy essentials for their livelihood
RBI measures (Actual)	113.1	• Various measures by the Reserve Bank of India to inject liquidity
Total	**295.8**	

Source: Respective Government Ministries, News Articles, Frost & Sullivan Analysis

Chart 1.3 (b): Components of stimulus package announced by government of India, 2021

Stimulus Heads	Value (USD Billion)
Loan guarantee for COVID affected sectors	15.5
ECLGS (Emergency Credit Line Guarantee Scheme), as part of 'Atmanirbhar Bharat'	21.1
Financial aid to power distributors	13.8
Free food grain supply	13.2
Export insurance cover (Infuse equity in Export Credit Guarantee Corporation (ECGC) over 5 years to boost export insurance cover)	12.4
Additional corpus to National Export Insurance Account (NEIA) to boost project exports	4.6
Additional fertiliser subsidy	2.1
New health scheme	2.1
Village Broadband - BharatNet to expand and upgrade broadband connectivity to cover all gram panchayats and inhabited villages	2.7
Credit guarantee for microfinances	1.1
Free visas to boost tourism	0.01
Revival of North East Agri Marketing Corp	0.01
Total	**88.6**

Source: Respective Government Ministries, News Articles, Frost & Sullivan Analysis

Real GDP for key regions and growth outlook

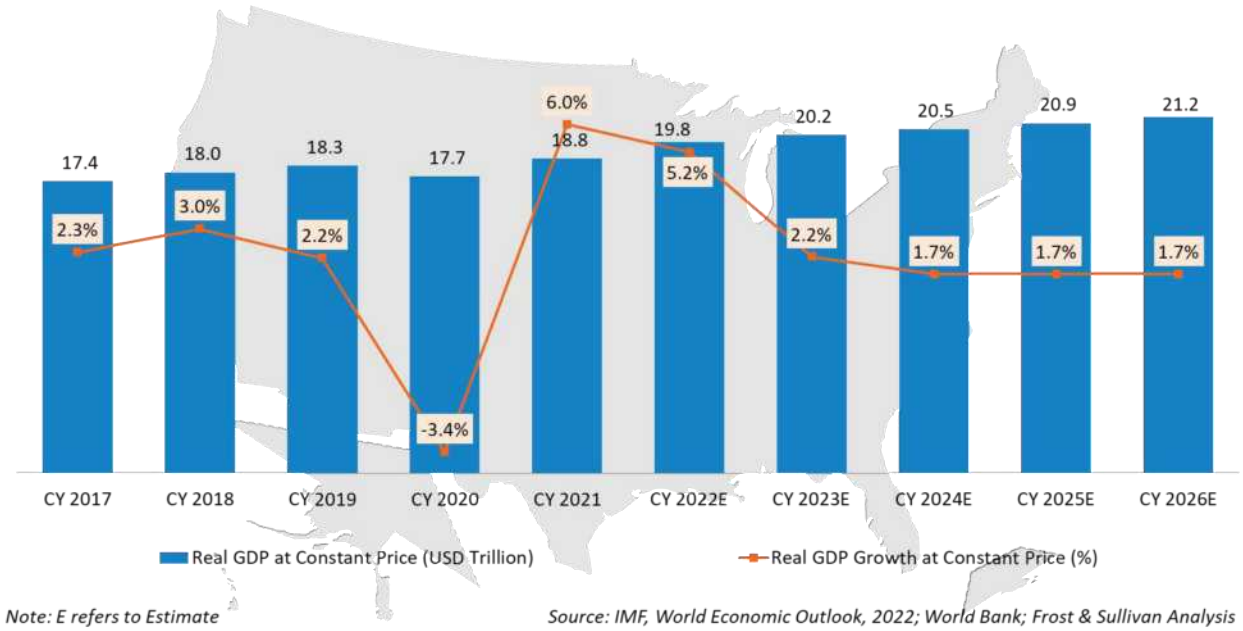
A) United States of America (USA)

USA economy was progressing well with more than 2.0% growth between 2017 and 2019 before it experienced the biggest decline in 2020 when the economy contracted by approximately 3.5%. This was worse than the 2.5% decline witnessed during the economic recession of 2009. The economy showed signs of positive recovery growing at 6% in 2021

and is anticipated to grow between 5.2% in 2022 and 1.7% in 2025.

The US policy makers have taken proactive decisions to protect lives and businesses. The stimulus announced by the government has given the nation some additional relief. Few of the economic indicators like employment are showing significant improvement in 2021. Household expenditure has now been rising gradually since April 2021. Retail sales and housing sales has also gathered pace and exceeded pre-crisis levels. Improvements in public health situation saw increase in service consumption through the end of 2021 and early 2022. Supply disruptions although improved may take some more time to fully ease. The short-term economic impacts of the war are likely limited for the U.S. since its trade ties with Ukraine and Russia are modest

.Chart 1.4: Real GDP and real GDP growth (annual percentage change), USA, value in USD trillion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

B) Europe

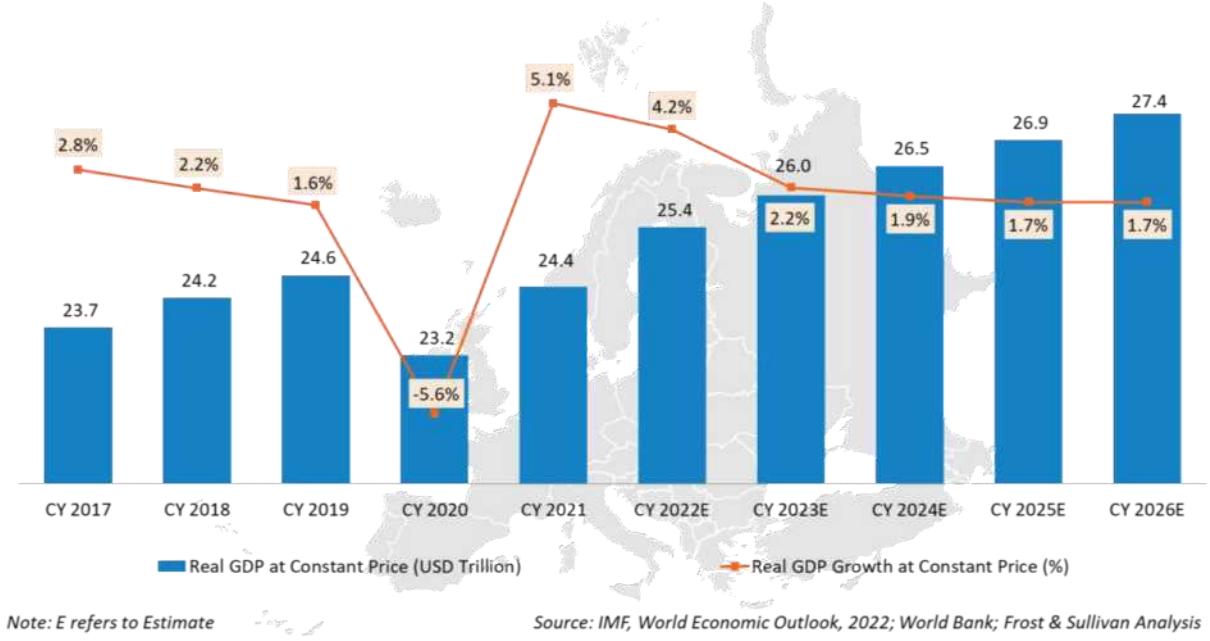
The European Union (EU) economy has shrunk by 5.7% in 2020 with a recovery anticipated at 4.3% in 2021. Spain, UK, Italy, Greece and France were the worst affected economies, experiencing a GDP decline of 10.8%, 9.1%, 8.9%, 8.2% and 8.1% respectively. But the European Union (EU) showed a recovery of 5.1% in 2021. After the pandemic, EU and the United Kingdom have adopted various trade control measures to ensure the availability of essential items, medicines and medical equipment. In addition to this, EU member countries introduced export bans, notification requirements for exports, power to seize goods etc.

Most of the economies are now operating normally and a positive sentiment prevailing buoyed by a landmark agreement forged by the European Union to raise a EUR 750 billion (USD 883 billion) relief fund

through the sale of bonds backed collectively by all members. Countries are now looking towards more sustainable growth with resilience and cohesion.

The European Union is expected to grow at a rate of 4.2% in CY 2022. Considering recent events like the Russia – Ukraine war, it will be interesting to follow Europe's recovery this year, as Europe derives nearly 25% of its energy from natural gas and cancelling the Nord Stream 2 pipeline which runs between Russia and Germany could affect its future gas imports. Energy is a chief concern to Europe, which is one of the world's most energy dependent regions. As a result, Frost and Sullivan expect the European economy to grow at a slower pace in 2022.

Chart 1.5: Real GDP and real GDP growth (annual percentage change), Europe, value in USD trillion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

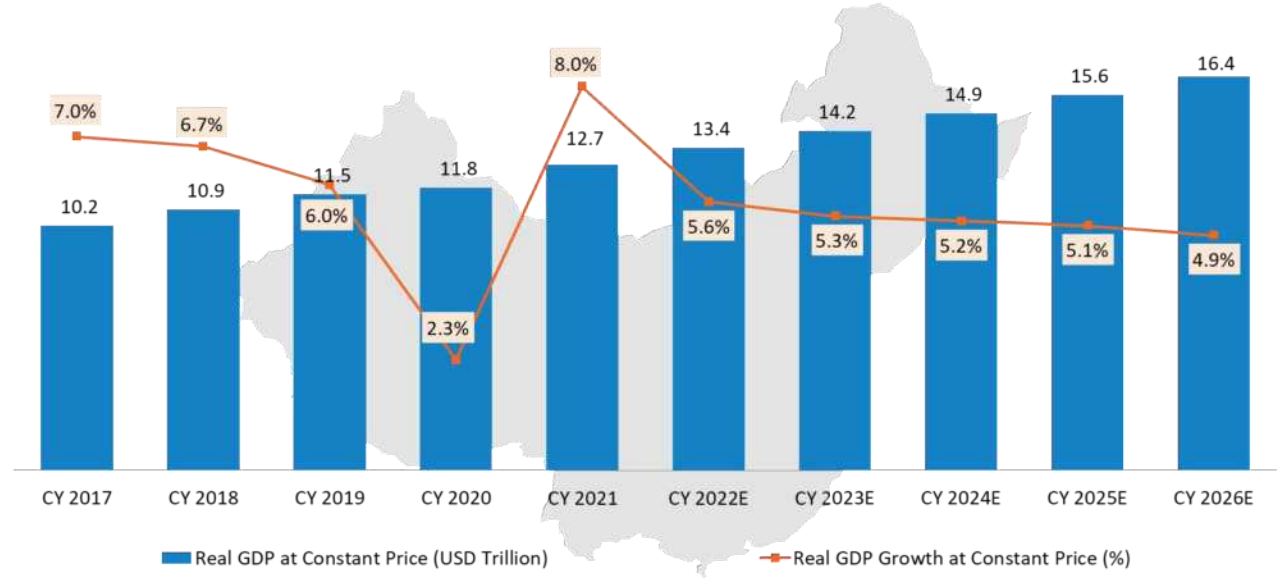
Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

C) China

China is the only large economy to register a positive GDP growth in a year when the global economy contracted by 3.3 %. China's economy had a positive growth of 2.3 % during 2020. The country has shown its resilience during the pandemic year and registered 8% GDP growth in 2021. Government focused on supporting Small and Medium Enterprise (SME's) and allowed delay of loan repayments. Though China's industrial economy showed positive signs, retail and investment industry remained weak and challenging.

However, the recent lockdowns, due to the wake of XE variant of COVID-19, has created some disruptions in select regions of China. It presents fresh challenges for the authorities to protect its population, while ensuring that the economy is not excessively strained. Owing to these factors, 2022 targets will be challenging to meet.

Chart 1.6: Real GDP and real GDP growth (annual percentage change), China, value in USD trillion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

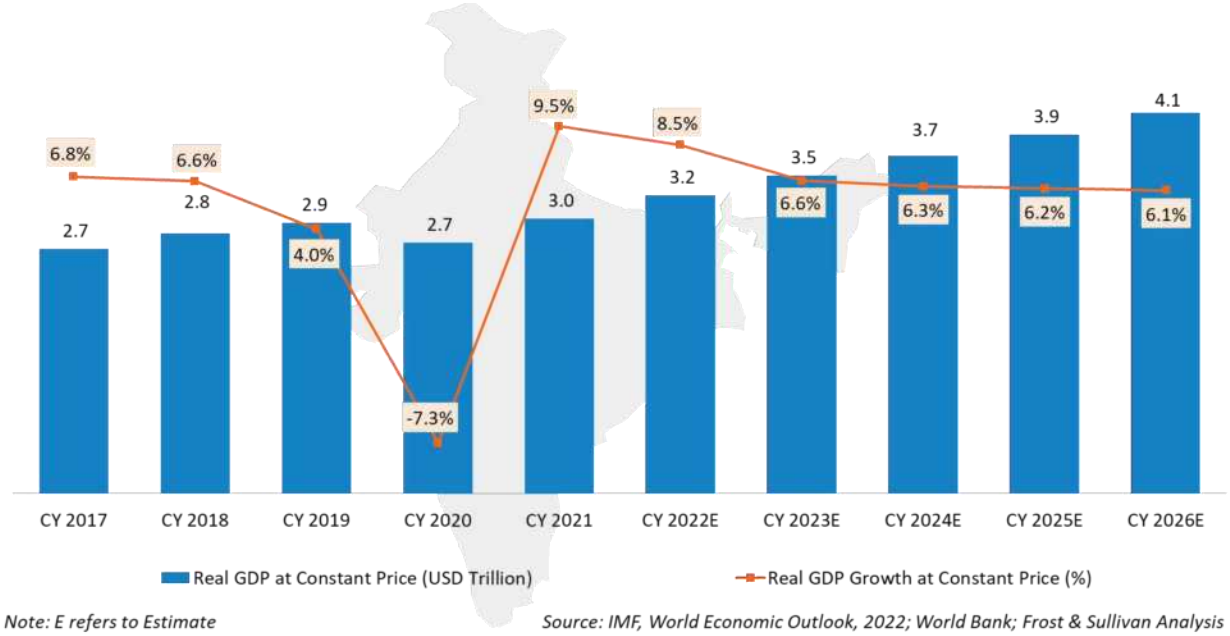
Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

The Ukraine crisis will add to challenges as China faces soaring commodity prices. But with its past record of handling similar outbreaks, it is expected that China will suppress the outbreak before it gets out of control, however it may come at some economic cost.

D) India

The Indian economy continued to grow between 2017 and 2019. However, there was a moderation in the growth rate during these years. As the Government was taking various measures to counter this slowdown, COVID-19 created havoc in 2020 which resulted in ~ 7.3% contraction of the country's economy. This was worst ever economic performance by India, worst year in terms of economic contraction in the country's history and much worse than the overall contraction in the world. Unemployment rate was more than 20% in April and May 2020 and individual income dropped by more than 40% during this period. Private consumption, the mainstay of aggregate demand, was severely affected by the pandemic. As per NSO estimate, Private Final Consumption Expenditure (PFCE) contracted by 9.0 per cent in 2020-21, reflecting impact of the stringent nation-wide lockdown and social distancing norms, heightened uncertainty as a result of transitory and permanent job losses, closures of small, micro and unincorporated businesses and wage resets.

Chart 1.7: Real GDP and real GDP growth (annual percentage change), India, value in USD trillion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

However, the country showed tremendous resilience in these difficult times and macroeconomic indicators started improving gradually since Q3 2020. The medium term growth outlook is positive and country recorded a growth of 9.5% in 2021, on account of strong macroeconomic fundamentals including moderate inflation, implementation of key structural reforms and improved fiscal and monetary policies. Among all large economies, India is demonstrating a rapid and sustainable growth post COVID-19, driven by strong manufacturing-led industrial expansion and consumption demands from the private sector.

One of the key reasons for the anticipated growth of Indian economy is the country's focus on the manufacturing sector. Indian manufacturing sector's contribution has increased from 16 % to over 18 % in the past 10 years buoyed by initiatives like the "Make In India" and sector specific initiatives to various manufacturing companies that aim to make India a global manufacturing destination.

For the Electronics industry, The National Policy on Electronics (NPE 2019) aims to position India as a global hub for Electronics System Design and Manufacturing (ESDM) by encouraging and driving capabilities in the country for developing core components, including chipsets, and creating an enabling environment for the industry to compete globally. The NPE 2019 also envisions the creation of a vibrant and dynamic semiconductor design ecosystem in the country by way of incentivizing the start-ups and making design infrastructure accessible to them. Towards this, the Govt. has promoted entire ecosystem of the Indian electronics industry through incentive schemes such as;

- Incentive support to companies / consortia that are engaged in Silicon Semiconductor Fabs, Display Fabs and Compound Semiconductors / Silicon Photonics / Sensors (including MEMS) Fabs

Semiconductor Packaging (ATMP / OSAT) and Semiconductor Design (Design Linked Incentive or DLI);

- Production Linked Incentive (PLI) for IT hardware and large scale electronics manufacturing

These incentive schemes will boost investment in the entire value chain of the Indian electronics industry include designing and ensure local availability of components (Integrated Circuits (ICs), Chipsets, System of Chips (SoCs), Systems or IP Core etc.) and enable Indian Electronics industry more self-reliant and export oriented. Development of local manufacturing ecosystem will strengthen the local supply chain thereby improving time to market, reducing lead times, saving precious foreign exchange, reducing component and logistics costs, and making electronics products more affordable in the coming years.

The pandemic also created unique growth opportunity for India. Supply chain disruption during the pandemic has forced many countries and organization to re-think on their sourcing strategy and to reduce dependency on one country for the entire supplies. These large companies started looking for alternate low-cost manufacturing locations in South East Asia and South Asia and India has emerged as one of the sought after investment destinations for many of these organization. As there would be re-alignment of global supply chain in the coming years, India is likely to benefit immensely from these strategic decisions and likely to become a manufacturing powerhouse in the coming years. Favourable business environment, liberal FDI norms, constantly improving 'Ease of Doing Business' rankings, enormous consumer base and rapidly improving digital infrastructure are some of the key factors that will drive investment in India in the coming years.

Moving forward, the Indian Economy is expected to register an 8.5% growth in 2022. According to Frost and Sullivan analysis, despite the ongoing war between Russia – Ukraine, India has limited direct exposure. The impact of the Russia – Ukraine war will be a combination of some supply disruptions and the ongoing terms of trade shock that will likely phase-out in the coming months.

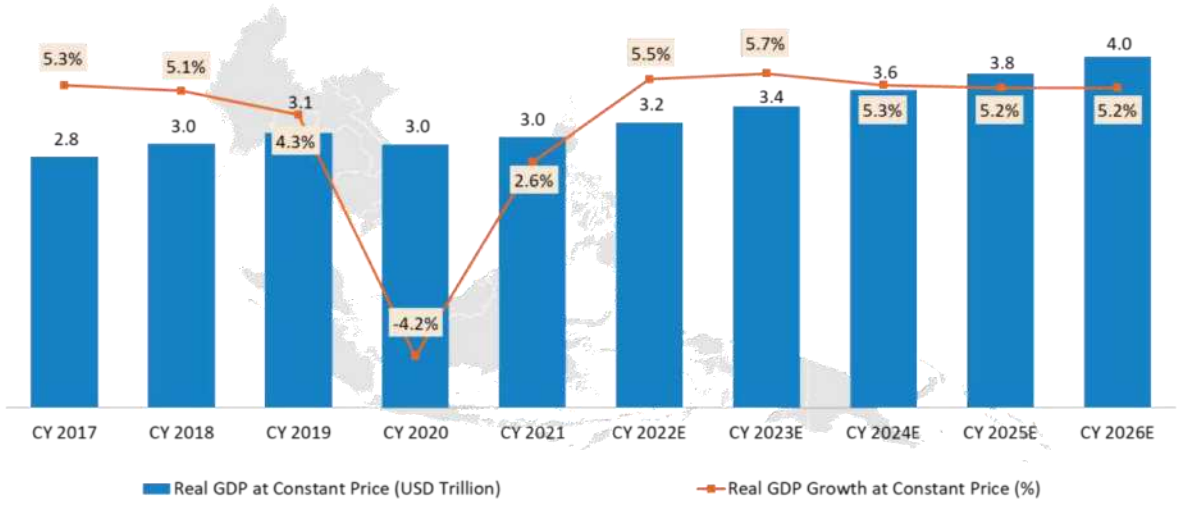
E) South East Asia (SEA)

For the first time in 20 years, due to the economic downturn, the poverty rate in South Eastern Asia is expected to increase. Trade and other sectors are experiencing a sharp decline in the region and likely to recover at a much slower rate due to recurring waves and imposition of multiple lockdowns.

Following the COVID-19 pandemic, South East Asia went through socioeconomic crises, with GDP falling by 4.2 % in 2020. Declining tourism and businesses had caused sharp downturn in the overall economy of the region. Low material movements and lockdowns affected countries dependent on trade and tourism especially Singapore, Vietnam, Cambodia, Malaysia and Thailand. Also, reduced remittance has negatively impacting the economic growth of countries such as Philippines and Taiwan. According to the recent International Monetary Fund projections, the region is expected to register GDP growth of 5.5%, 5.7% and 5.3% in 2022, 2023 and 2024. Although the outlook is shadowed by uncertainty, three major elements have shaped Southeast Asia's experience with the crisis thus far and will be critical in the following years (a) Controlling the virus through vaccine drives (b) Role of international trade (c) Responsiveness of the macroeconomic policy.

With the US China trade war and the economies are showing remarkable recovery from the impact of COVID-19, the focus of global growth is shifting towards South East Asia. With a rapid growth in urbanization and industrialization, high proportion of young population, digitization, and growing access to education and employment, South East Asia is set to emerge as one of the manufacturing hotspots in the coming years.

Chart 1.8: Real GDP and real GDP growth (annual percentage change), South East Asia, value in USD trillion, growth in %, CY2017-CY2026E



**List of South East Asian countries: Brunei, Burma (Myanmar), Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand and Vietnam.*

Note: E refers to Estimate

Source: IMF, World Economic Outlook, 2022; World Bank; Frost & Sullivan Analysis

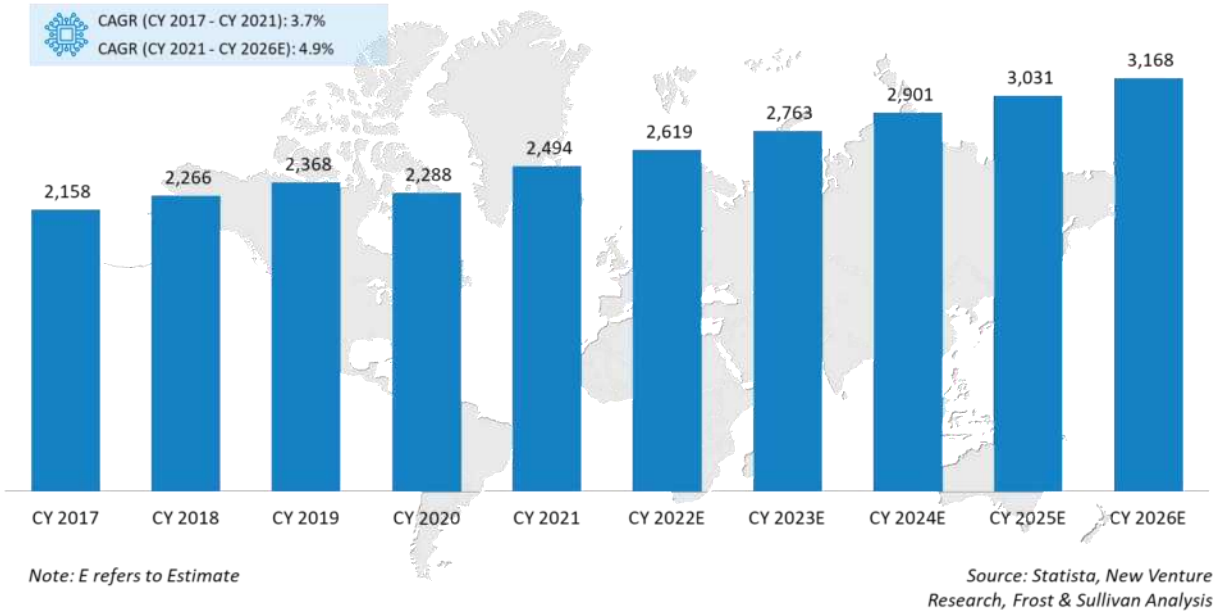
CHAPTER 2 - GLOBAL ELECTRONICS INDUSTRY OVERVIEW

Global Electronics industry

The global electronics industry has evolved tremendously over the last 60 years. Global demand for 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 decline in private expenditure triggered by the COVID-19 pandemic.

The global electronics industry was valued at USD 2,288 billion in 2020 and grew to USD 2,494 billion in 2021. As per Frost & Sullivan 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, inclination of the youth towards next gen technologies, emergence of e-commerce, rising demand from rural markets especially for washing machines and mobile phones, etc.

Chart 2.1: Overall Electronics industry, global, value in USD billion, growth in %, CY2017-CY2026E



Note: E refers to Estimate

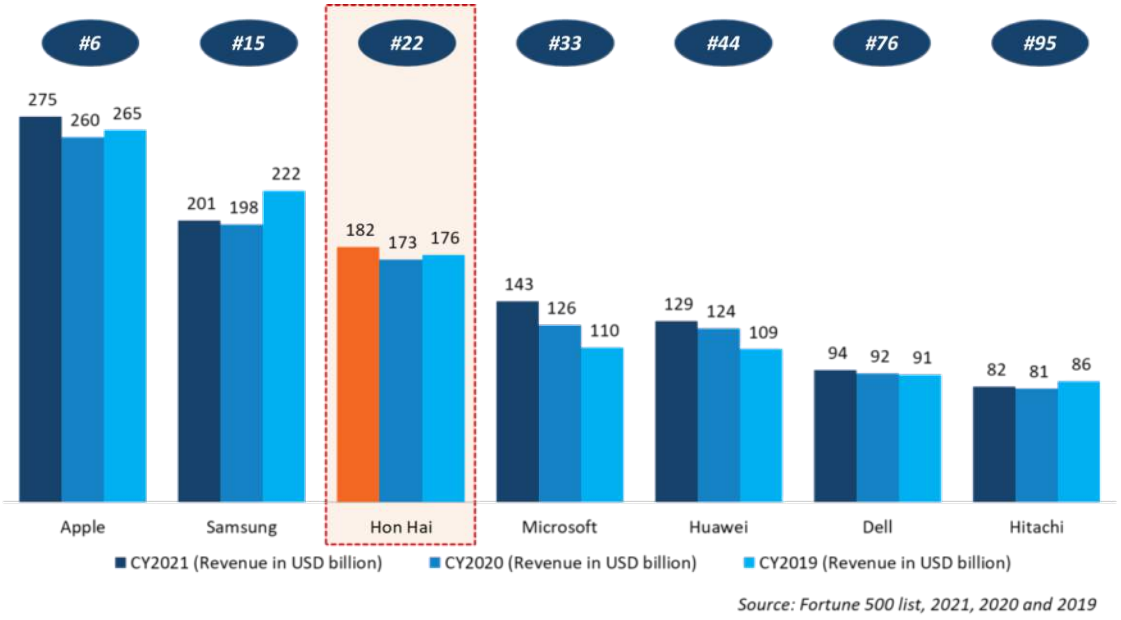
Source: Statista, New Venture Research, Frost & Sullivan Analysis

Established in Taiwan in 1974, Hon Hai Technology Group (also known as Foxconn and the parent company of Bharat FIH) is the world's largest electronics manufacturing service provider. The group has been ranked 22 among Fortune Global 500 companies in 2021, 4 places higher than its rank in 2020.

Foxconn is also the leading technological solution provider, and it continuously leverages its expertise in software and hardware to integrate its unique manufacturing systems with emerging technologies. By capitalizing on its expertise in Cloud Computing, Mobile Devices, IoT, Big Data, AI, Smart Networks, and Robotics / Automation, the Group has expanded not only its capabilities into the development of electric vehicles, digital health and robotics, but also into three key technologies –AI, semiconductors and new-

generation communications technology – which are key to driving its long-term growth strategy and into the four core product pillars: Consumer Products, Enterprise Products, Computing Products and Components and Others.

Chart 2.2: Fortune global 500 companies, CY2019, CY2020 and CY2021



Source: Fortune 500 list, 2021, 2020 and 2019

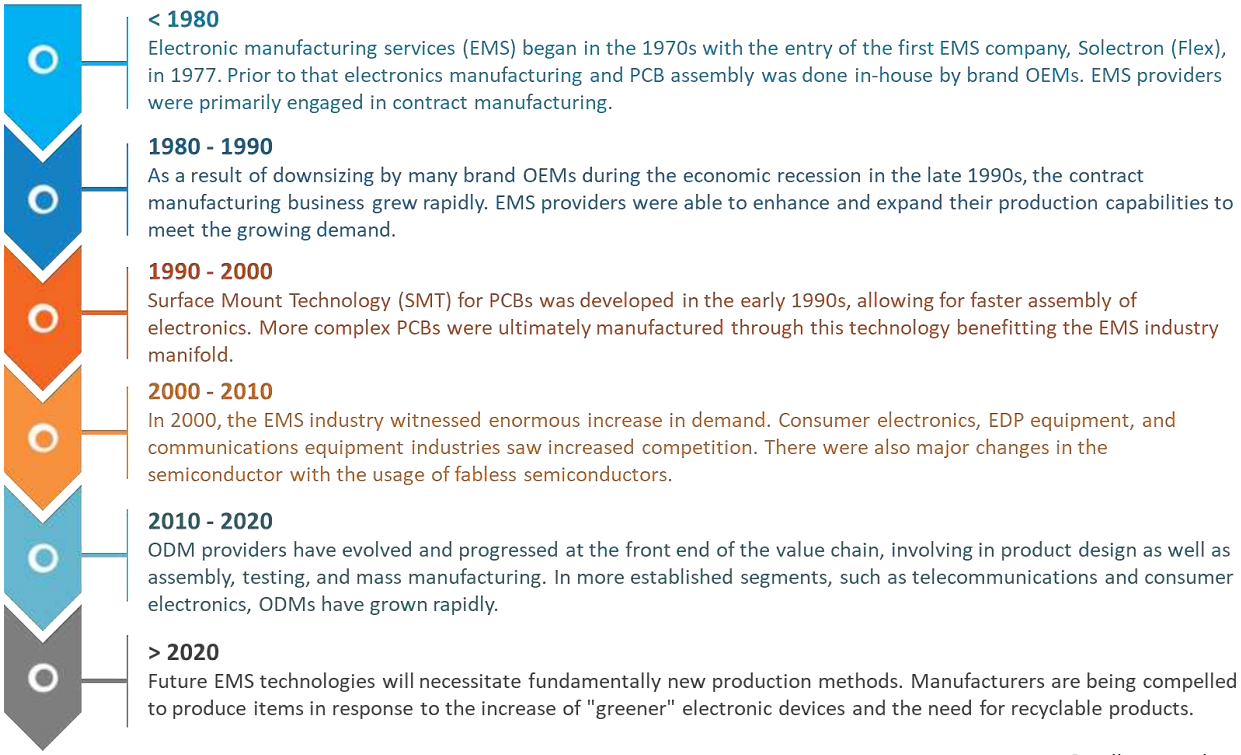
Introduction to Electronics Manufacturing Services (EMS) Industry

The global electronics manufacturing services market is traditionally comprised of companies that manufacture electronic products, predominantly assembling components on printed circuit boards (PCBs) and box builds for major brands. Today, brands are seeing more value from EMS companies, leading to involvement beyond just manufacturing services to include product design and development, testing, and aftersales services such as repair, remanufacturing, marketing, and product lifecycle management.

Evolution of Global EMS industry

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 the manufacturing capacity of the brands. By the mid-1990s, the advantages of the EMS concept became extremely evident and major brands started outsourcing PCB assembly on a large scale. By the end of the 1990s and early 2000s, several brands having their own manufacturing facilities sold their assembly plants to the EMS players, aggressively striving for 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.

Chart 2.3: Evolution of EMS industry, Global, CY2021



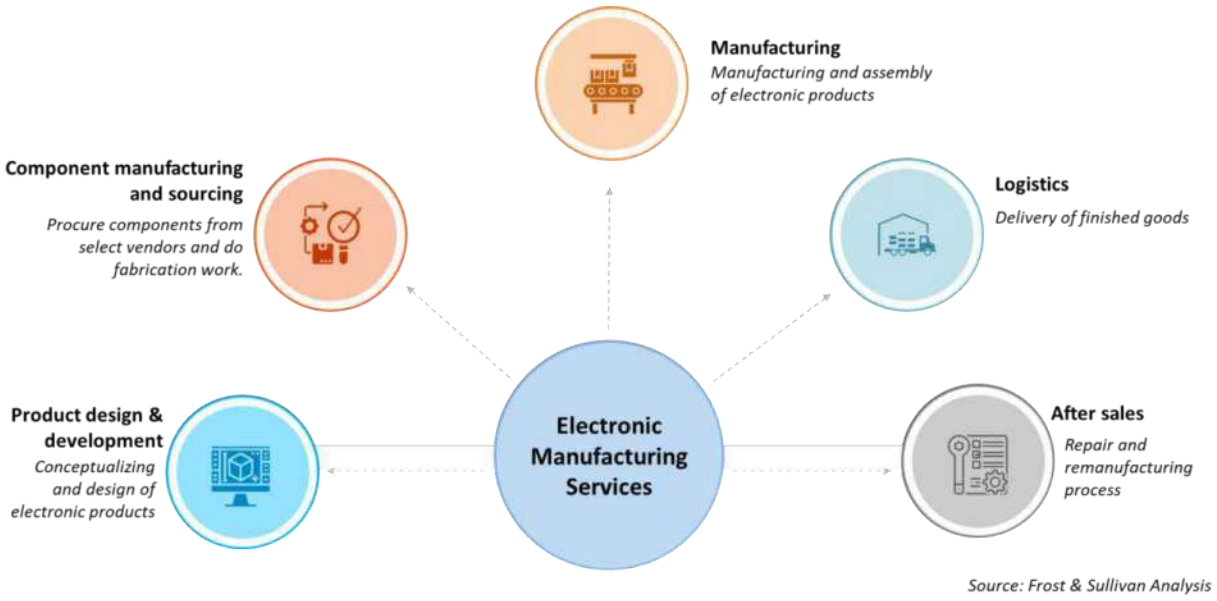
Source: Frost & Sullivan Analysis

As the technology advances, the size of the components and the circuits usually becomes smaller. With the demand for the 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 the 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 to the speedy transitions in the manufacturing space.

Range of services offered by EMS companies globally

EMS companies are equipped to provide a gamut of services which include design, assembly, manufacturing, and testing of electronic components for brands. These companies can be contracted at different points in the manufacturing process. While large EMS companies have the capability to offer an entire range of services starting from design, sourcing of components, assembly and testing (also known as ODM), small and mid-size EMS companies offer primarily assembly and testing services.

Chart 2.4: Range of services offered by EMS companies, Global, CY2021



Electronic manufacturing contains different levels of automation, depending on the capability of the service providers and the projects they can deliver. Corporations that yield large runs of products, typically employ heavily automated manufacturing. Service providers who specialise in the small production or prototypes, runs manual assembly of Printed Circuit Boards to save time and cost. Electronics manufacturing services differ by the service providers and an EMS company can provide any combination of the following: product design, prototyping, sourcing of components, PCB assembly, cable assembly, electro mechanical assembly, box assembly, testing and aftermarket services.

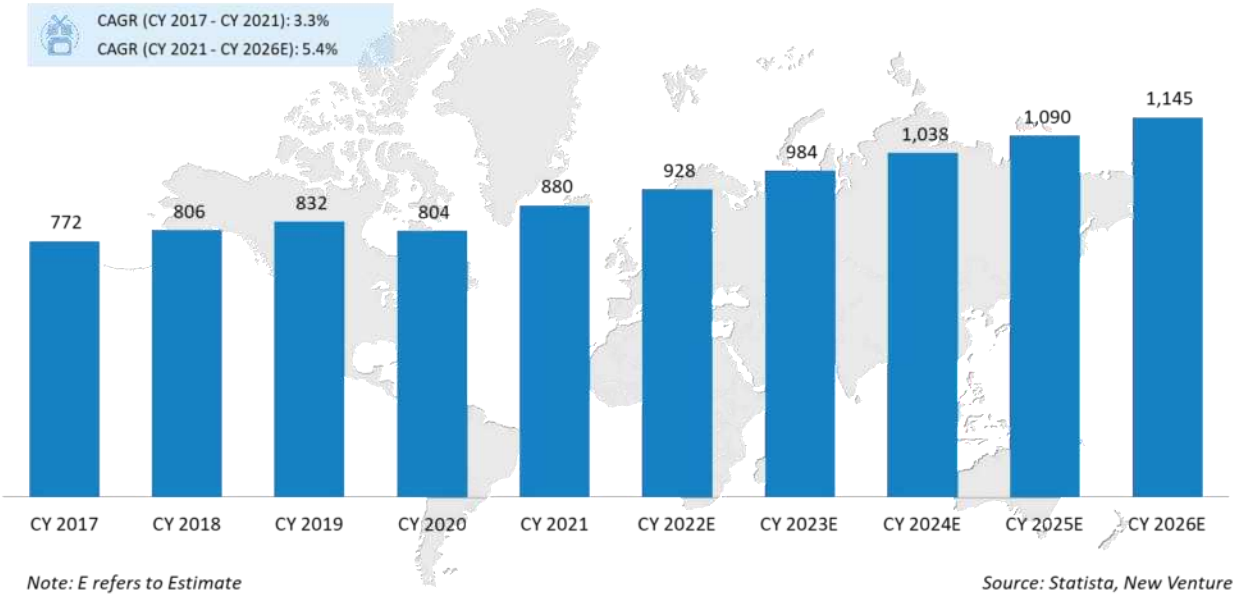
Globally the EMS market is well established and most service providers have high maturity levels in component fabrication, system assembly and testing. In the last few decades, the market has expanded to offer design and development services and after sales services such as repair and remanufacture, marketing, and product lifecycle management. Recently, some market participants have even started offering software solutions due to the increased penetration of digitization in the end markets they serve.

Size of 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. However, in 2019, the opportunities started stagnating due to multitude of factors. Firstly, decline of global automotive sales and saturation of consumer electronic sales. Secondly, supply chain restriction due to heightened trade tensions between US and China.

While the industry was still coming to terms with the above setbacks, a bigger blow was waiting for the industry in the form of the COVID-19 pandemic. The pandemic-induced lockdown produced an even more complicated environment for the industry affecting demand, supply, and manufacturing activities. Despite growing demand in the Q4, EMS industry recorded a 3.4% decline in 2020.

Chart 2.5: Electronics Manufacturing Services (EMS) Industry, Global, value in USD billion, CY2017-CY2026E



Note: E refers to Estimate

Source: Statista, New Venture Research, Frost & Sullivan Analysis

However the industry made a strong recovery in 2021 and grew by 9.5%. Certain factors worked in favour of the industry. These are

- The pent-up demand created by the need for life-sustaining medical devices
- The work-from-home economy, which created demand for smartphones, tablets, and laptops
- Increasing use of data has resulted in the need for data privacy and this is creating demand for large domestic servers. Growth in data analytics is also contributing to the growth of data serves, which in turn creates demand for electronics
- Adoption of Industry 4.0 across manufacturing segments
- Growth in 4G/ 5G networks
- Increasing adoption of clean energy/ renewable energy
- The push for climate change, which created demand for digitalization or digital software, products, or solutions that can track, monitor, measure, and verify sustainability initiatives.

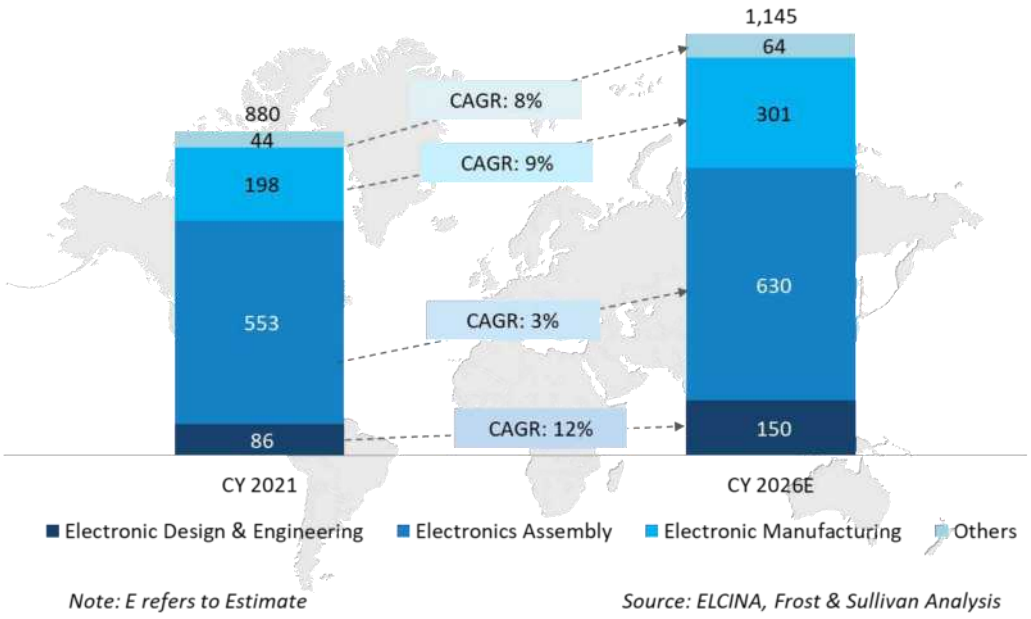
While EMS market has bounced back sharply, it is still grappling with supply side issues such as shortage of chipsets. The market is expected to face some challenges with supply chain in 2022, which will have a medium restraining effect. The issue is expected to be resolved through various measures including part localization. EMS providers are increasing their focus on the design aspects which would also add into their revenue stream going ahead. According to market participants, technological expertise would add to the competitive advantage of EMS providers and will increase their revenue opportunities.

Global EMS market dynamics

A. By services

Large EMS companies who have mastered the art of manufacturing and assembly, are now trying to move up in 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 9.7% in 2020 to 13% in 2026.

Chart 2.6: EMS market break-up by services, Global, value in USD billion, CY2021 and CY2026E



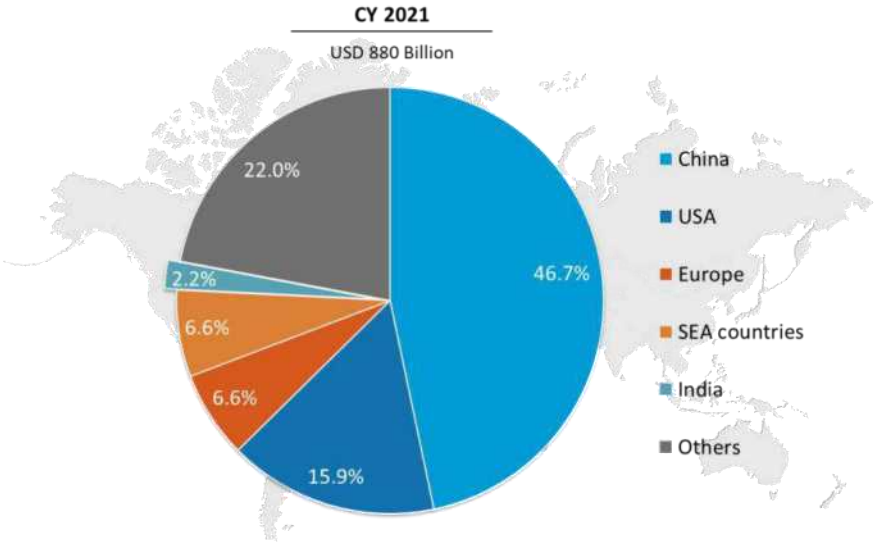
Note: E refers to Estimate

Source: ELCINA, Frost & Sullivan Analysis

B. By geography

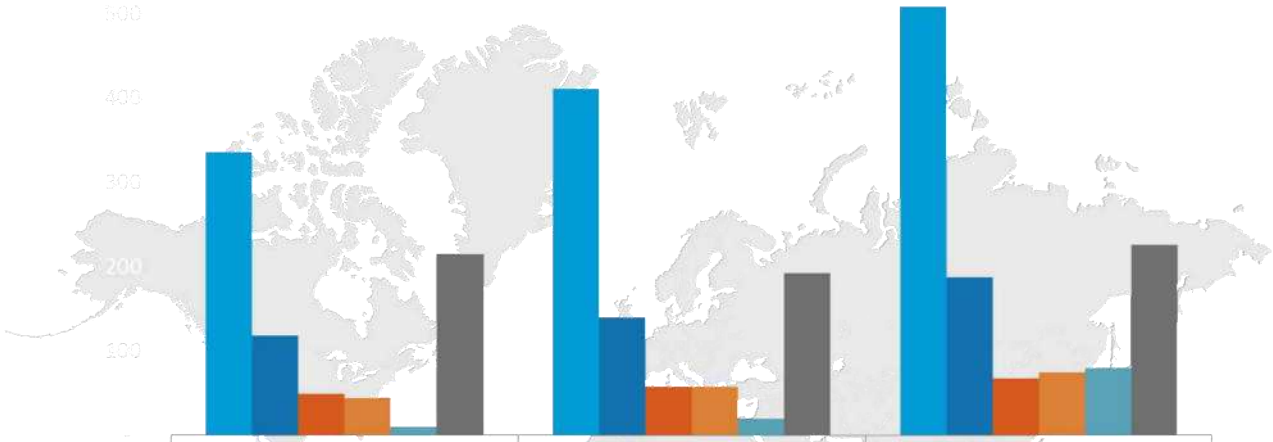
China leads the global EMS business with almost 46.7% share in CY2021. Its dominance in the global market is attributed to a blend of cost effectiveness and technological leadership in electronics manufacturing. It is a high growth region due to operational cost benefits, availability of a large number of highly skilled personnel, infrastructure, logistical advantages, and proximity to the largest end-user base across all end-user verticals.

Chart 2.7: EMS market break-up by select countries, Global, value in USD billion, in %, CY2021



Source: Frost & Sullivan Analysis

Chart 2.8: EMS market break-up by select countries, Global, value in USD billion, CY2017, CY2021 and CY2026E



	CY2017	Market share	CY2021	Market share	CY2026E	Market share
China	336	43.5%	411	46.7%	508	44.4%
USA	118	15.3%	140	15.9%	188	16.4%
Europe	49	6.4%	58	6.6%	68	5.9%
SEA	44	5.7%	58	6.6%	75	6.6%
India	10	1.3%	20	2.2%	80	7.0%
Others	215	27.8%	193	22.0%	226	19.7%

** Others include: Rest of Asia, Latin America (LATAM), Middle East & Africa (MEA)*

Note: E refers to Estimate

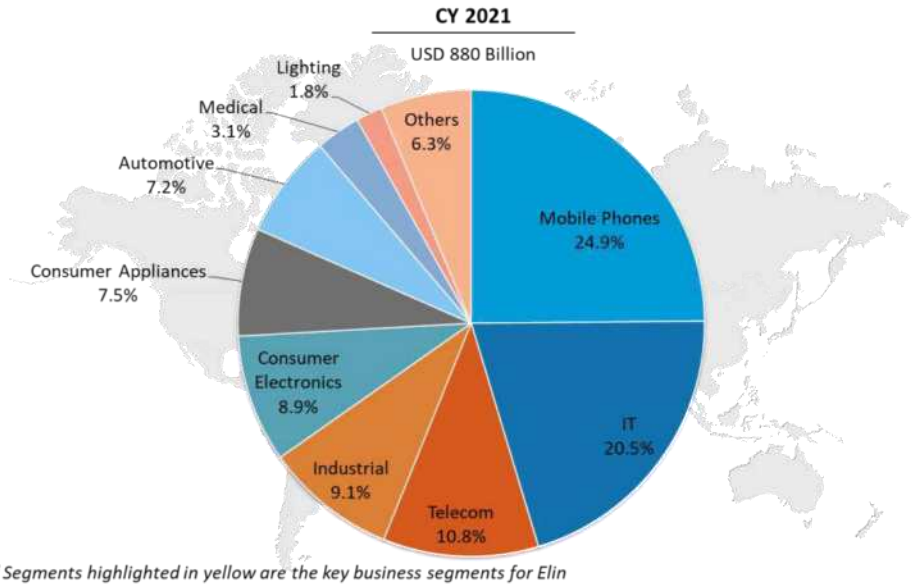
Source: Frost & Sullivan Analysis

However, post COVID-19 pandemic, many global electronics manufacturers are contemplating on China + 1 strategy and looking for alternate manufacturing locations for exports business. This is creating tremendous

investment potential for countries like Vietnam, India, and Philippines etc. India contributes to approximately 2.2% of the global EMS market in 2021. However, there is a strong push from the government to make India an ideal location for Electronics manufacturing in the region. Under the National Policy on Electronics (NPE), India announced various programmes in 2019, including EMC 2.0, to enhance the infrastructure of electronics manufacturing and offer incentives to manufacture more products that promote EMS in India. The PLI programme, which benefited electronics manufacturing firms, was introduced in 2020. In the southern state of Tamil Nadu, in Chennai, an EMS corridor is being built. The EMC Smart City investment in Greater Noida is planned at USD 162.7 million. Jabil, Dixon, Flextronics, SFO, Elin Electronics, Rangsons, Kaynes, and Centum are among the companies that have invested in manufacturing capacity as a result of Make in India policy efforts.

C. By end-user segments

Chart 2.9: EMS market break-up by industry applications, Global, value in USD billion, CY2021



 # Segments highlighted in yellow are the key business segments for Elin
** Others include: Aerospace & Defence, Energy, etc.*

Source: Frost & Sullivan Analysis

Products included under each industry application:

- ***Mobile Phones**: Smart Phones and Feature Phones*
- ***IT:** Computer, Laptops, Tablets, Printers, etc.*
- ***Telecom:** BTS, GPON, modems, routers, servers, etc.*
- ***Industrial**: Energy meters, HMS, PLC, SCADA, Inverter, etc.*
- ***Consumer Electronics**: Television, Air Conditioning, Washing Machine, etc.*
- ***Consumer Appliances**: Small appliances (Fans, Water Heater, etc.) and Kitchen appliances (Mixer-Grinder, Hand-blender, etc.)*
- ***Automotive**: ABS, AMT, Body Control Modules, Engine Control Unit, etc.*
- ***Medical**: All related medical electronic equipment*
- ***Lighting:** CFL, LED and LCU*
- ***Others:** Aerospace & Defence, Data centre & Cloud Storage, Energy, etc.*

Consumer appliances have had a consistent performance in the last few years, which is aided by growth in advanced economies and developing countries. EMS manufacturers have also profited from rising consumer

spending and technological improvements. Rising demand for smart solutions will fuel future growth. Furthermore, Brand and EMS manufacturers are progressively supplying both premium and mid-range appliances in order to meet the growing demand for both product categories and increase revenue.

LED lighting has grown from strength to strength over the last decade driven by energy efficiency regulations, widespread manufacturing and reduced prices of LED light sources. Smart LED lights have rapidly entered the residential market and widespread commercial adoption. Leading manufacturers are looking to add new applications into their portfolio by partnering with niche application providers.

Automotive is one of the key growth opportunity verticals for EMS providers in the next 5 years, due to the technology 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.

Medical devices electronics manufacturing services are a key revenue opportunity in the others segment. Though the COVID-19 pandemic had created a surge in demand for EMS in this vertical, it is important to carefully assess the demand level for the mid and long terms.

D. Competitive landscape of top 10 Global EMS companies

The global EMS market, which accounts for 35% of the total electronics industry, has developed into a significant market for electronics manufacturing. 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. Historically, EMS companies were engaged in the assembly of components on PCBs and box builds for OEMs. The OEMs are increasingly recognizing the value of EMS/ODM companies, resulting in involvement that extends beyond manufacturing services to include product design and development, testing, and after-sales support.

The global EMS market is addressed by more than 1,000 players. However, the top 10 players contribute to 53.6% of the market. Hon Hai Technology (Foxconn Group) is the market leader, accounting for 24.4% of the market in 2021 and 5x times larger than the nearest competitor. Pegatron, Quanta, Compal Wistron, Jabil and Flex are some of the leading players in the EMS market.

Foxconn, founded in 1974, is renowned for manufacturing highly advanced 3C electronics (communication, computing, and consumer) products. The company offers a wide range of design, manufacturing, and aftersales services. Foxconn group has enhanced its focus on design services which is specifically evident from the R&D activities, which has the highest spend and number of patents among its competitors.

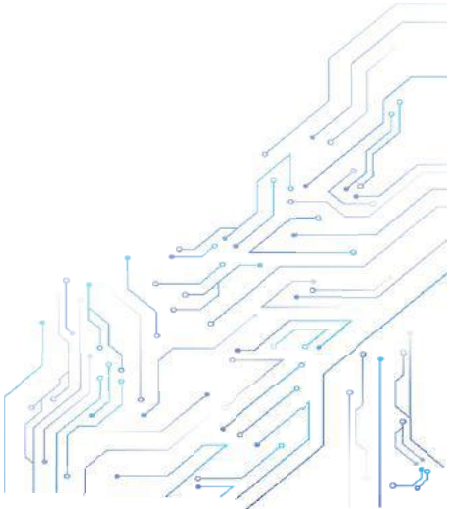
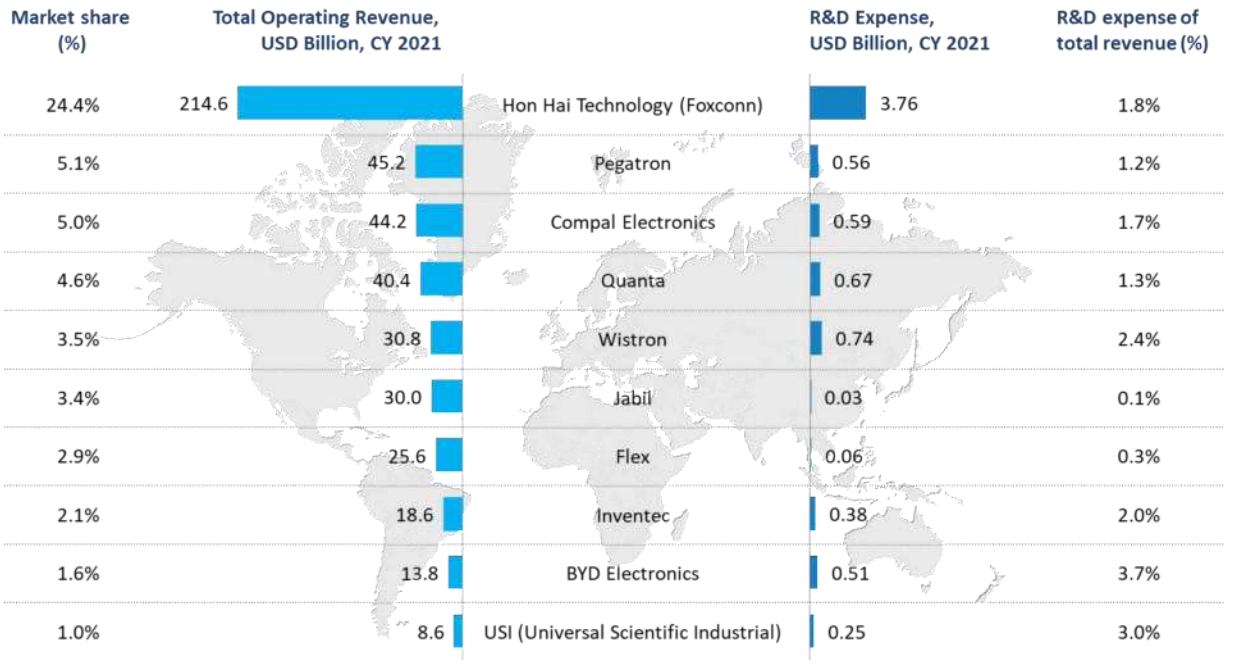


Chart 2.10: Operating revenue and R&D expense of top 10 EMS companies, Global, value in USD billion, CY2021



Source: Annual Reports (Company websites), Frost & Sullivan Analysis

Drivers and challenges for the growth of Global EMS industry

Key drivers for the growth of Global EMS industry

- **Technological advancements and acceptance of smart home devices**
- **Greater emphasis on vehicle electrification**
- **Technological upgrade of facilities**
- **Product development activities**
- **Accelerated demand post COVID-19**

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 subdue 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.

Challenges / market restraints hindering the growth of Global EMS industry

- **Presence of market participants is high**
- **Shrinking operating margin**
- **Complex structure and delay in supply chain**
- **Shortened product lifecycles and uncertain demand**
- **Regulations and violations of IP**
- **Skilled labour shortage**

Presence of market participants is high: Due to its strong growth potential, many companies are entering into the industry which is causing stiff competitions in the market .The existence of a high number of market participants in all areas results in competitive pricing, which reduces market revenue potential. Despite the fact that the market is seeing a number of mergers and acquisitions, Frost & Sullivan does not foresee a substantial beneficial impact.

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 difference 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

Geopolitical situation and their positive impact on the Indian EMS industry

US-China Trade War: Beginning in the early 2017, the Trump government began making threats of tariffs on the 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. 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.

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, it remains huge. Nevertheless, some decoupling trends in India also became visible in 2019/20, mainly owing to the pandemic which has paved the way for 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. On top of these challenging concerns, none of which have been fully resolved, the COVID-19 pandemic has caused major supply disruptions around the world. 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 of these companies such as Foxconn, Wistron, Pegatron, etc. have all invested in manufacturing facilities in India which have given huge boost to the Indian EMS industry.

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

Impact of Global chip shortage on 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 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.

Global vendor diversification: Global EMS players have presence in a number of countries and have a diverse range of products and services. Given the magnitude of manufacturing, global companies are expanding their product offerings across countries, through partnerships with multiple vendors rather than depending solely on a single vendor for electronic manufacturing services. As a result, there is tremendous potential for market expansion and the entry of new players into this industry.

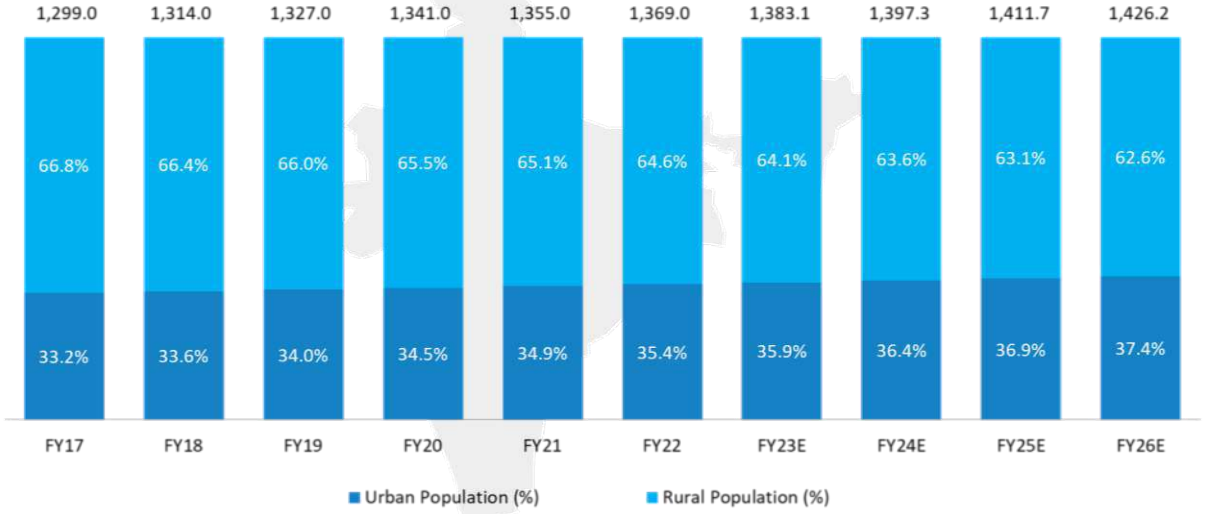
Given the rising population, manufacturers have an opportunity to diversify their production bases in order to tap into the domestic market. Furthermore, manufacturers would benefit from rising domestic demand for consumer electronics. Several large brands have announced capacity diversification in India with an aim to expand their manufacturing operations. This helps to upscale their benefits and also to help maintain a certain level of control over production quality.

CHAPTER 3 - INDIA'S MACROECONOMIC OUTLOOK

Population and urbanization in India

India is the world's second most populous country, with 1.35 billion people, or 17% of the world's total population. India's population is expected to grow at an average of 1.0% between FY22 and FY26. India's Gen Y constitutes a third of the country's population and will join the working-age group, forming 42% of the total working-age population by FY26. India is in the midst of a massive wave of urbanization. There has been a drastic increase in urban towns and cities in the country over the past few years. India's seven largest metropolitan areas - Mumbai, Delhi, Bengaluru, Kolkata, Chennai, Hyderabad, and Ahmedabad—dominate the country's economic landscape. A better standard of living and increasing opportunities in the cities have led to urbanization, which has further increased the burden on these cities in terms of the requirement for infrastructure and housing.

Chart 3.1: Urban Vs rural population in India, in %, India, FY17-FY26E



Note: E refers to Estimate *Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series; World Bank; Frost & Sullivan Analysis*

Employment opportunities and the opportunity for income generation across newly urbanised towns create a positive outlook for the consumption of electronic products. Urbanization is expected to be a major driver of the overall electronics market's growth, particularly for mobile phones, which are imperative for establishing and maintaining communication with family members. High-end technology adoption also contributes to the growth of consumer electronic devices. The introduction of significant technological transitions such as the Internet of Things (IoT) and 4G/LTE networks is rapidly increasing consumer electronics adoption. Also, rural markets will likely see increased demand for consumer electronics as the government aims to invest heavily in rural electrification.

India real GDP and nominal GDP

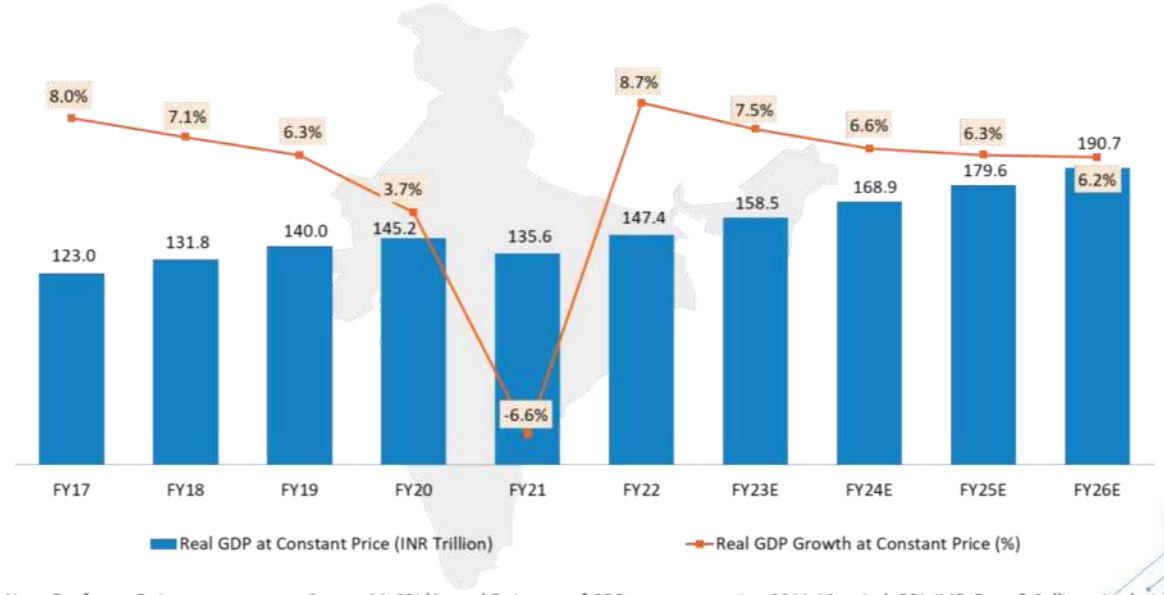
The last decade was a mix bag for the Indian economy and the country has seen see-saw movement in the GDP growth between 2010 and 2020. Indian real GDP growth has steadily increased from 5.5% in FY13 to 8% in FY17. The growth was robust and fundamentals were strong. However, the growth started slowing down since FY18 and the economy grew by a moderate 3.7% in FY20. Experts cited weak consumer demand and slow private investments as the key reasons for this moderation in growth.

While the Government was taking corrective measures, the economy received a jolt from COVID-19 pandemic in the beginning of FY21. During the first wave (March 2020 onwards), the Indian government had to enforce four-phase countrywide lockdown till May 2020 in order to curb the spread of the virus.

However, the economy started to bounce back since Q3 FY21 on the back of huge pent-up demand and festive season. While industries such as travel & tourism, aviation, hospitality, construction were impacted heavily, some of the industries such as healthcare, pharmaceuticals, e-commerce, and electronics products experienced phenomenal growth during this period.

The economy has recovered strongly in FY22 and achieved a growth of 8.7% to be back to the pre-Covid levels. As the size of the economy is expected to touch USD 5 trillion by 2026-27, the EMS sector has to play an important role in this journey.

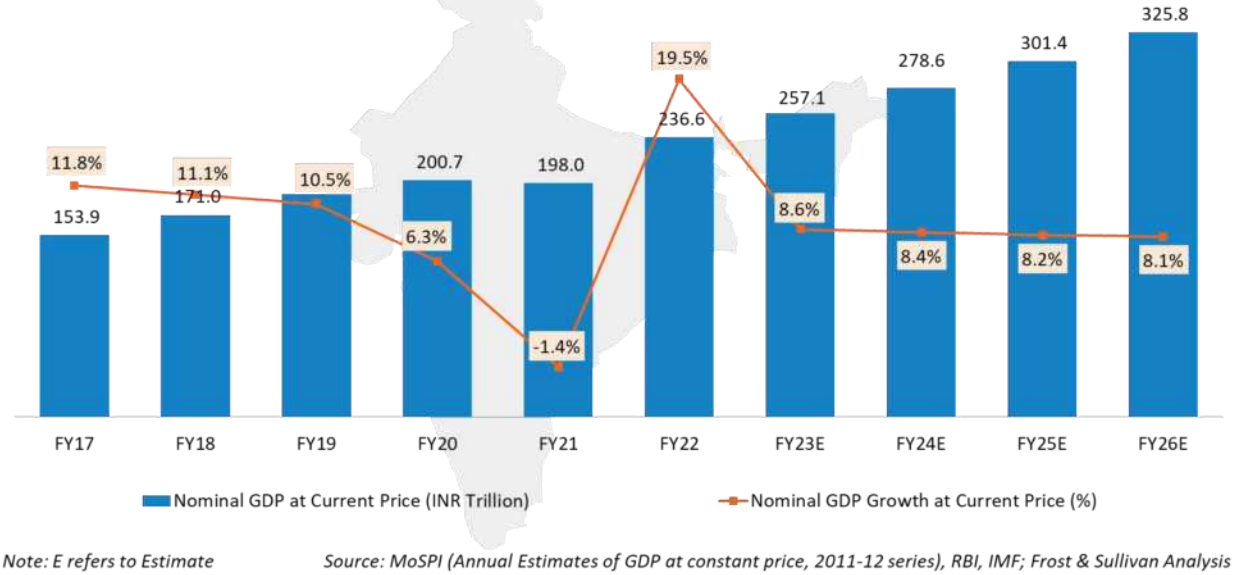
Chart 3.2: Annual real GDP and real GDP growth (annual percentage change), value in INR trillion, growth in %, India, FY17-FY26E



Note: E refers to Estimate

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), RBI, IMF; Frost & Sullivan Analysis

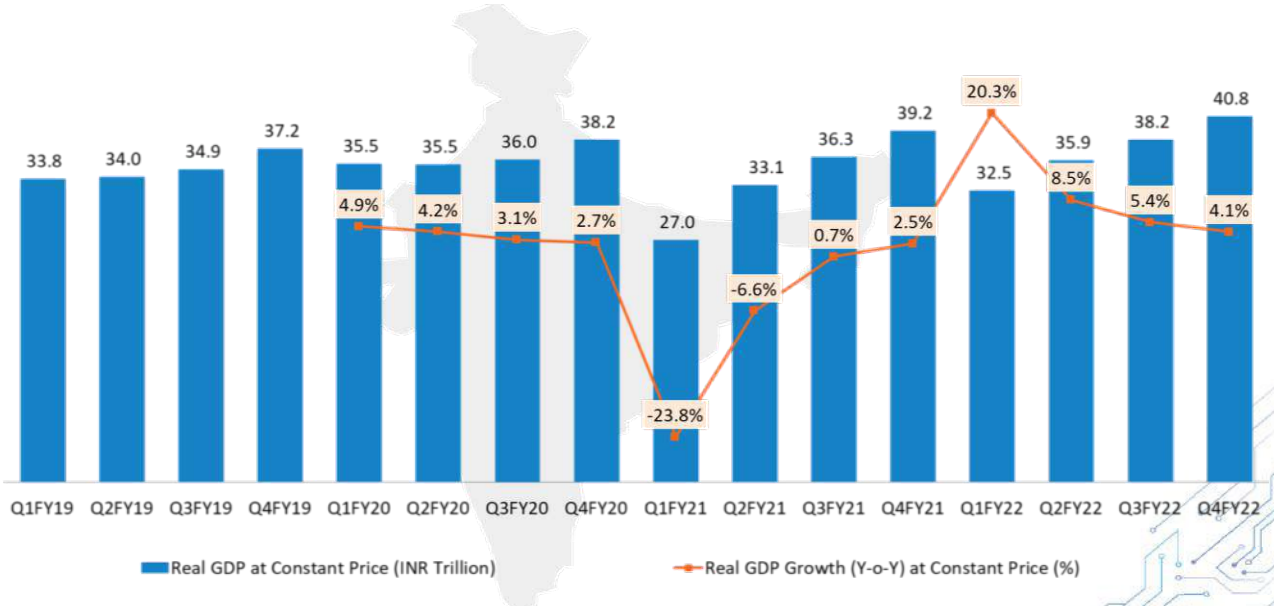
Chart 3.3: Annual nominal GDP and nominal GDP growth (annual percentage change), value in INR trillion, growth in %, India, FY17-FY26E



Note: E refers to Estimate

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), RBI, IMF; Frost & Sullivan Analysis

Chart 3.4: Quarterly real GDP and real GDP growth (quarterly percentage change), value in INR trillion, growth in %, India, Q1FY19-Q4FY22



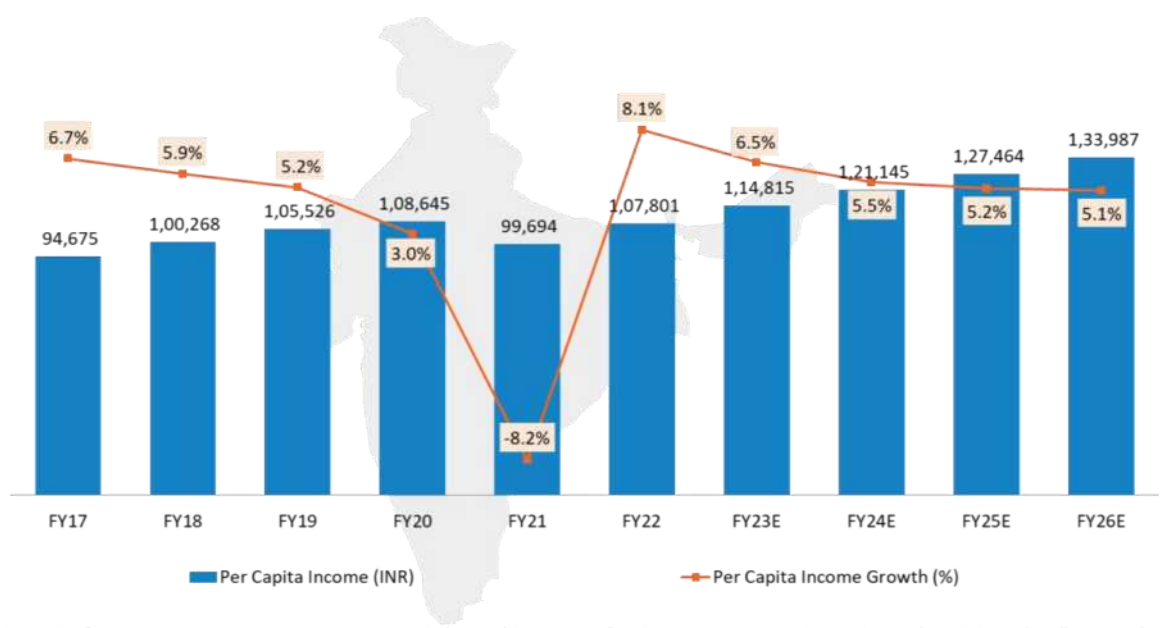
Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), RBI, IMF; Frost & Sullivan Analysis

Indian Government has taken slew of measures to bring the economy back into track. There is strong focus on 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 6.5% in the medium term.

Per capita income

The per capita income is a broad indicator of prosperity of an economy. India's per capita income, calculated in correlation to Real GDP, was INR 99,694 during FY21 compared to INR 108,645 in FY20, an approximate decline of 8.2%. As the economy is reviving, the per capita income increased by 8.1% during FY22 to touch INR 107,801. Post that, the growth is likely to be stable at approximately 5.6% CAGR over the medium term.

Chart 3.5: Per capita income and growth (annual percentage change), value in INR, growth in %, India, FY17-FY26E



Note: E refers to Estimate

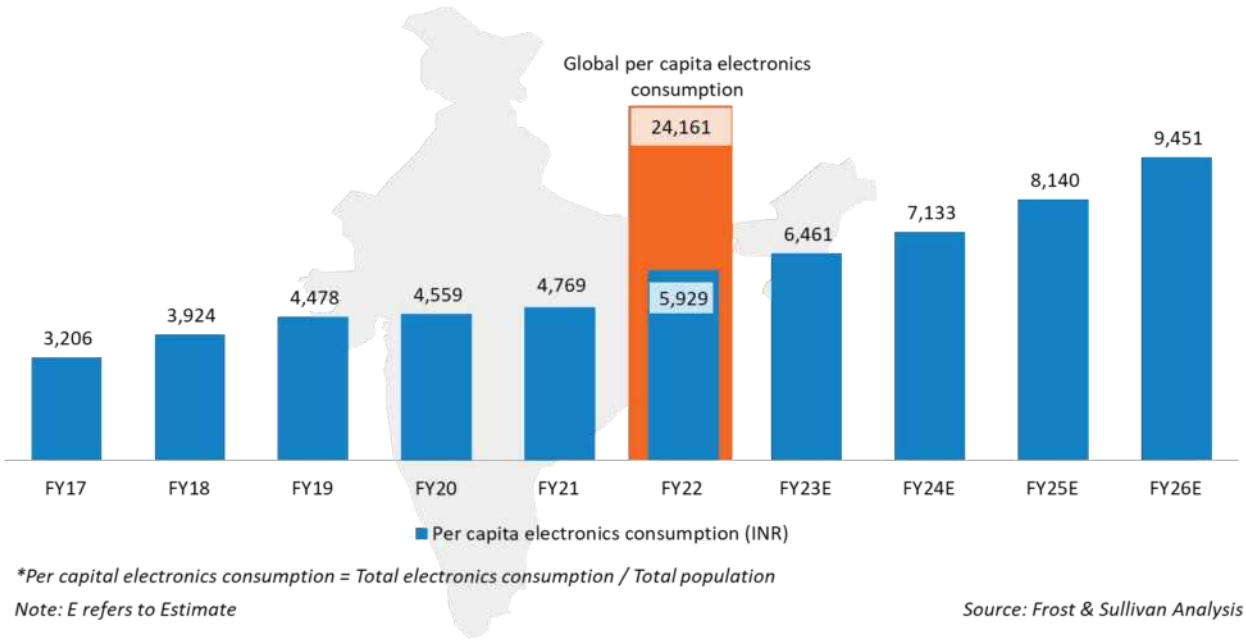
Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), IMF; Frost & Sullivan Analysis

Per capita Electronics consumption

At a global level, the per capita electronics consumption is increasing. India's per capita electronic usage is low compared to the worldwide average. Global per capita electronics consumption is 4.1 times that of India. While Indian government has initiated various measures to boost Indian domestic electronics manufacturing industry, the country has also witnessed 13.1% growth in electronics consumption between FY17 and FY22. Long term growth outlook for the industry is extremely positive, primarily because market penetration for many electronics products are still very low compared to global average. Besides factors such as stable growth outlook for the economy, Digital India programme, rising disposable incomes (proportion of mid & high income earners expected to increase from 64% in FY21 to 85% in FY30), changing

lifestyles, emerging work from home culture, expansion of organized retails to tier 2 & tier 3 cities[3], improving electricity and internet infrastructure, and better logistics infrastructure will provide additional impetus to the industry. It is with these strong fundamentals, many global electronics brands along with their supply chain partners have invested in electronics manufacturing infrastructure in the recent years and India is ready to become an important electronics manufacturing hub in the coming years.

Chart 3.6: Per capita Electronics consumption, value in INR, India, FY17-FY26E



**Per capital electronics consumption = Total electronics consumption / Total population*

Note: E refers to Estimate

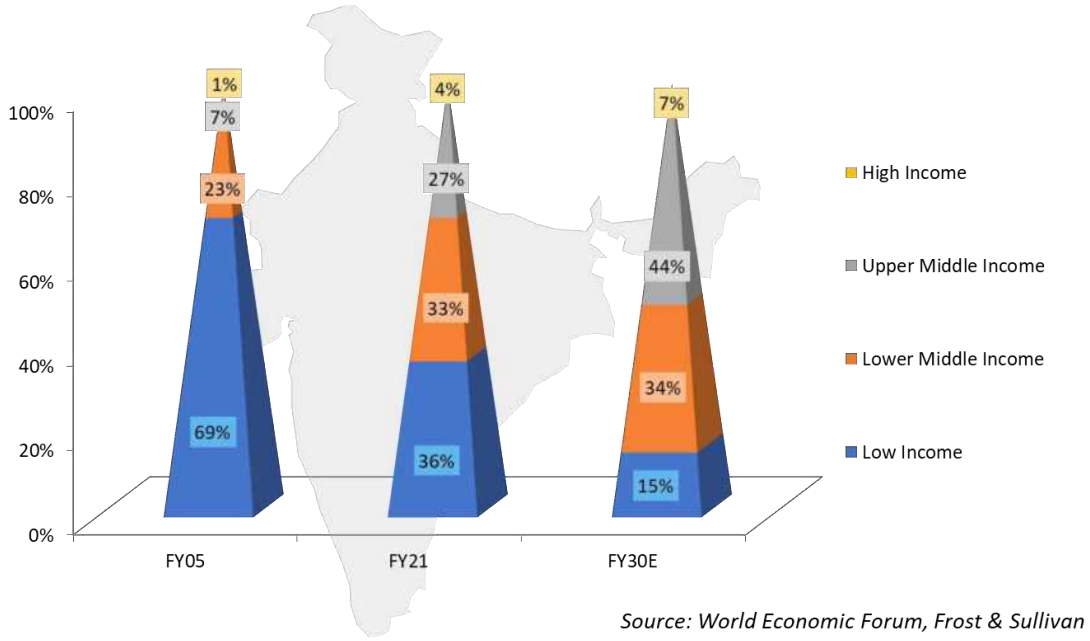
Source: Frost & Sullivan Analysis

Consumer pyramid in India basis income levels - past and future projections

Robust economic development, growing population, relatively slower ageing, rising income levels coupled with urbanization would result in over 500 million additional middle class and high income owner being added to the country's economy by FY30 effectively pushing the share of upper middle class and high income earners to nearly 51% of the population by FY30. The lower middle class will also witness an increasing share in total consumption rising from an estimated 33% in FY21 to over 34% by FY30 with total low income group decreasing from 36% to 15% during the same period. By FY30, India is also expected to have the largest working age population at the youngest relative age effectively resulting in higher income generating opportunities and rising contribution to consumer spending. Growing urbanization and rising income levels will lead to a significant shift in consumption patterns. Frost & Sullivan believes that the Indian market and consumers are primed to create a demand for consumer electronics across all price ranges.

[3] *Tier classification of cities - As per RBI, Indian cities are classified as tier 1,2 and 3 based on the size of population. Tier 1 (> 100,000); Tier 2 (50,000-100,000); Tier 3(20,000-50,000)*

Chart 3.7: Evolution of income levels, in %, India, FY05, FY21 and FY30E



Source: World Economic Forum, Frost & Sullivan

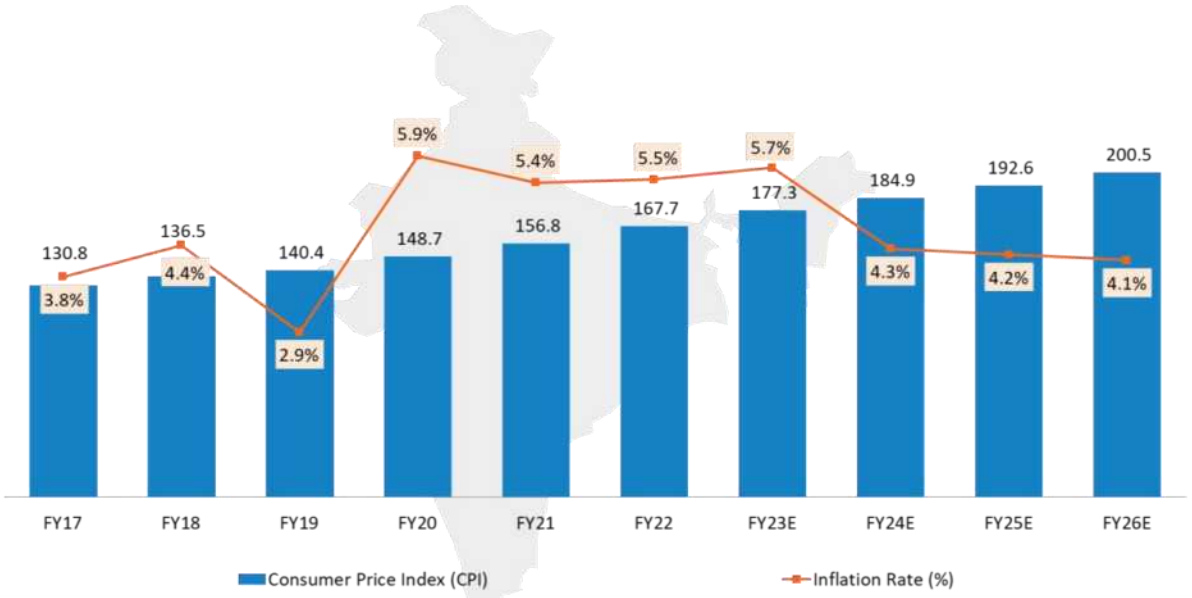
In FY21, consumer's spending on communication equipment and services including mobile phones accounted for 2% of their total spending. While it is a known fact that Indian consumers are price sensitive, their purchase behaviour is evolving in the recent times. Although price still remains an important consideration, Indian consumers have now started become more quality conscious. The key trigger for this shift has been the exposure to modern lifestyle and media which provides a perspective on various products and their benefits.

Consumer Price Index (CPI) and Inflation

Inflation has been trending lower since FY19, which was a positive sign for the consumption economy since customers can then afford to purchase more products, providing the necessary fuel to the manufacturing sector. However, inflation rate has almost doubled in FY20 remained at that level till FY22. Rising inflation has been emerged as a key macroeconomic concern in the recent months with prices of almost every commodity has touched new heights. Going forward, the trajectory of inflation will be governed by multiple factors such as global commodity prices, crude prices etc.

As always, The RBI has to strike a balance between managing growth and inflation in the face of weak consumer demand. RBI in the next six to eight months will work on reversing effects of inflation. The inflation rate is likely to ease out in the near future and stabilize at around 4.6% CAGR in the medium term.

Chart 3.8: Consumer Price Index (CPI) and annual Inflation rate, index in number, rate in %, India, FY17-FY26E

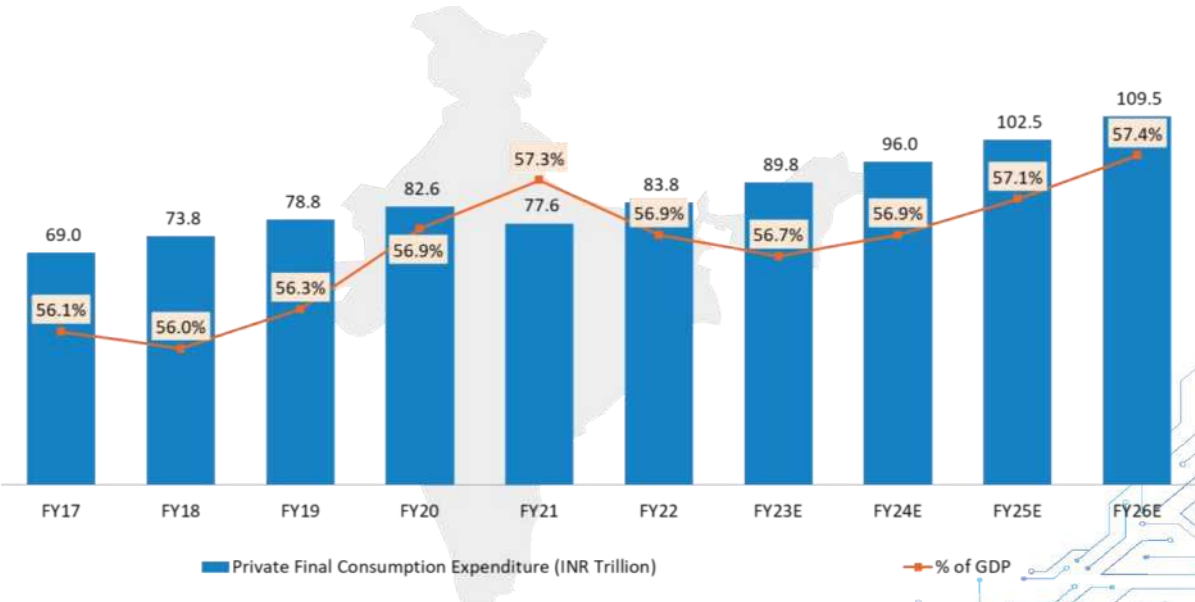


Note: E refers to Estimate

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), IMF; Frost & Sullivan Analysis

Private Final Consumption Expenditure

Chart 3.9: Private Final Consumption Expenditure and contribution to Real GDP, Value in INR Trillion, % of GDP, India, FY17-FY26E



Note: E refers to Estimate

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), IMF; Frost & Sullivan Analysis

India's Private Final Consumption Expenditure (PFCE) has increased by 8.0% in FY22. Due to COVID-19 pandemic, the FY21 PFCE was not only 9.1% lower than FY20; it was also 4.1% lower than FY19. Consumption expenditure growth has been slowing through the last decade. This shrinking of consumption expenditure had a direct impact on the intermediate industries that feed India's consumption engine. As the threat and uncertainty around COVID-19 has significantly declined, consumer confidence is back and PFCE has reached pre-COVID levels in FY22. In the next few years the PFCE is expected to be stable at approximately 56% in the medium term. The PFCE is expected to grow at a CAGR of 6.9% between FY22 and FY26.

Index of Industrial Production (IIP)

Due to the pandemic, the investment activity was sluggish from March to May 2020. Project completions were delayed, and industrial activities remained muted during this period. India's Index of industrial production (IIP) rose compared to contraction a year ago. This is mostly on account of improved performance in mining and electricity sectors.

The manufacturing sector constitutes around 24% of the IIP. Manufacturing businesses reported that output, order books, and employment have improved in the FY22. Availability of finance from banks, internal accruals and foreign sources has also improved during the quarter. There has been increase in the industrial activity since June 2021, which continued to gain momentum through FY22. The key indicators sustained their pace with further relaxation of lockdowns. Furthermore, the year saw increase in consumer activity on the ground, which gathered pace with the impending festive season.

Chart 3.10: Index of Industrial Production based on sector, index in nos., India, FY15-FY22

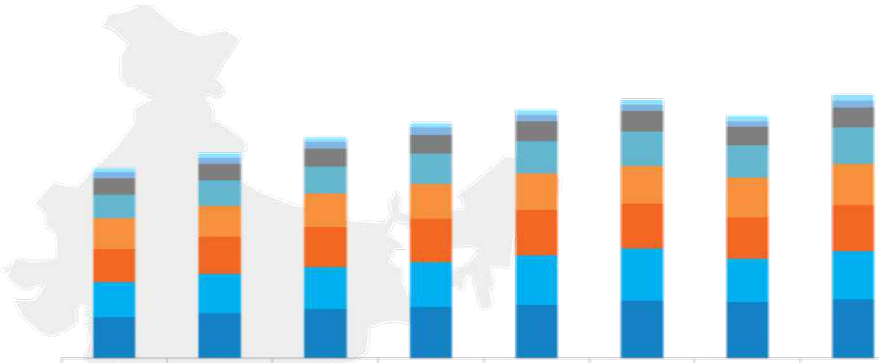
	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
General	111.0	114.7	120.0	125.3	129.8	129.0	117.9	130.0
Mining	93.3	97.3	102.5	104.9	107.9	109.6	101.0	110.4
Manufacturing	112.7	115.9	121.0	126.6	131.0	129.6	116.9	129.6
Electricity	126.6	133.8	141.6	149.2	156.9	158.4	157.6	168.2

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series); RBI (Reserve Bank of India); Frost & Sullivan Analysis

Gross Value Added (GVA) at basic price by economic activity

The Indian GVA increased better than the advance forecast in FY 2022. However, GVA showed moderate growth to reach pre-COVID levels. Consistent opening of the economy and updated receipts of GST data for the third and fourth quarters, have equally contributed to this increase. Manufacturing sector growth rebounded strongly and surged to 12% in FY22, compared to a decline of 4.7% a year ago.

Chart 3.11: Gross Value Added (GVA) at basic price by economic activity, value in INR trillion, FY15-FY22



	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
Electricity, Gas, Water supply & Other utility	2.1	2.2	2.5	2.7	2.9	3.0	3.1	3.3
Mining & Quarying	2.9	3.3	3.5	3.7	3.3	3.2	2.9	3.4
Construction	8.4	8.7	9.2	9.6	10.3	10.4	9.5	10.5
Public administration, Defence & Other services	12.0	12.8	13.9	15.3	16.2	17.6	16.8	18.6
Agriculture, Forestry & Fishing	16.1	16.2	17.2	18.3	18.9	19.7	20.4	21.2
Manufacturing	16.9	19.0	20.6	21.9	23.3	22.7	21.1	23.7
Trade, Hotels, Transport & Communication services	18.0	19.9	21.5	23.1	25.4	27.0	22.1	24.7
Financial, Real estate & Professional services	20.8	23.0	24.9	26.1	27.2	29.2	28.7	29.9

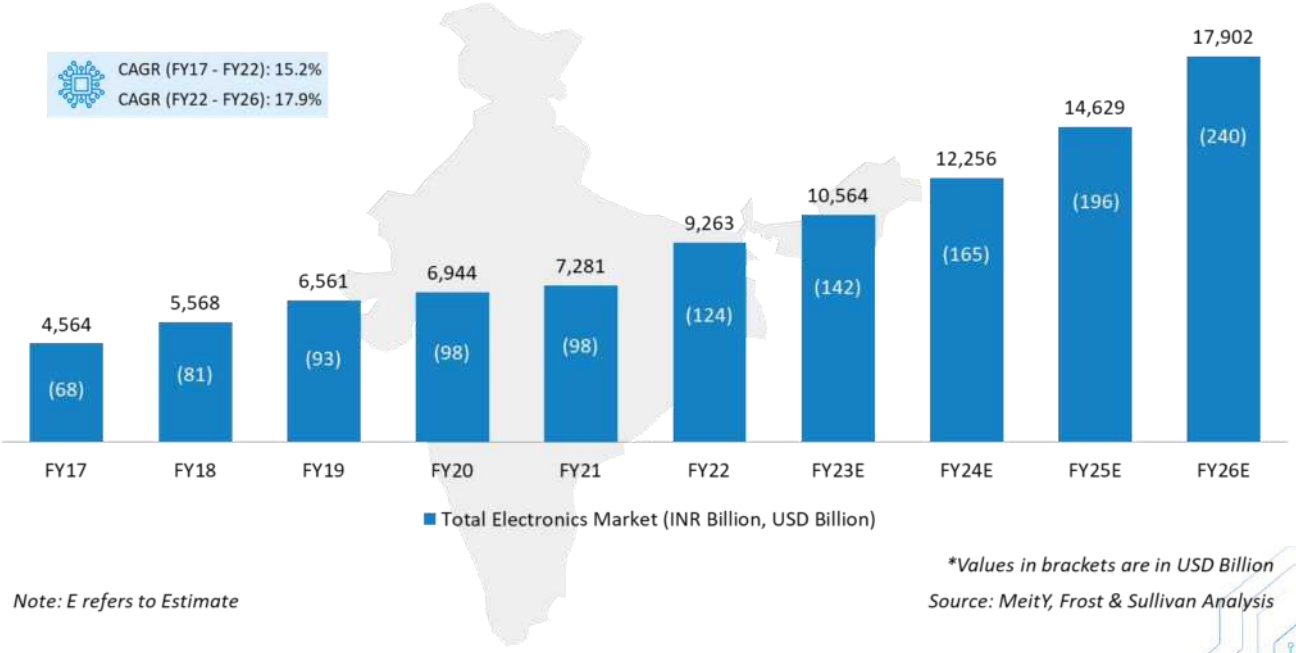
Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series); RBI (Reserve Bank of India); Frost & Sullivan Analysis

CHAPTER 4 - OVERVIEW OF INDIAN ELECTRONICS INDUSTRY

Indian Electronics market - historical trends and outlook

Electronics is one of the fastest growing industries in the country. The total electronics market (which includes domestic electronics production and imports of electronic finished goods) in India is valued at INR 9263 billion (USD 124 billion) in FY22, which is expected to grow at a CAGR of 17.9% to reach INR 17,902 billion (USD 240 billion) in FY26. Domestic 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 at a CAGR of 24.2% to touch INR 15,159 billion (USD 203 billion), owing to various government initiatives to boost domestic electronics manufacturing industry. Also, the global landscape of electronic design and manufacturing is changing significantly, and revised cost structures have shifted the attention of multinational companies to India. At present, the Indian government is attempting to enhance manufacturing capabilities across multiple electronics sectors and to establish the missing links in order to make the Indian electronics sector globally competitive. India is positioned as a destination for high-quality design work as well as a cost-competitive alternative. Many multinational corporations have established or expanded captive centres in India. Increasing penetration of consumer electronics in semi-urban and rural markets, a shift in lifestyle among the Gen Y population, and the adoption of smart devices are some of the key drivers that are assisting the rapid expansion of this industry.

Chart 4.1: Total Electronics market, value in INR billion, USD billion, India, FY17-FY26E



*Values in brackets are in USD Billion

Note: E refers to Estimate

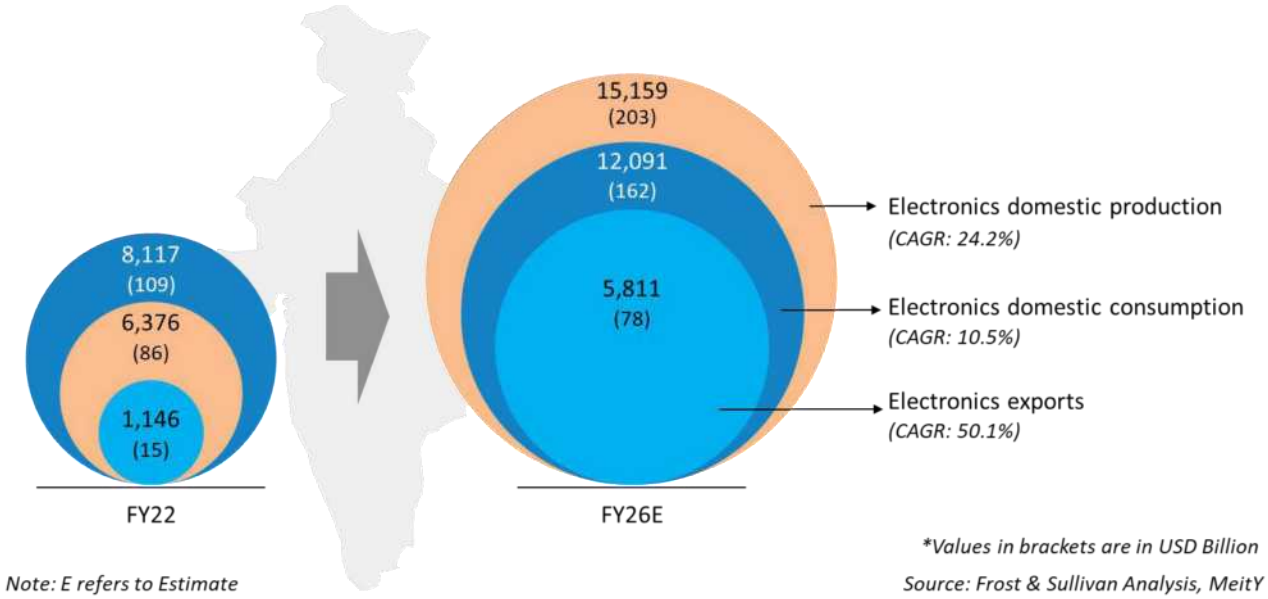
Source: MeitY, Frost & Sullivan Analysis

Trends in Electronics consumption vs. share of domestic production

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.

Chart 4.2: Overview of Electronics industry - domestic production vs. consumption vs. exports, value in INR billion, USD billion, India, FY22 and FY26E



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.

A. Consumption of Electronics products in India

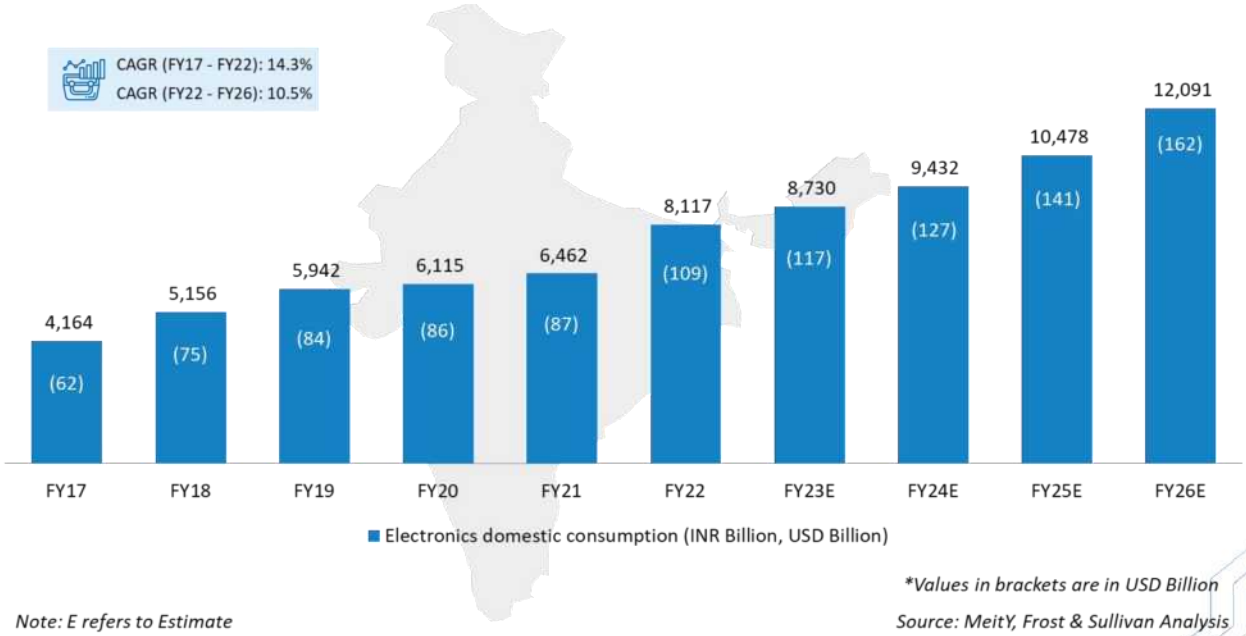
Electronics consumption market in India is estimated at INR 8,117 billion (USD 109 billion) in FY22, and is expected to grow at the rate of 10.5% to reach INR 12,091 billion (USD 162 billion) by FY26. India's vast consumer base is one of the largest in the Asia-Pacific region, and the country's electronics industry is one of the fastest growing in the world.

- **Mobile phones**: In this segment, with introduction of new smartphone models along with better availability, declining prices and increased customer spending across Tier1/2/3 cities are causing increased mobile phone penetration in India. Mobile phone penetration in India has increased further as a result of the proliferation of mobile data networks, a widespread distribution network, and support from e-commerce websites.
- **Consumer electronics**: It is one of the largest segments which have a broad category of electronic products that includes televisions, cameras, audio players, and a range of other household items.

Growing awareness, greater access, changing lifestyles, higher discretionary incomes, and reduction in per unit prices are the key drivers.

- **Telecom and Networking Products**: Need for deep penetration of broadband networks and availability of mobile telephony to propel Telecom and Networking Products sector. The government's push for the availability of broadband in remote areas of the country is a key demand driver for the telecom segment. Also, the increasing focus on the 5G sector is driving this segment. 3G/4G will remain strong over the coming years and 5G will start making impact pretty soon.
- **IT Hardware**: Availability of broadband in remote areas of the country is a key demand driver for entry level notebooks and desktops. Due to the pandemic, the work-from-home lifestyle for office workers and online education for school children have created a lot of opportunities for the IT hardware market in India.
- **Automotive (including EV):** The automotive industry's innovation and development in environmental sustainability and digitalization is taking centre stage. Four megatrends i.e., Connected, Autonomous, Shared and Electric (CASE) are driving the transformation in global automotive industry. Electric vehicles are already a reality and this decade will see significant proliferation and dominance in the automotive mix. Customer preferences for an in-vehicle digital experience, along with an increase in embedded connected services, will continue revolutionize the sector. Digitalization would be at the centre of this evolution and this would drive higher usage of electronics components in the automotive sector.

Chart 4.3: Electronics domestic consumption market, value in INR billion, USD billion, India, FY17-FY26E



*Values in brackets are in USD Billion

Note: E refers to Estimate

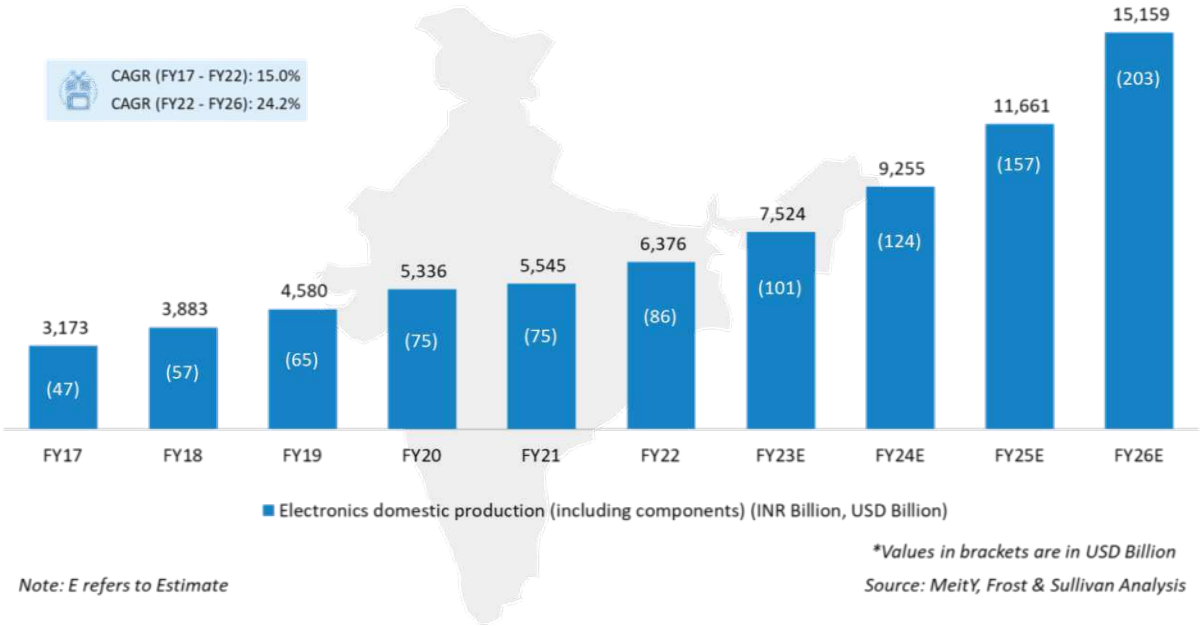
Source: MeitY, Frost & Sullivan Analysis

B. Indian Electronics domestic production

Electronics production in India is estimated at INR 6,376 billion (USD 86 billion) in FY22, and is expected to grow at a CAGR of 24.2% to reach INR 15,159 billion (USD 203 billion) by FY26. 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, along with the electronics industry, needs to collaborate and drive initiatives to help India move among the top 5 countries in electronics production and among the top 3 in electronics consumption. To improve the manufacturing capability of the electronics industry, the government of India has taken several initiatives and developed a series of policies to build the complete electronics manufacturing ecosystem in the country. The policies must be reviewed at regular intervals in order to determine their efficacy in achieving the intended objective of increasing the manufacturing capability.

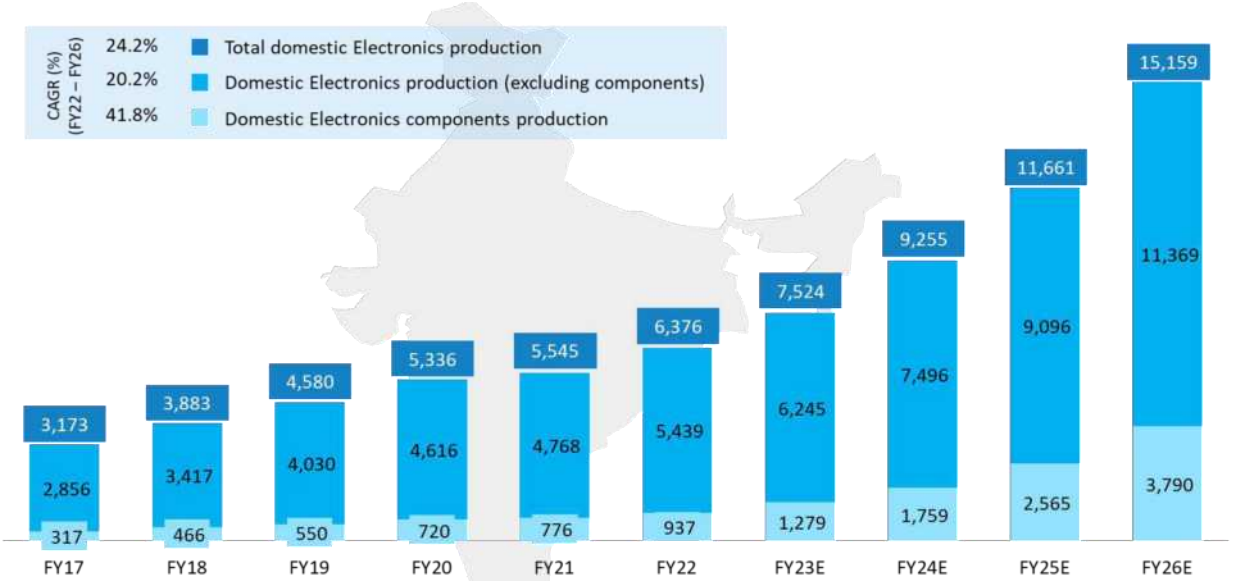
Chart 4.4: Electronics domestic production (including components), value in INR billion, USD billion India, FY17-FY26E



The success of the PLI scheme for the electronics segment in large-scale manufacturing of electronic products is being viewed with great confidence. Similarly, the National Policy on Electronics (NPE) aims to make India a global hub for electronic system design and manufacturing and has fixed some aspirational targets. Excellent opportunities for increasing electronics manufacturing are estimated to come from consumer electronics and appliances, the automotive sector, lighting, electronic components, and the medical electronics sector. India is finding its way to be a part of the global value chain to increase production and exports.

The biggest challenge for India is to make a fast transition to the manufacturing of high-technology electronics. Electronic products do need continuous design modifications, as end-users expect creativity and continuous innovation. Consequently, the design and development of electronics products is often undertaken by ODMs. The earlier a brand engages an ODM for product design and development services, the sooner the product enters high-volume production.

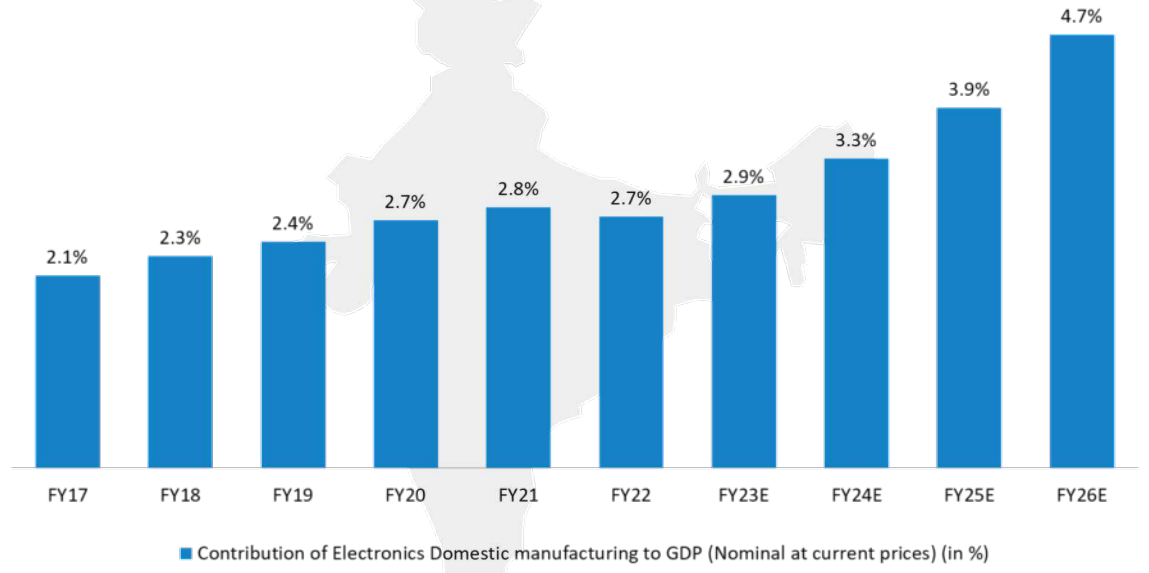
Chart 4.5: Total domestic Electronics production market (including and excluding components), value in INR billion, India, FY17-FY26E



Note: E refers to Estimate

Source: MeitY, Frost & Sullivan Analysis

Chart 4.6: Contribution of Electronics domestic production (incuding components) to Indian GDP, in %, India, FY17-FY26E



Note: E refers to Estimate

Source: MoSPI (Annual Estimates of nominal GDP, at current prices); Frost & Sullivan Analysis

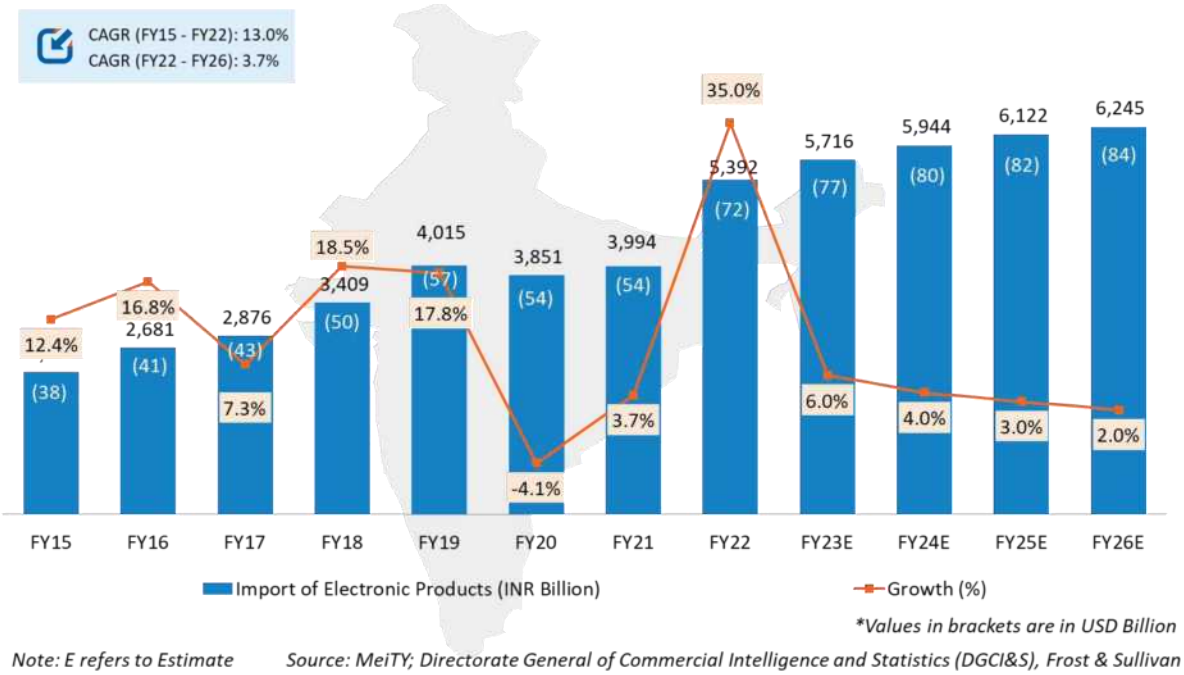
In FY22, the electronics production in India contributed to 2.7% of the nominal GDP (at current prices), which is expected to increase to around 4.7% by FY26. The Government's objective is to provide domestic manufacturers with a better facility to make them competitive with imports into the industry 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 EMS companies to export.

C. Import of Electronic products in India

The total import value of electronics products was INR 2,296 billion (USD 38 billion) in FY15 and INR 3,851 billion (USD 54 billion) in FY20. The import value decreased by 4.1% in FY20 compared to FY19, when it was valued at INR 4,015 billion (USD 57 billion) and eventually leapfrogged to INR 5,392 billion (USD72 billion) in FY22. Shortage of chips has slowed down domestic manufacturing in the last quarter of FY22 which resulted into higher imports of electronics products. China and Hong Kong accounted for ~ 62.5% of India's total electronic imports in FY22. The majority of semiconductor demand is now fulfilled by imports from the United States, Japan, and Taiwan. The government is developing electronics manufacturing clusters (EMCs) around the country to provide world-class infrastructure and facilities in order to minimise reliance on imports.

Chart 4.7: Import of Electronic products, INR billion, USD billion, India, FY15-FY26E



Note: E refers to Estimate *Source: MeiTY; Directorate General of Commercial Intelligence and Statistics (DGCI&S), Frost & Sullivan*

The electronics industry relies extensively on Chinese suppliers, especially consumer electronics, industrial electronics, computer and IT hardware, strategic electronics, light-emitting diodes, etc. The top 3 leading products in the import category are laptops & desktops, FPD (Flat Panel Display) televisions, and storage devices. In the laptops and notebooks segment, almost all the components used in building notebooks are completely imported or as semi-knocked down units from China and Thailand. Mobile phones contribute to around 2.1% of the total import value. In GPON (Telecom and Networking Products) and CCTV segments, the components are still imported from China and Taiwan. Despite the government's efforts to build India's electronics ecosystem, domestic manufacturers' reliance on China for components persists, which is

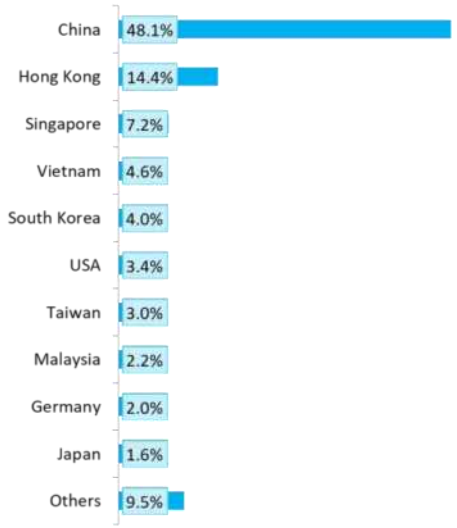
expected to improve slowly as the localization of production for these products is increased with the opening of new manufacturing facilities.

Indian electronics import is expected to grow between 3.7% CAGR between FY22 and FY26 while Indian domestic electronics manufacturing is expected to grow by 24.2% during the same period. This shows lesser reliability on import and increasing dependability on domestic components and EMS in the coming years.

Chart 4.8: List of top 10 imported Electronic products by value, India, FY22

Source: Export-Import Data Bank, Frost & Sullivan Analysis

Chart 4.9: Import of Electronic products by key countries, value in %, FY22



Source: Ministry of Commerce & Industry, Govt. of India

D. Export of Electronic products in India

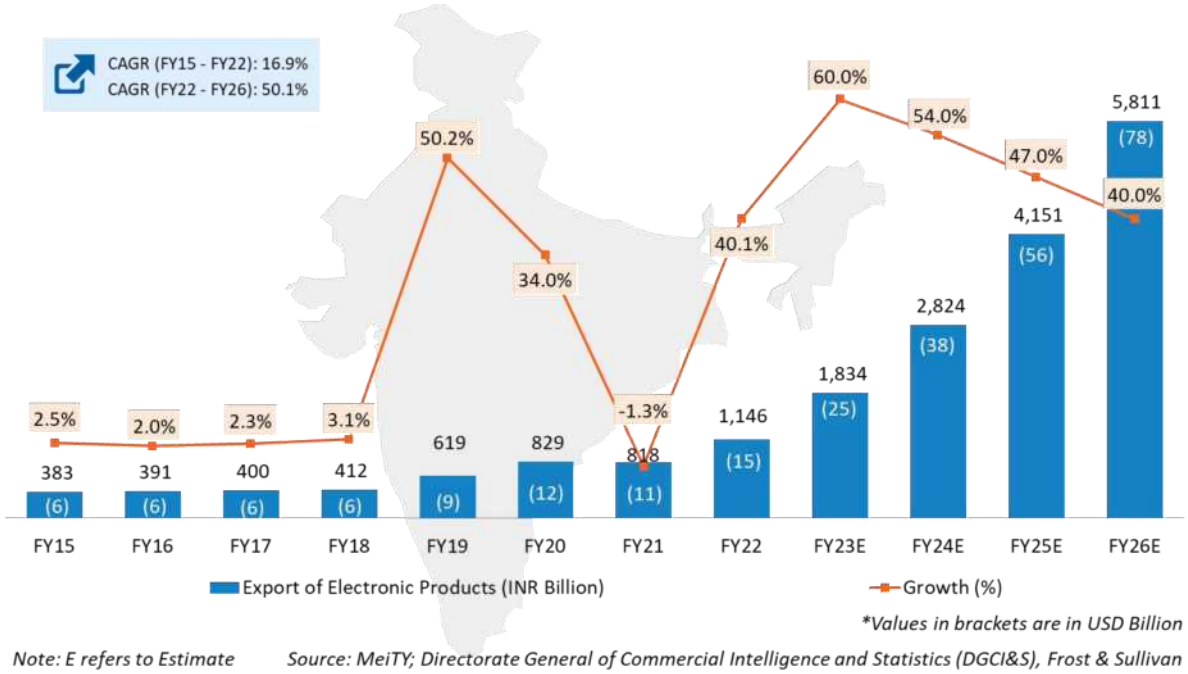
The total export value of electronic products in FY15 was INR 383 billion (USD 6 billion) and in FY22 it was INR 1146 billion (USD 15 billion). The value of exports increased by 40.1% in FY22 compared to FY2021, which was worth INR 818 billion (USD 11 billion). The export market is expected to grow substantially in next five years at a CAGR of 50.1%, owing to various government initiatives such as PLI scheme, Atmanirbhar Bharat which facilitates the domestic manufacturing.

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 for the globe. Cost-effectiveness, a talented and affordable workforce, a burgeoning domestic electronics market, and export opportunities will drive the market for EMS/ODM in India. Globally, India ranks second in mobile phone manufacturing, which involves design of the handset, assembly of components, and manufacturing of the device.

With more than 270 mobile handset and accessory manufacturing units in India, only top players have complete integrated manufacturing capabilities. Also, India has a strong base with the automotive industry,

including component suppliers, in the engine control unit and has emerged as the global hub for auto component sourcing.

Chart 4.10: Export of Electronic products, INR billion, USD billion, India, FY15-FY26E



Note: E refers to Estimate *Source: MeiTY; Directorate General of Commercial Intelligence and Statistics (DGCI&S), Frost & Sullivan*

Chart 4.11: List of top 10 exported Electronic products by value, India, FY22

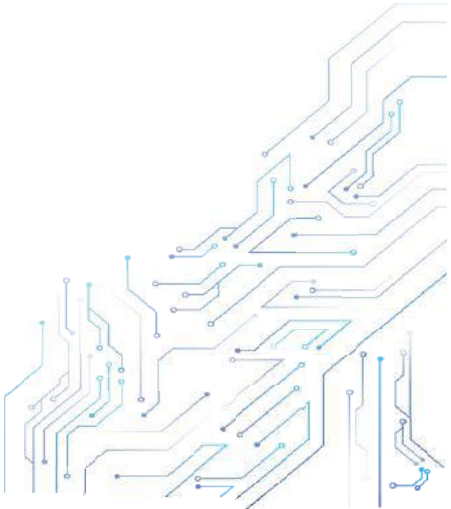
Source: Export-Import Data Bank, Frost & Sullivan Analysis

Chart 4.12: Export of Electronic products by key countries, value in %, FY22

Source: Ministry of Commerce & Industry, Govt. of 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. Jabil, Nainko, Dixon, and Kortek electronics are some of the EMS

companies manufacturing Set Top Boxes in India, though they primarily cater to the export market. Global players also 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.



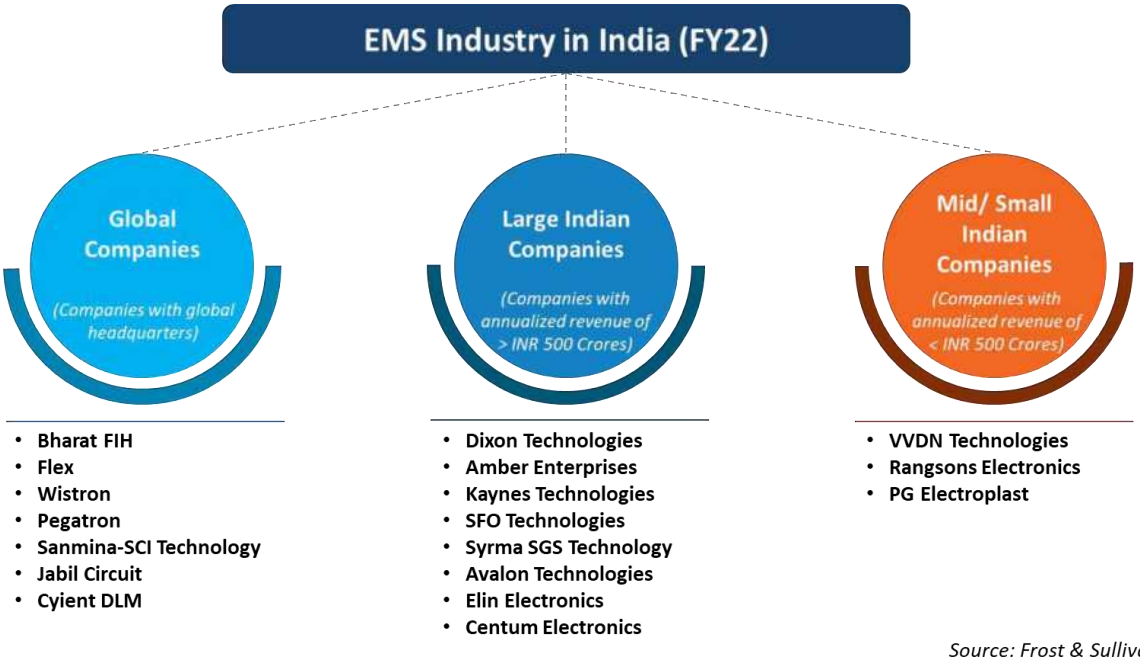
CHAPTER 5 - OVERVIEW OF INDIAN EMS INDUSTRY

Overview of 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. Indian EMS industry, which was traditionally a domain of the PSU's, saw participation of few MNCs and many private sector Indian companies post liberalization of Indian economy. These companies were addressing requirement of Consumer Electronics OEMs and some of them were manufacturing for their global requirement.

The period of 2005-07 saw the first big ticket investment in EMS operations in India with entry of Jabil Circuits and Nokia. This triggered a series of large / medium scale investments in Indian EMS sector. Period of 2013-14 was a dampener as Nokia wound up its India operation however, this was short-lived. By 2015, global EMS giants have started showing interest in India. Indian EMS industry has since then embarked on an upward journey. Now with most of the global Mobile Phone manufacturers and their supply chain partners are investing in manufacturing, Indian EMS industry is well poised to unlock its true potential in the coming years.

Chart 5.1: Industry structure of EMS market in India



Source: Frost & Sullivan

There are nearly 700 EMS companies in the market, ranging from large, medium-sized, to small players. Major global companies are Bharat FIH, Flex, Wistron, Pegatron, Jabil; large Indian companies include Dixon, Amber, SFO, Syrma, Elin, Centum among other. Mobile Phones, Consumer Electronics and Industrial Electronics contribute to more than 83% of the total EMS market in India. Few EMS providers are slowly evolving to offer complete design services apart from contract 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 coupled with venturing into new product segments is propelling OEMs to pursue this engagement. High volumes will influence EMS companies to bring in the component ecosystem locally and enhance domestic capabilities for component sourcing, making the electronics ecosystem stronger.

Ambitious expansion plans and capacity augmentation of indigenous EMS & ODM players to capitalise on favourable policy initiatives ensure that the EMS sector in India will witness heightened growth in coming days. Also, India has done well in electronic design and has established itself as the design hub of the world. The next phase of growth in the design sector will be characterised 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.

Some of the notable expansions announced recently:

- Flex, a manufacturer of electronic components based in the United States, is considering increasing its investment in India to around USD 12 billion in order to expand its manufacturing capabilities and boost exports from India.
- 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 segments to serve the domestic and global markets.
- 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. There are also plans to establish a manufacturing technology centre of excellence that will serve as incubation for the product development and hardware start-up ecosystem.

PEST analysis of electronics manufacturing services in India

POLITICAL

- Government policies and incentives focused at the electronics manufacturing sector, including favourable FDI policies
- Transparency in government process and improving ease of doing business in India
- Promotion of electronics Industry and focus on Exports
- Co-ordination among state and central government
- Flexible labour laws

ECONOMICAL

- Quality infrastructure through development of special economic zone
- Growth across sectors in electronics industry
- Improving business cycle and expanding business profitability
- High manufacturing productivity
- Business consolidation through Joint ventures

SOCIAL

- Customer centric approach and addressing the needs and demands of end-users
- Identifying key market potential areas
- Creating employment opportunities
- Competitiveness in performance of the industry
- Social and ethical values e.g.: less carbon emission in production

TECHNOLOGICAL

- Increasing focus on research and development
- Owning more patents and copyrights for indigenous products
- Collaborative research approach and integrated decision making
- Providing innovative products and service to end-customers
- High technological capability along with recycling of electronics waste

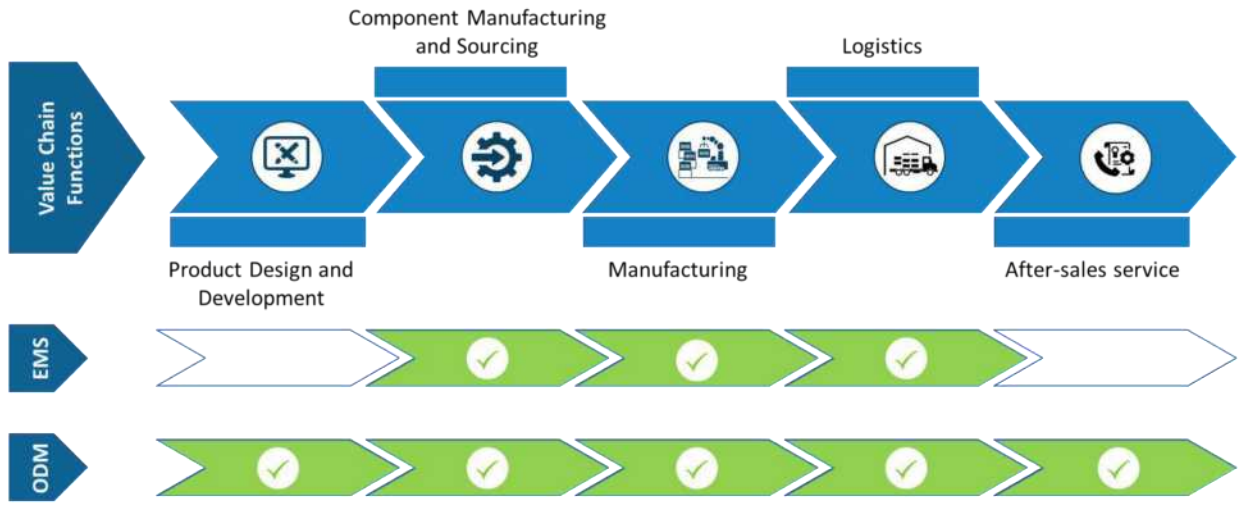
Business models of Indian EMS Companies

Business models of Indian EMS companies can broadly be classified under four categories[4].

1. ODM model
2. EMS model
3. Job work
4. After-sales service

[4] *Source: ELCINA EMS Task Force report, Frost & Sullivan analysis*

Chart 5.2: Business models of Indian EMS companies, FY22



Source: Frost & Sullivan

ODM (Original Design Manufacturers) model

Under this, EMS companies design products as per the specifications provided by the OEMs. EMS companies then source components, carry out fabrication and assembly, test the final product, and also undertake logistics and after sales services related activities. ODM model helps the EMS companies to have deeper and long term business relations with the OEMs. This is a high margin business and comes at a premium for good designs.

EMS (Electronic Manufacturing Services) model

At present, this model is widely followed in India. Under this, OEM provides designs and specifications to the EMS companies. EMS companies source components manufacture / assemble components and supply the finished product back to OEMs.

EMS companies are gradually adding capabilities to offer ODM or JDM (Joint Design Manufacturers) services. Increasingly, OEMs are preferring engagement on ODM / JDM basis. This is win-win situation as EMS companies can earn higher margins while OEMs can focus on expansion activities.

Job Work

This business model is followed mostly by the small and micro EMS companies. Smaller EMS companies, who do not have any engineering or sourcing capabilities, undertake this business with OEMs in a fragmented or Price sensitive market. Large OEMs and Overseas companies generally like to have one point solution with their EMS /. This is a very low margin business.

After-sales service

After-sales service is an important activity which helps the companies to build long-term brand image and brand loyalty. Globally, EMS companies are offering end-to-end services including after-sales service. This is a nascent business for Indian EMS companies, however gaining traction in the recent times.

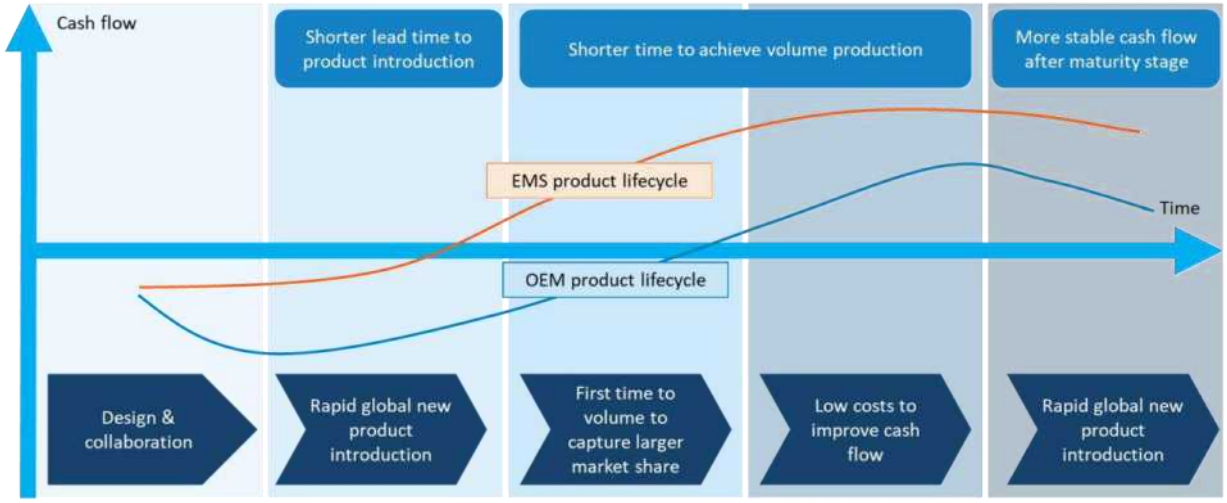
Various activities performed by the EMS companies have been described below:

- **Products design and development:** This activity refers to designing of an electronics product as per OEM's requirement / specifications. This includes sub-activities such as product development, DFM / DFA analysis, prototyping, test development etc. EMS providers are increasingly providing end-to-end new product introduction services to the OEMs.
- **Component manufacturing and sourcing:** Component sourcing refers to the purchasing of the electronic components to be assembled onto the printed circuit board. Brands/EMS providers purchase these components directly from manufacturers or from authorised distributors, either through import or local sourcing.
- **Manufacturing:** This activity refers to manufacturing and assembly of the electronics products. This could either be PCBA or box build assembly.
- **Logistics:** The activity refers to logistics involved in sourcing of components or delivery of the finished goods.
- **Aftersales:** Globally, EMS companies also offer after sales support such as repair and maintenance of products. This is however, is a new trend in India.

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 OEMs and EMS providers from investing. Most MNCs hold their IP in the headquarter location (mostly located in the USA and Europe) and do not prefer to invest in local R&D. However, India has a competitive edge in design services, since most such work is outsourced to cost-effective destinations. In terms of manufacture/ system assembly, India has an established set-up. Many EMS providers are slowly evolving to offer complete design services apart from contract 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.

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 fairly important for the Indian buyer as the use-and-throw perception is still not acceptable in the Indian electronics ecosystem. EMS/ODM companies having an extra ability to provide the reverse logistics will get additional business from the OEMs at the same time they would also be playing a very significant role in the e-waste management which is a huge concern globally. Many players like Bharat FIH, Dixon, Flextronics, etc. are offering after-market services like repair, refurbishment, vendor management etc.

Chart 5.3: Time and cashflow of OEM vs EMS product lifecylce, India, FY22



Source: Foxconn

Indian EMS market size and growth outlook

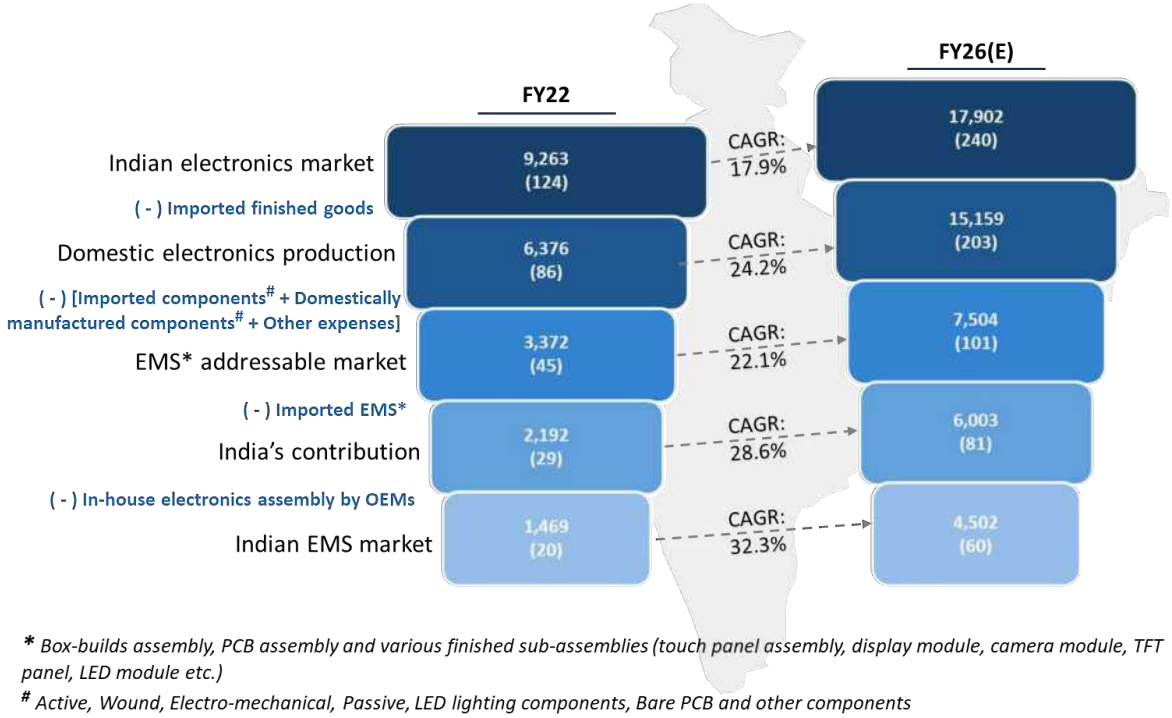
Indian EMS industry is part of the larger Electronics ecosystem of the country. Systematic approach has been followed to separate various components of the Indian Electronics market and derive size and potential for EMS business in India. Below chart depicts the size of Indian Electronics market, various segments of the market and their respective sizes, including Indian EMS market. The chart also shows how each of these segments likely to grow over medium term till FY26.

In FY22, domestic electronics production is estimated to be USD 86 billion which includes domestically manufactured electronics components worth USD 12 billion and imported components worth USD 18 bn. The remaining market, after subtracting the cost of the components and other expenses (logistics, packaging, administrative expenses, etc.), represents the addressable business opportunities for EMS companies in India. This addressable market worth USD 45 billion consists of three components:

a) Contribution of Indian EMS companies or Indian EMS market worth USD 20 billion;
b) In-house electronics assembly by OEMS worth USD 9 billion; and
c) Imported EMS worth USD 16 billion (this is a direct loss to the EMS companies in India)

The total addressable EMS market in India was valued at INR 3,372 billion (USD 45 billion) in FY22, and is expected to grow to INR 7,504 billion (USD 101 billion) in FY26 with a CAGR of 22.1%. Contribution of Indian EMS companies is around 43.5% - INR 1,469 billion (USD 20 billion) in FY22. This is expected to grow at 32.3% CAGR to reach INR 4,502 billion (USD 60 billion) by FY26. Bharat FIH has already established itself as the largest EMS Company in India and was more than 2.3x the size of 2nd largest player by revenue in FY20. Bharat FIH retained its market leadership position in FY22, with 12.4% market share.

Chart 5.4: EMS addressable market vs. contribution of EMS companies for goods made in India, value in INR billion, FY22 and FY26E



* *Box-builds assembly, PCB assembly and various finished sub-assemblies (touch panel assembly, display module, camera module, TFT panel, LED module etc.)*

\# *Active, Wound, Electro-mechanical, Passive, LED lighting components, Bare PCB and other components*

Values in brackets are in USD billion *Source: MeitY, ELCINA, Frost & Sullivan Estimates*

India is positioned as a destination for high-quality design work, not merely as a low-cost alternative. Many multinational companies have established and expanded captive centres in the country. Despite the fact that the establishment of EMS companies supported the economy by establishing domestic infrastructure and jobs, the Intellectual Property rights are owned by the global headquarters, hence contribution from ODM model is minimal in India. Most brands prefer engaging EMS partners for contract manufacturing, but the ODM model is slowly gaining traction in India, where brands collaborate with ODMs on product development. Many EMS players are gradually expanding to provide complete design services in addition to contract manufacturing/ original equipment manufacturing. Embracing ODM model of partnership with EMS partners coupled with venturing into new product segments is propelling brands to pursue EMS engagement. High volumes will influence EMS/ODM to bring in the component ecosystem locally and enhance domestic capabilities of component sourcing thus making the electronics ecosystem stronger.

A strong consumer economy with increasing demand for consumer and industrial electronics has driven the Indian EMS sector into the forefront. Domestic electronics production in India has received a lot of attention from both industry and the government, owing to the necessity for import substitution. Favourable policy initiatives in recent years, as well as changes in the global manufacturing environment, have drawn attention to India as a preferred destination for electronics manufacturing investments.

Electronics have become more prevalent in the Indian EMS industry, and domestic demand for mobile phones, consumer electronics and appliances, medical products and automotive electronics offers a huge growth potential. Furthermore, increasing labour costs have indeed prompted large brands to favour India,

where they outsource manufacturing rather than build their own infrastructure. The EMS market in India benefits from high domestic demand and production migration from other manufacturing hubs due to a variety of factors.

The Indian EMS industry has benefited from a greater focus on manufacturing and an overall growth in the usage of electronics in many aspects of life. Domestic demand for mobile phones, PCs, consumer electronics, medical products, strategic and automotive electronics and offers a huge growth potential. Because of the 5G rollout, there is an increase in demand for telecom infrastructure projects, as well as a necessity to build them locally. Furthermore, growing labour costs in other parts of the world have led major OEMs to favour India, which is a practice of large OEMs to outsource manufacturing rather than to create their own infrastructure. EMS market in India enjoys unique benefits of an explosive domestic demand and the migration of manufacturing from other manufacturing havens driven by multiplicity of factors. These reasons have resulted in the Indian EMS market growing at a higher rate than average global market and are expected to intensify in the next decade.

A. Indian EMS market break-up by industry applications

The expansion of India's EMS industry is being fuelled by a variety of factors, including an increase in mobile phone adoption and consumer electronics and appliances. Other 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.

Mobile Phones - Mobile manufacturing is the largest segment within EMS and is growing at a robust pace. India is the world's second-largest manufacturing hub and market, producing 11% of all mobile phones worldwide. Mobile phone includes Smart phones[5] and Feature phones[6]. Feature phones have two categories which include simple feature phone and smart feature phone. The rising popularity of the Smartphone can be credited to innovation in features, design and aesthetics. While 3G technology enabled smartphones had limited bandwidth, succeeding technologies such as 4G, 4G+, VOLTE and soon 5G, are defining the mobility in terms of data in the country. 4G technology has largely been responsible for enhancing the Internet access and increasing the data usage in the Indian Market.

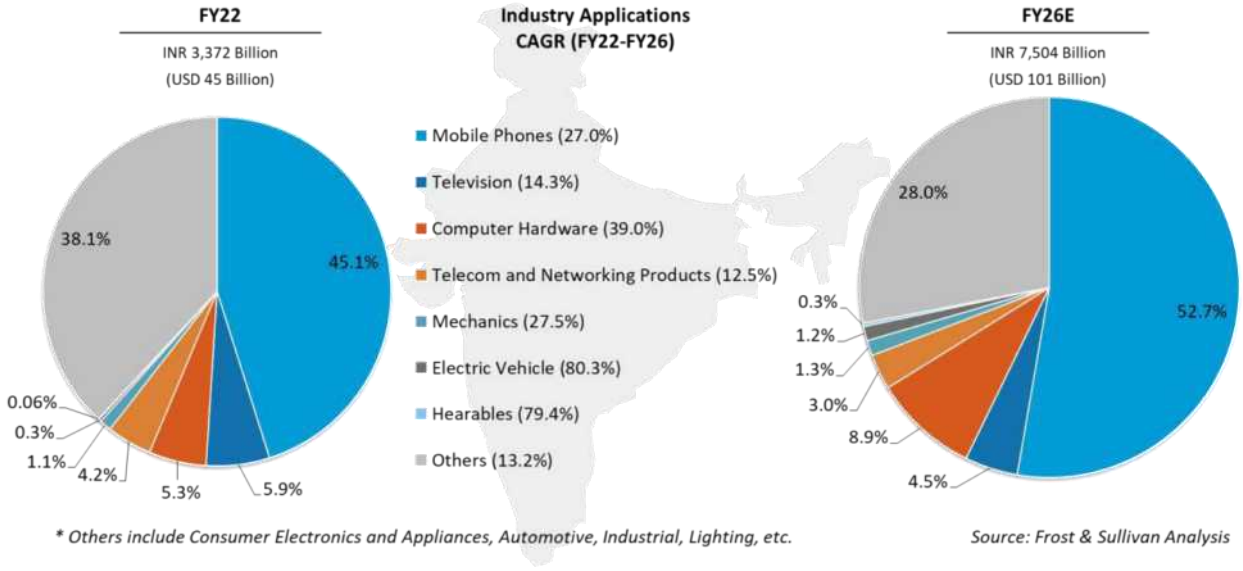
Televisions - The Indian Media & Entertainment industry is been anticipated to grow at a pace of approximately 14% over the period 2016-2021, outstripping the global average of 4.2% compound annual growth rate. Televisions is projected to grow at a CAGR of more than 14% over the next five years as both the advertisement and the subscription revenues are projected to exhibit very strong growth

[5] Mobile phones that run on a mobile operating system offering a variety of features that allows advanced computing capability and connectivity

[6] Feature phones run on a proprietary firmware, with third-party software support and have basic features like calling, camera, music player

Telecom and Networking Products – The Telecom and Networking Products industry in India is the second largest in the world having a subscriber base of 1.14 billion as on March 2022. The total number of broadband -subscribers rose to a value of 760 million in the month of March 2022. The industry has observed exponential growth over last few years primarily driven by the affordable tariffs, roll-out of Mobile Number Portability, wider availability, expanding 3G & 4G coverage, growing consumption patterns of the subscribers and a favourable regulatory environment.

Chart 5.5: EMS addressable market: Break-up by industry applications (segments of interest for Bharat FIH), India, by value in %, FY22 and FY26E



** Others include Consumer Electronics and Appliances, Automotive, Industrial, Lighting, etc.*

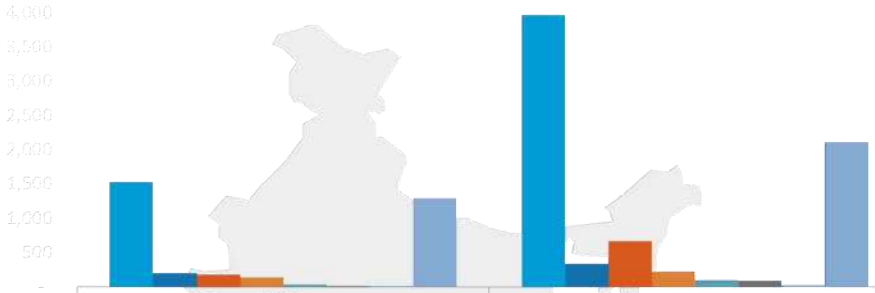
Source: Frost & Sullivan Analysis

IT Hardware - India's traditional PC market includes desktops, laptops, & workstations, and the shipments have been on the rise during the last few years. The most recent developments boosting the investment viability of India's IT sector include a push for local hardware manufacturing through the PLI scheme. It aims to increase India's manufacturing capability for laptops, tablets, all-in-one PCs, and servers while also attracting more foreign investment.

Electric Vehicles - 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. The e2W segment has seen a significant increase in the number of start-ups such as Ather and Tork, as well as many fleet services such as Vogo and eBike, which are driving the segment's growth. Battery swapping is a huge success in the country, which is driving the EV market, particularly in smaller vehicle segments like 2Ws and rickshaws. Emission standards are also a major driver of electrification in the country, as many OEMs (such as Tata, Mahindra, and Hero) and start-ups (such as Ather) expand.

Hearables (TWS) - Earwear device shipments raised more than threefold in the year 2020 in comparison to the previous year, primarily driven by the affordable launches, & expanding use cases beyond entertainment like e-learning requirements and virtual meetings. Truly Wireless Stereo (TWS) devices were the highest gainer seeing a tenfold increase having shipments crossing 11 million units in 2020.

Chart 5.6: EMS Addressable Market break-up by industry applications (segments of interest for Bharat FIH), India, by value in INR billion, FY22 and FY26E



	FY22	FY26E	CAGR
Mobile Phones	1,522	3,958	27.0%
Television	198	339	14.3%
Computer Hardware	180	671	39.0%
Telecom and Networking Products2	142	226	12.5%
Mechanics	37	98	27.5%
Electric Vehicle	9	92	80.3%
Hearables	2	20	79.4%
Others	1,283	2,100	13.2%

** Others include Consumer Electronics and Appliances, Automotive, Industrial, Lighting, etc.*

Source: Frost & Sullivan Analysis

B. Contribution of ODM in EMS market

Range of services offered by ODM companies

ODM companies can offer end-to-end services right from product design & development, component sourcing and fabrication, manufacturing, logistics and after sales, while EMS companies are not involved in product design activities. However, only very few companies in India provide end-to-solutions, as most EMS providers are primarily involved in assembly and testing. The evolution of the Indian electronics market has, surprisingly, resulted in a gradual but drastic shift in the supplier base. The availability of technology and regional presence has contributed to their growing acceptability. Involvement in an OEM customer's product design and development process provides the ability to offer, or coordinate the sourcing of, the components required to manufacture the product, giving a greater share of the revenues, and higher margins, in the ODM value chain.

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. OEMs have realised the benefits of EMS providers serving as joint design manufacturers. Partnering right from the design stage results in significant cost reduction, as the initial stage sets the price of the end product. Increased competition has emphasised the importance of time-to-market. OEMs are moving away from an era where they trailed behind demand to a scenario where they have to create demand in order to remain more profitable. The impact of this driver is expected to remain high for the short and medium terms and is expected to become very high during the long term.

Benefits of ODM in EMS market

Chart 5.7: Advantages and Disadvantages of EMS and ODM

Original Design Manufacturing (ODM)	Electronic Manufacturing Service (EMS)
✓ ODM retains IP rights to their design, giving them better negotiating power.	✓ EMS helps in quicker production time
✓ ODMs may produce client products themselves or through subcontract; also into final assembly of products.	✓ OEMS save on their capital costs by involving EMS providers
✓ ODMs will manage the technical resources required for the successful completion of the production process.	✓ Better economies of scale when the business grows, when contract manufacturers produce for multiple customers.
✓ It is difficult for OEMs to switch suppliers since ODM players hold the rights for the design.	✗ OEMs gain complete ownership of all IP rights, including product specifications. EMS providers do not have negotiating power.
✗ Product development costs will be high	✗ Lack expertise in producing their own set of products, development starts from the scratch.
✗ Minimum order quantity requirements are quite high.	✗ OEMs can easily move to other providers, as they own rights for the design.

Source: Frost & Sullivan Analysis

Constantly increasing logistics and raw material costs are resulting in a rise in total manufacturing costs, which is affecting the OEMs. This serves as a catalyst for the OEMs to choose the ODM model, which provides an end-to-end solution, including product design and after-sales support, owing to better margins and increased visibility. Additionally, ODM offers to collaborate with the OEMs on product localisation and design. The ODM companies with their versatile capabilities in system designs, plastic moulding, PCBA, software engineering and more importantly manufacturing encourage OEMs to increasing the width of their partnership. Instead of investing in R&D, Tier-II players collaborate with ODMs to select and develop specific models from existing models. The secondary benefit for ODMs from such collaborations is the improvement of capabilities to handle fresh clients.

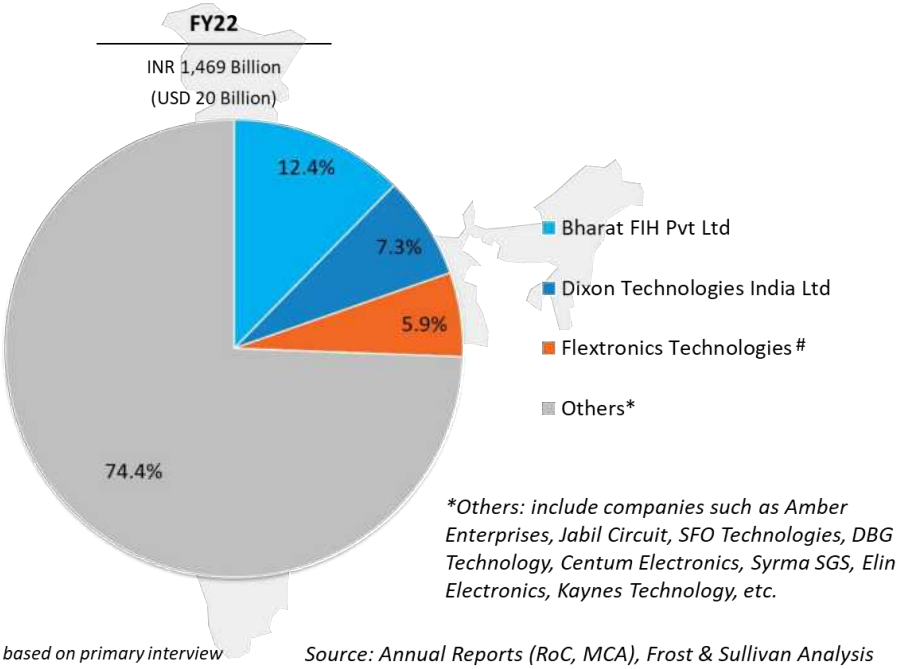
There is a growing perception that there is a rising outsourcing trend for some product segments where regional and private brands have gained dominant market position, and the ODM model allows companies to service this market as well. As the products moves towards maturity phase, more products are likely to become standard and fall within the purview of ODMs. As a result, in the long term, ODM firms will become an essential component in the success plans of OEMs of both tiers.

C. Competitive landscape of EMS market in India

The Indian EMS industry, which accounts for little above 2% of the global EMS market, has emerged as a significant electronics manufacturing destination. The EMS market has risen rapidly in recent years due to rising mobile phone sales and increasing adoption of electronic products. The increased usage of contractual services by OEMs is driving the Indian EMS sector. Product design and development, testing, and after-sales support are becoming increasingly important to OEMs as they recognize the importance of EMS/ODM firms.

More than 700 global and domestic companies operate in the Indian EMS/ODM market (Source: ELCINA). The top three players, account for around 25.6% of the market. Bharat FIH is the market leader, accounting for approximately 12.4% of the market and outpacing the nearest competitor by 1.7x times in FY22. Flextronics, Dixon, Amber, and Jabil are some of the leading players in the market.

Chart 5.8: EMS market split by major companies, India, by value in %, FY22



Note: # Flextronics based on primary interview

Source: Annual Reports (RoC, MCA), Frost & Sullivan Analysis

Bharat FIH (formerly Rising Stars Mobile India Pvt. Ltd.), a subsidiary of FIH Mobile Ltd. (a Foxconn Technology Group), entered and established its presence in India in 2015, and has been instrumental in the country's progress, spearheading the electronics manufacturing boom. The company is a global leader in manufacturing of mobile phones. At present, Bharat FIH is one of the country's largest EMS providers with additional capabilities of providing ODM services, addressing both domestic and international brands.

Emerging trends in Electronics manufacturing in India

Key trends for Electronics manufacturing industry
▪ Faster replacement cycle and high demand for emerging technologies and emerging applications in electronics industry
▪ EMS companies offering design services
▪ Localization of supply chain
▪ Component miniaturisation
▪ After sales service as part of offerings of the EMS companies

Faster replacement cycle and high demand for emerging technologies and emerging applications in electronics industry: Electronic products have shorter life cycles as a result of rapid technological improvement and newer products with enhanced technology. Customers are also replacing their existing electronic equipment with newer products thanks to constantly changing customer views and many consumer-to-consumer websites.

Augmented demand for high-speed data has contributed to the increasing demand for high-end smartphones. This growing preference for advanced technology products has driven rapid innovation in the consumer electronics business. Emerging technologies, for example, IoT, AI, and the introduction of robotics and analytics in the industrial and strategic electronics segment, have all led towards the overall development of numerous electronic products, which has given a lift to local demand. Utilization of IoT/sensors, 5G, artificial intelligence, and machine learning are providing stimulus for the creation of advanced multi-utility electronic products. The EV market is gaining traction, owing to the governments various initiatives to promote EV sales in India. As the EV segment is reliant on the electronic sector for a range of components, the EMS market is projected to gain impetus in the near future.

To lead in electronics manufacturing, India must focus on new and emerging technologies. Although major economies are keen to invest in India, the domestic industry needs to develop its manufacturing base. This requires significant investment in new technology, research, and development, as well as capacity expansion for the fabrication of high-quality electronic components. The Indian electronics manufacturing sector is well-positioned for growth. India's electronics manufacturing industry can endure by gaining market share in emerging technologies.

The electronics market in Telecom and Networking Products segment is increasingly adopting 5G technology for enhanced mobile broadband and ultra-reliable low latency connectivity. Wearable technology and flexible displays (TV segment) are two emerging electronic applications that are gaining wide acceptance globally.

EMS companies offering design services: EMS companies are moving up in the value chain and Indian design companies work on end-to-end product development, right from concept design to development to prototype testing. Advanced product development focusing on miniaturisation, IoT, automation, AI, and defence applications is likely to be one of the biggest trends in market growth in electronics design. IoT-based advanced analytics and industrial automation provide manufacturers with better efficiency and productivity gains.

Electronic Design Automation (EDA) is a category of software tools which drives the design of Integrated Circuits and PCBs. Until recently, EDA software tools were used to cater mainly to the semiconductor business, but the digital transformation has actually made these tools tremendously relevant across numerous industries. The fast rise of AI, ML, deployment of 5G communication, edge and cloud computing have all created the need for invention in hardware, as an outcome of which electronic design automation software tools are in very high demand.

Localization of supply chain: High domestic volumes and consumption, higher outsourcing volumes will influence EMS/ODM to bring in the component ecosystem locally and enhance local capabilities of component sourcing, thus making the ecosystem stronger and closer. Tier-2 players (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/ODM services. In 2014, there were only about 2 companies in India manufacturing mobile phones, which have increased to more than 270 in 2020.

A vigorous and localised supply chain offers numerous advantages, like reduced reliance on imports and the ability to cater to larger volumes in relatively shorter time periods, leading to lower costs and additional flexibility.

Component miniaturization: Manufacturing equipment is very essential for guaranteeing the quality of any electronic device or electronic component. During the course of the complete production cycle, an electronic device is being handled by a variety of manufacturing equipment. The ever-increasing complexity of electronic assemblies, as well as component miniaturization, has increased demand for advanced and dependable manufacturing equipment.

The choice of PCB is dictated by three major factors from the product perspective, which is complexity of operation, form factor, and level of miniaturization. Technological advancements, which are a need to meet the high performance expectations in the field of electronics, combined with today's high-speed production, comprehensive process automation, and rigorous quality control standards, are all driving up the demand for manufacturing equipment. The dawn of the conjunction has led manufacturers to assimilate numerous devices and produce small-scale devices for mechanical, electronic, and optical products.

After sales service as part of offerings of the EMS companies: Repair and rework are no longer seen as non-value-added services in electronic manufacturing industry. It is increasingly becoming part of OEM and EMS/ODM service offerings. The high value of today's electronics assemblies justifies the purchase of rework equipment. Repairing and reworking equipment allows electronic manufacturers to save valuable electronic components and semiconductors instead of discarding them. It is also being accepted in the electronics industry due to the development of precise SMT repair and rework equipment.

Complex, high density PCBA are simply too valuable to scrap. Due to the tight production runs of Just-In-Time manufacturing, even smaller boards with fewer components should be repaired. An experienced EMS/ODM provider will have strong processes in place to catch solder defects, wrong parts, opens, and shorts early. But defects are unavoidable, especially on multi-layer assemblies with an increasing number of SMT parts.

Growth drivers for Bharat FIH in EMS business

Key growth drivers for Indian EMS industry

- **Improvement in demand and supply scenario**
- **Ease of doing business in India**
- **China+1 strategy**

- **Atmanirbhar Bharat ('Make in India' initiative)**
- **Development of electronics ecosystem by global and domestic players**
- **BIS certification**
- **Government incentives and schemes**
- **Overview on QSTC (Quality, Services, Timeliness and Cost)**
- **Import substitution**
- **Supply chain realignment**
- **Component manufacturing / lead time**
- **Local value addition**

Improvement in demand and supply scenario: India has witnessed more than 14% growth in electronics consumption between FY17 and FY22. Long term growth outlook for the industry is extremely positive, primarily because market penetration for many electronics products are still very low compared to global average. Besides factors such as stable growth outlook for the economy, Digital India programme, 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 electronics 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.

Ease of doing business in India: India's business environment can be improved by simplifying 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 strengthen 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 in order 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.

India is registering increasing EV investment in the country. Companies such as Ola are investing in setting up manufacturing plants in the country. Likewise, EMS/ODM companies in the country, including the likes of Bharat FIH, are ramping up investments, which indicate a robust EV market for EMS in the next 5 years. Sub-assembly modules and the finished goods assemblies are things that 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. 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.

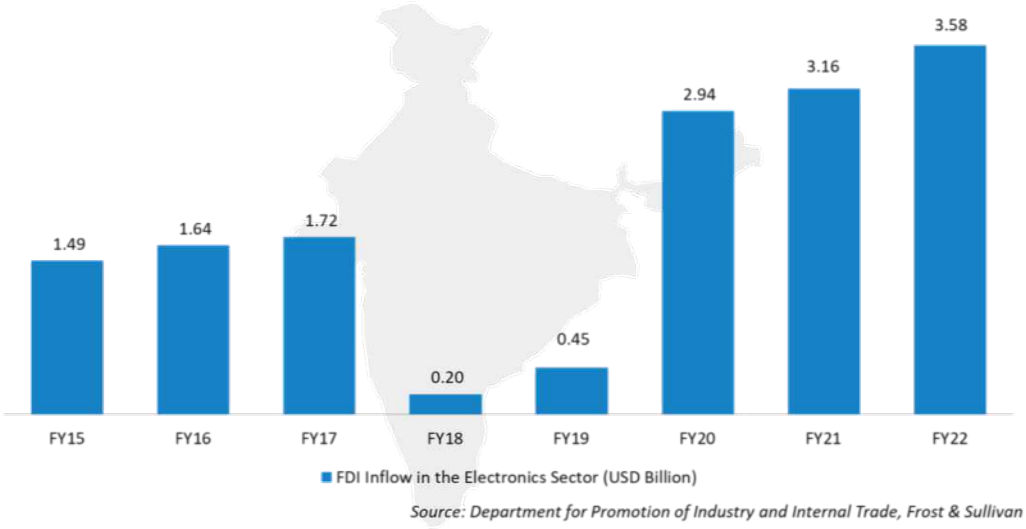
China + 1 Strategy: As the Chinese electronics contract manufacturing cost structure continues to be on the rise, along with changing geo-political landscape, so has the OEM customer interest amplified in moving the electronics production to the other countries having similar price, quality, and receptiveness. There is a new urgency now to examine practical alternatives to manufacturing in China given the tariff conflicts and the COVID 19 pandemic. Though, transferring production out decisions is not very straightforward. Sub-tier vendor incorporation of metal fab, plastics and other mechanical components all in China improve the product cost, efficiency and the time-to-market. Due to the above factors, OEMs are considering adding another country for additional production rather than completely replacing China. 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.

Atmanirbhar Bharat (Make in India initiative): 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 and industry needs to collaborate and drive initiatives to help India move among top 5 countries in electronics manufacturing and top 3 in electronics consumption. Many policy level initiatives are desired to be implemented in a fast-track mode. The effect of policies should be measured and evaluated against the desired objectives to re-check and refine at regular intervals.

Atmanirbhar Bharat Abhiyaan, or Self-reliant India campaign, launched in May 2020, is the government's vision of New India following the announcement of a special economic and comprehensive package worth INR 20 lakh crores, or 10% of India's GDP, to combat the COVID-19 pandemic in India. This scheme entails a variety of measures across sectors. With larger focus on the CAPEX and R&D, Budget 2021 has given a strong push to the domestic marketplace, which holds very significant to India's economic growth. In the following two-three years, high real GDP growth rates is going to be a rare in majority of the economies as they gradually recover from the impact of the COVID 19 pandemic.

Government incentives and scheme: Across nations, there is a strong government push to broaden the operations and revenue from the electronics industry. The government of India has been proactively building a base for electronics manufacturing in India and it has launched numerous incentive schemes, which have allowed manufacturing growth, reduced dependence on the imports, and promoted the exports. The GOI has launched numerous policies over the last few years to increase the innovation, protect the intellectual property, and develop the best-in-class electronics manufacturing set-up to build a favourable environment and invite the investment in the electronics hardware manufacturing. India's electronics production has more than doubled in the past five years from INR 3.2 Trillion in FY17 to INR 6.4 Trillion in FY22 depending on such favourable incentive schemes.

Chart 5.9: FDI inflow in the Electronics sector, value in USD billion, FY15-FY22



Source: Department for Promotion of Industry and Internal Trade, Frost & Sullivan

Some of the key schemes/ policies include (a) Product Linked Incentive Scheme (at a value of INR 2,000 billion) (b) Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (providing financial incentive of 25% on capital expenditure) (c) Modified Electronics Manufacturing Clusters Scheme (EMC 2.0) (provides financial assistance for setting up of EMC projects) (d) Merchandise Exports from India Scheme (MEIS) (the incentives under the schemes are calculated as a percentage, which is 2%, 3% or 5% of the realised FOB (free-on-board)

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 in order to prepare for this new tax regime. As a result, investments were low in fiscal year during the period, and it was gradually increased from the end of fiscal year 2019.

Bharat FIH has the largest inbound from Taiwan into India and it has always invested ahead of its curve in innovative technology and capabilities (Source: Invest India, Government of India)

Development of Electronics Ecosystem by Global and Domestic Players: 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.

BIS Certification: Importing electronics and IT products without the BIS registration is now currently prohibited in India. India is tightening the quality controls for the electronic products to restrain the rising import of the cheap electronic items, particularly from China, and boost the local manufacturing under its Make in India initiative. According to the DGFT (Directorate General of Foreign Trade) notification, every business importing and selling the 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 the BIS certification. These incorporated laptops, televisions, and notebooks among others. The order now encompasses to each imported electronic & IT product up for sale in the open market. New rules have got wider implications on the future imports of the electronic items to India – which imports closely 50% of its entire electronic products sold in the market. The proportion of the electronic apparatuses imported for the manufacturing is even higher. Given India's enormous appetite for the imported electronic products, it is very important for the importers and the foreign manufacturers to get to every aspect of the compliance right. Failing to do so can actually prove to be very expensive and can also damage the business credibility.

Overview on QSTC (Quality, Services, Timeliness and Cost): QSTC is prevalent in "High-mix, low-volume" manufacturing, which refers to a wide range of products produced in small quantities. There are two market benefits: customer demand for customization and inventory reduction. In a high-product-mix-low-volume scenario, manufacturing systems become more dynamic as customers demand more customised products. In such manufacturing, the ability to plan resource requirements drives competitive advantage. Choosing the appropriate manufacturing strategy, along with sound tactical knowledge, is essential for modern manufacturing. This will confer a competitive advantage in cost, quality, delivery, responsiveness, technology, and services.

Building complex products in very small quantities can be a major challenge for OEMs. As such, many choose to outsource their high-mix, low-volume production to service providers having more experience or expertise in the particular field. Outsourcing production can actually result in fewer costly errors, free up the internal engineering and R & D resources, and enable greater control of the finances.

Import substitution: India's import of electronics products systematically declined between FY'15 and FY'20 however increased sharply in FY'22 owing to slowdown in domestic production due to shortage of semiconductors globally. Long run mission of the Govt. is to reduce dependency on imported electronics products and services through 'Atmanirbhar Bharat' and developing local electronics manufacturing ecosystem with the help of various incentives and policies.

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.

The introduction of the PLI scheme to promote component sourcing; FDI policies relaxing companies' ability to set up bases in India, allowing them to drive product development, R&D, and other knowledge-intensive activities in collaboration with Indian companies; and the establishment of dedicated freight corridors that help in the advancement of transportation technology and increase in productivity are some of the key initiatives taken by the government of India. Freight corridors are high-speed, high-capacity railway lines designed solely for freight traffic, requiring the seamless integration of improved infrastructure. The Bhaupur-Khurja segment of the Eastern Dedicated Freight Corridor (EDFC) in Uttar Pradesh was recently inaugurated by the government.

Component manufacturing/ Lead time: Companies in the electronics industry should work together to obtain a minimum amount 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. India's PCB manufacturing capacity is restricted, particularly for flexible, HDI, and multilayer PCBs. Currently, OEMs import pre-designed and pre-built PCBA from third parties. However, in-house PCBA design and assembly is required. Demand for PCBs is projected to be driven by EMS/ODM investments in high-value-added production. Reduction in lead times from 4 weeks to 1 week by discrete local sourcing of PCB is a significant driver for PCBAs to source their bread boards locally than import. PCBA design and assembly alone will drive overall local value addition and entice foundry players to manufacture high-cost silicon based PCBA sub-components locally. This might bring a lot of value to the Make in India programme.

Local value addition: In India, the electronics sector faces cost disadvantages in terms of logistics and limitations in terms of local value addition. As the cost of value addition is increasing, it leaves domestic manufacturers at a competitive disadvantage and has stifled new investments in value-added manufacturing, keeping them heavily reliant on imports. The COVID crisis has highlighted the vulnerability of relying on global electronics supply chains. A notable example is the recent shortage of chips.

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 will open up 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 complexity of operations, are pull factors for MNCs to invest in India.

The Government has given higher priority to promote mobile phones segment within the electronics manufacturing, by providing focus on development of mobile phones, components, sub-assemblies and the entire ecosystem. Right from providing land at a subsidized rate to offering them variable investment subsidy and VAT exemption, the government is also providing mega industry status to these companies.

India's domestic demand has been increasing, thus encouraging the likes of Apple, Xiaomi, Oppo, Vivo, Lava, OnePlus, RealMe and Samsung to expand local manufacturing and also export from the world's second largest smartphone market. Some of the key initiatives/ schemes/ programs introduced by the government in boosting the mobile phone market in India include:

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. 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 country's business operations by encouraging 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, pharmaceuticals 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 specifically to mobile phones and components market in India. 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 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. The allocation for Mobile Manufacturing and Specified Electronic Components is around INR 409.5 billion, which is significantly higher than any other sector. It has different thresholds of investments required for domestic and international companies. The scheme proposed financial incentive to boost domestic manufacturing and attract large investments in the electronics value chain including mobile phones, electronic components and ATMP units. Fully integrated manufacturers are going to be the biggest beneficiary of this scheme. This scheme will definitely help India Inc. to be an integral part of the global supply chain.

Chart 5.10: 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#	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
Total		**1,661.9**

 # 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 5.11: Production Linked Incentive scheme (PLI): scheme 1 (Round 1) - for large scale Electronics manufacturing, india, April 2020

Target Segments Eligible under PLIC Scheme

- Mobile Phones
- Specified Electronic Components
  - SMT components
  - Discrete semiconductor devices including transistors, diodes, thyristors, etc.
  - Passive components including resistors, capacitors, etc. for electronic applications
  - Printed Circuit Boards (PCB), PCB laminates, prepregs, photopolymer films, PCB printing inks
  - Sensors, transducers, actuators, crystals for electronic applications
  - System in Package (SIP)
  - Micro / Nano-electronic components such as Micro Electromechanical Systems (MEMS) and Nano Electromechanical Systems (NEMS)
  - Assembly, Testing, Marking and Packaging (ATMP) units

Segment	Proposed Incentive Rate (%)	Incremental Investment Over Base Year (INR Billion)	Incremental Sales of Manufactured Goods Over Base Year
Mobile Phones (Invoice Value of INR 15,000 and above)	Year 1: 6% Year 2: 6% Year 3: 5% Year 4: 5% Year 5: 4%	INR 10 Billion over 4 years Cumulative minimum: Year 1: INR 2.5 Billion Year 2: INR 5.0 Billion Year 3: INR 7.5 Billion Year 4: INR 10.0 Billion	Year 1: INR 40.0 Billion Year 2: INR 80.0 Billion Year 3: INR 150.0 Billion Year 4: INR 200.0 Billion Year 5: INR 250.0 Billion
Mobile Phones (Domestic Companies)		INR 2 Billion over 4 years Cumulative minimum: Year 1: INR 0.5 Billion Year 2: INR 1.0 Billion Year 3: INR 1.5 Billion Year 4: INR 2.0 Billion	Year 1: INR 5.0 Billion Year 2: INR 10.0 Billion Year 3: INR 20.0 Billion Year 4: INR 35.0 Billion Year 5: INR 50.0 Billion
Specified Electronic Components		INR 1 Billion over 4 years Cumulative minimum: Year 1: INR 0.25 Billion Year 2: INR 0.50 Billion Year 3: INR 0.75 Billion Year 4: INR 1.0 Billion	Year 1: INR 1.0 Billion Year 2: INR 2.0 Billion Year 3: INR 3.0 Billion Year 4: INR 4.5 Billion Year 5: INR 6.0 Billion

**Year 1 (FY2020-21); Year 2 (FY2021-22); Year 3 (FY2022-23); Year 4 (FY2023-24); Year 5 (2024-25)*

Source: MeitY (Ministry of Electronics and Information Technology)

After announcement of the first round in April 2020, the second round of the PLI scheme for large-scale electronics was approved in February 2021 with revisions to incentive rates, ceilings, target segments, and criteria. The PLI scheme announced in the second round is only valid for four years for specified electronic components (which includes SMT components, discrete semiconductor devices, passive components, PCBs, sensors, transducers, MEMS, NEMS and ATMP units).

Chart 5.12: Production Linked Incentive Scheme (PLI): Scheme 1 (Round 2) - for Large Scale Electronics Manufacturing, India, March 2021

Segment	Incentive Rate (on Incremental Sale of Manufactured Goods) (%)	Incremental Investment Over Base Year (INR Billion)	Incremental Sales of Manufactured Goods Over Base Year
Specified Electronic Components	Year 1: 5% Year 2: 4% Year 3: 4% Year 4: 3%	INR 0.25 Billion over 4 years Cumulative minimum: Year 1: INR 0.05 Billion Year 2: INR 0.11 Billion Year 3: INR 0.18 Billion Year 4: INR 0.25 Billion	Year 1: INR 0.15 Billion Year 2: INR 0.35 Billion Year 3: INR 0.60 Billion Year 4: INR 1.00 Billion

**Year 1 (FY2021-22); Year 2 (FY2022-23); Year 3 (FY2023-24); Year 4 (FY2024-25)*

Source: MeitY (Ministry of Electronics and Information Technology)

The Production Linked Incentive Scheme for IT Hardware proposes a financial incentive to boost domestic manufacturing and attract large investments in the value chain. The scheme seeks to incentivise companies to utilise the existing installed capacity to fulfil the increasing domestic demand. Product Linked Incentives of up to INR 73 billion will be awarded over a period of 4 years.

Chart 5.13: Production Linked Incentive Scheme (PLI) for IT Hardware, India, March 2021

Target Segments Eligible under PLIC Scheme

- Laptops
- Tablets
- All-in-one PCs
- Servers

Segment	Proposed Incentive Rate (%)	Incremental Investment Over Base Year (INR Billion)	Incremental Sales of Manufactured Goods Over Base Year
IT Hardware Companies (I) Laptops (Invoice value of INR 30,000 and above) (II) Tablets (Invoice value of INR 15,000 and above) (III) All-in-one PCs (IV) Servers	Year 1: 4% Year 2: 3% Year 3: 2% Year 4: 2% / 1%	INR 5 Billion over 4 years Cumulative minimum: Year 1: INR 0.5 Billion Year 2: INR 1.0 Billion Year 3: INR 3.0 Billion Year 4: INR 5.0 Billion	Year 1: INR 10.0 Billion Year 2: INR 25.0 Billion Year 3: INR 50.0 Billion Year 4: INR 100.0 Billion
Domestic Companies (I) Laptops (II) Tablets (III) All-in-one PCs (IV) Servers		INR 0.20 Billion over 4 years Cumulative minimum: Year 1: INR 0.04 Billion Year 2: INR 0.08 Billion Year 3: INR 0.14 Billion Year 4: INR 0.20 Billion	Year 1: INR 0.5 Billion Year 2: INR 1.0 Billion Year 3: INR 2.0 Billion Year 4: INR 3.0 Billion

**Year 1 (FY2021-22); Year 2 (FY2022-23); Year 3 (FY2023-24); Year 4 (FY2024-25)*

Source: MeitY (Ministry of Electronics and Information Technology)

There are few more schemes which have given boost to domestic electronics manufacturing. These are:

a) **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS):** The aim is to strengthen the manufacturing ecosystem of electronic components and semiconductors. Target manufacturing of electronic components and semiconductors through the scheme will help meet domestic demand, increase value addition and promote employment opportunities in this sector. Incentives of up to INR 32.85 Billion will be awarded under the Scheme over a period of 8 years.

b) **Merchandise Exports from India Scheme (MEIS):** The scheme falls under foreign trade policy of India, replacing five other similar incentive schemes in the past. As per this scheme the government of India provides benefits up to 4% depending on the country of exports and the products. Rewards under the scheme are payable as percentage of realized free-on-board value and, MEIS duty credit scrip can be transferred to the company for working capital needs or used for payment of various duties such as basic customs duty.

c) **Modified Electronics Manufacturing Clusters Scheme (EMC 2.0):** The scheme is aimed to strengthen the infrastructure base for the electronics industry and deepen the electronics value chain in India. The scheme provides financial incentives for creating quality infrastructure as well as common facilities and amenities for electronics manufacturers. Financial Incentives of up to INR 37.62 Billion will be disbursed over a period of 8 years.

d) Semiconductors and Display Fab Ecosystem

In furtherance of the vision of Atmanirbhar Bharat and positioning India as the global hub for Electronics System Design and Manufacturing, Govt. of India has approved the comprehensive program for the development of sustainable semiconductor and display ecosystem in the country with an outlay of INR 76,000 Crore (>10 billion USD). The programme will usher in a new era in electronics manufacturing by providing a globally competitive incentive package to companies in semiconductors and display manufacturing as well as design. This shall pave the way for India's technological leadership in these areas of strategic importance and economic self-reliance.

The programme aims to provide attractive incentive support to companies / consortia that are engaged in Silicon Semiconductor Fabs, Display Fabs, Compound Semiconductors / Silicon Photonics / Sensors (including MEMS) Fabs, Semiconductor Packaging (ATMP / OSAT) and Semiconductor Design. Following broad incentives have been approved for the development of semiconductors and display manufacturing ecosystem in India:

- **Semiconductor Fabs and Display Fabs:** The Schemes for Setting up of Semiconductor Fabs and Display Fabs in India shall extend fiscal support of up to 50% of project cost on pari-passu basis to applicants who are found eligible and have the technology as well as capacity to execute such highly capital and resource intensive projects. Government of India will work closely with the State Governments to establish High-Tech Clusters with requisite infrastructure in terms of land, semiconductor grade water, high quality power, logistics and research ecosystem to approve applications for setting up at least two Greenfield Semiconductor Fabs and two Display Fabs in the country.

- **Semi-conductor Laboratory (SCL):** Union Cabinet has also approved that Ministry of Electronics and Information Technology will take requisite steps for modernization and commercialization of Semi-conductor Laboratory (SCL), Mohali. MeitY will explore the possibility for the Joint Venture of SCL with a commercial fab partner to modernize the brownfield fab facility.

- **Compound Semiconductors / Silicon Photonics / Sensors (including MEMS) Fabs and Semiconductor ATMP / OSAT Units:** The Scheme for Setting up of Compound Semiconductors / Silicon Photonics / Sensors (including MEMS) Fabs and Semiconductor ATMP / OSAT facilities in India shall extend fiscal support of 30% of capital expenditure to approved units. At least 15 such units of Compound Semiconductors and Semiconductor Packaging are expected to be established with Government support under this scheme.

- **Semiconductor Design Companies:** The Design Linked Incentive (DLI) Scheme shall extend product design linked incentive of up to 50% of eligible expenditure and product deployment linked incentive of 6% - 4% on net sales for five years. Support will be provided to 100 domestic companies of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor linked design and facilitating

the growth of not less than 20 such companies which can achieve turnover of more than INR 1500 Crore in the coming five years.

- **India Semiconductor Mission:** In order to drive the long-term strategies for developing a sustainable semiconductors and display ecosystem, a specialized and independent "India Semiconductor Mission (ISM)" will be set up. The India Semiconductor Mission will be led by global experts in semiconductor and display industry. It will act as the nodal agency for efficient and smooth implementation of the schemes for setting up of Semiconductor and Display Fabs.

Chart 5.14: Atmanirbhar Bharat 3.0 - Stimulus package (after first COVID-19 wave), India, November 2020

Sectors	Stimulus Package (INR Billion)
Boost for Atmanirbhar Manufacturing - Production Linked Incentive Scheme	1,459.8
Industrial Infrastructure, Industrial Incentives and Domestic Defence Equipment	102.0
Boost for Project Exports - Support for EXIM Bank	30.0
Boost for Infrastructure - equity infusion in NIIF	60.0
Atmanirbhar Bharat Rozgar Yojana	60.0
Support for Agriculture - Fertiliser Subsidy	650.0
Boost for Rural Employment	100.0
R&D Grant for Covid Suraksha - Indian vaccine development	9.0
Housing for All - PMAY-U	180.0
Total	2,650.8

Source: Ministry of Finance, Govt. of India

All the above mentioned policies and initiatives, 'Make in India', PLI, DLI, Scheme for development of Semiconductor and Display Fab ecosystem, SPECS, MEIS, and EMC, have provided necessary impetus to the domestic electronics manufacturing industry and India is now on path to become a global manufacturing hub for electronics products

Comparative Analysis of industry in India, China and Vietnam

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 on favourable manufacturing parameters

Chart 5.15: Economic comparison on favourable manufacturing parameters, India, China & Vietnam, 2021

PARAMETERS		INDIA	CHINA	VIETNAM
Population (Million)		1,390.0	1,410.0	98.30
Annual GDP (USD Trillion)		3.18	17.46	0.37
GDP Growth (%)	2021	8.7	8.1	2.6
	2026	6.5	4.9	6.8
Inflation (%)		5.5	0.9	1.9
Manufacturing Value Added (% of GDP)		14.4	26.2	25.0
Export (USD Trillion)		0.42	3.36	0.34
Imports (USD Trillion)		0.61	2.69	0.33
Manufacturing Risk Index (Rank)		2	1	4
FDI Investments (USD Billion)		45	334	20

Source: World Bank, IMF, Frost & Sullivan

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 and Vietnam's median age of 31.9 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. Due to a lack of manpower, this has resulted in a labour shortage and increased costs.

B. Labour market comparison

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. 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).

Chart 5.16: Labour market comparison, India, China & Vietnam, 2021

PARAMETERS	INDIA	CHINA	VIETNAM
Total Labour Force (Million)	471.68	750.6	56.54
Total Labour Force, Female (% of Total population)	26.2	63.7	62.2
Labour force participation rate (% of total population)	51.1	71	68.6
Employment in Industry (% of Total Employment)	26.18	28.18	28.36
Wage and salaried workers (% of Total Employment)	23.9	53.5	44.38
Average Daily Wages - Manufacturing (USD)	~6	~35.5	~10.48

Source: World Bank, IMF, Frost & Sullivan

C. Manufacturing eco-system comparison

Chart 5.17: Manufacturing eco-system comparison, India, China & Vietnam, 2021

PARAMETERS	INDIA	CHINA	VIETNAM
Favorable Government Policies and Programs	Low Med High	Low Med High	Low Med High
Developed Component eco system	Low Med High	Low Med High	Low Med High
Labour availability and Cost	Low Med High	Low Med High	Low Med High
Maturity of Infrastructure	Low Med High	Low Med High	Low Med High
Ease of Export	Low Med High	Low Med High	Low Med High

Source: Frost & Sullivan

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.

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.

D. Disability analysis

As per ELCINA's 'EMS Task Force Report on Market & Industry Analysis on EMS Sector in India', the EMS Task Force along with Invest India had undertaken a detailed disability analysis of the Indian EMS industry in comparison with China. The disability analysis was undertaken for both the Professional / Industrial / Strategic sectors (HMLV) and the Consumer Products industry (Mobile & others – HVLM). The analysis has been depicted in the chart 5.18. The analysis suggests that disability is 8.53% in the HMLV segment which is largely catered by the domestic EMS firms. On the other hand, disability is comparatively lower at 6.97% in the HVLM segment as this segment is dominated by global EMS firms and has established supply chain networks. The analysis was later used to introduce various policies and incentive schemes for the industry.

Chart 5.18: Disability analysis

Break-up of components and sub-components in Production cost		High Mix Low Volume (HMLV)		High Volume Low Mix (HVLM)	
Components	Sub-components	China	India	China	India
A. Materials and consumables cost	Basic component costs	74.52	81.06	85.36	90.07
	Inventory costs	1.20	2.44	0.94	1.25
	Total cost of materials	75.71	83.5	86.30	91.32
	% Disability	10.28%		5.81%	
B. Manufacturing cost	Wages (including labour costs and productivity)	12.94	7.03	6.41	3.48
	Power	0.74	0.91	0.12	0.16
	Other costs	1.33	2.00	0.88	1.77
	Total cost of manufacturing	15.01	9.94	7.42	5.41
	% Disability	-33.74%		-27.07%	
C. Logistics Cost	Logistics	1.16	2.43	0.13	0.25
	Total cost of logistics	1.16	2.43	0.13	0.25
	% Disability	110.35%		100.00%	
D. Finance cost	Cost of finance	2.30	4.12	1.67	3.02
	Total cost of finance	2.30	4.12	1.67	3.02
	% Disability	79.41%		80.74%	
Total cost of production		94.18	100.00	95.51	100.00
Absolute disability (Production)		6.18%		4.70%	
Preferential policies	Applicable incentives & EOB measures	2.50	0.50	2.50	0.50
	Total refund	2.50	0.50	2.50	0.50
	% Disability	-80.00%		-80.00%	
Total cost		91.68	99.50	93.01	99.50
Absolute disability		8.53%		6.97%	

Source: ELCINA, Frost & Sullivan

Advantage India: A favourable destination for Electronic Manufacturing

India has long been seen as an attractive destination with low-cost skilled labour and a challenging business environment. In recent years, India has risen significantly in the global rankings to become a favoured investment destination. Previously hampered by poor demand and value addition, India's electronics sector was not regarded as a top destination by decision makers. With the recognition of electronics as a key segment for policy focus, this situation has changed. The National Policy on Electronics (NPE) emphasised local value addition and created an enabling environment. The shift in government in 2014, and its unwavering focus on manufacturing through Make-in-India policies, attracted the interest of both global and domestic companies.

Around INR 20,000 billion (USD 300 billion) has been set aside for the PLI scheme over the next five years, with the scheme expected to result in an increase in production of approximately USD 520 billion over the next five years. The scheme provides an average of 5% of production as an incentive. Till date PLI schemes have been announced for 13 sectors.

India has been able to take advantage of its demographic dividend while also introducing much-needed flexibility in its manufacturing policies. The conscious efforts to attract global investors have resulted in a growth in FDI as well as investor confidence. The following driving factors contribute to India's increasing preference for electronics manufacturing:

- 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
- Duties and tariffs to discourage imports and encourage domestic value addition
- Digitalization that accentuates demand for select products

CHAPTER 6 – MARKET DEEP DIVE FOR SELECT SEGMENTS WITHIN INDIAN EMS/ ODM INDUSTRY

There are multiple factors due to which EMS has become a popular choice for the electronics OEMs globally in the last four decades.

- Outsourcing helps the OEMs to focus on their core activities i.e., product innovation, marketing and selling. EMS companies in India are slowly evolving to take up designing work as well.
- It helps OEMs to cut down on their operational costs and they no longer need to invest in expensive capital equipment for electronics assembly and testing
- It helps OEMs to de-bottleneck their capacities and scale up faster.
- It increases purchasing power of the OEMs as large EMS companies have experience across a breadth of products and industries and also have access to a wider range of suppliers.

Nature and size of EMS business opportunity vary across the industry segments. The same has been listed in the table below:

Summation of opportunities from select business segments for Bharat FIH's EMS business in India

Industry	Market dynamics	EMS market size (INR billion)			BFIH Share (FY22)
		FY22	FY26E	CAGR	
Mobile Phones	▪ Fastest growing electronics segment in India and 2nd largest market globally ▪ Account for approximately two-third of EMS business in India ▪ Strong growth outlook backed by favourable govt. policy ▪ EMS companies offer end to end manufacturing services for mobile phones including designing for select models	912	2,723	31.5%	19.6%
Electric Vehicles	▪ Themes such as Connected, Autonomous, Shared and Electric are driving digitalization and requirement for EMS in this space ▪ Significantly higher usage of electronics and controls in EV compared to ICEV ▪ Infotainment electronics is a fast emerging segment ▪ Critical electronics components such as infotainment, battery management system, engine control systems, hands-free communication system etc. are supplied by the EMS companies	6	76	86.8%	17.3%

Televisions	▪ A key segment under consumer durables ▪ Current penetration is approx. 70% ▪ Increasing access to electricity and higher disposable income driving penetration ▪ Introduction of next-gen technologies driving demand among urban population ▪ Designing, PCB Assembly for smart TVs, final TV assembly are some of the key offerings of EMS companies in this space	63	186	30.9%	0.2%
Hearables	▪ India is currently world's third largest wearable market ▪ Gaining popularity due to features such as internet connectivity and data exchange between a network and a device ▪ EMS companies offer end to end manufacturing services for hearables including electro-mechanical components	2	20	79.4%	9.3%
Telecom and Networking Products	▪ India is one of the largest exporter of telecom equipment and this trend expected to increase ▪ Increased outsourcing to companies with design, logistics and after sales support services ▪ Data centre storage solutions, racks and enclosures, GPON, IP PBX, Media Gateway, Router, Modems, 5G infra related solutions etc. are some of the current and future offerings of the EMS companies in this space	57	109	17.8%	-
IT Hardware	▪ EMS activity significantly lower compared to other segments ▪ Starting from basic PCB assembly to manufacturing of final products such as desktop PCs, notebook PCs, tablets, adaptors and workstations are offered by EMS companies in this space. ▪ Strong growth potential considering Indian can service 15 – 20% of global demand in next 5 – 6 years	45	314	62.6%	-
Mechanics	▪ Mechanics business, includes notably injection moulding, paint mechanics, metal stamping, CNC and electro mechanics assembly ▪ Strong growth outlook	20	64	33.3%	-

Mobile Phones

Mobile phones manufacturing value chain in India

Chart 6.1: Value chain of mobile phone manufacturing

OS Vendors

- OS vendors are key value chain members in the smartphone market.
- There are only a few OS developers worldwide providing smartphone OS. They follow one of the models listed below:
  - Proprietary OS for their own devices such as iPhone
  - OS on per shipment royalty basis such as Windows
  - Open-source OS such as Android and Symbian

Chipset Manufacturers

- Chipset forms another important value chain component in the smartphone market.
- Chipset manufacturers follow one of the models listed below:
  - Providing integrated application processors and modems such as Qualcomm
  - Providing only modems for various technologies such as Infineon
  - Providing application processors compatible with various modems such as NXP

Mobile Application Developers

- Application forms a more important decision-making parameter for an end customer when compared to feature phones.
- There are different participants in the entire smartphone value chain developing platform - dependent/independent applications.
- The cost to the handset manufacturer for these preloaded applications is in the range of 3-4%

OEMs/EMS/ODM

- Manufacturing of mobile phones is either through OEM/ ODM and EMS/ Contract manufacturing
  - OEMs: Beyond manufacturing they offer a whole gamut of services from logistics, repair, servicing etc. brands such as Xiaomi, Nokia, Samsung, LG
  - EMS/ODM: China-based, Foxconn is the EMS provider manufacturing iPhones, and Apple sells under its brand name.
  - ODMs: companies that offer product design as a service for other brands.

Distribution Channels

- There are three tiers of mobile device distribution in India -from manufacturers to super and zonal distributors and finally to retailers.
- The margins offered by manufacturers to channel partners are different for global brands and Indian manufacturers.
- Global participants pay less and operate in a volume-driven market.

Manufacturing of a mobile phone is dependent on various inter-linked factors such as product design, component sourcing, partnership with stakeholders, etc. across the value chain segments. The ecosystem is complex and involves large number of stakeholders including OS vendors, chipset manufacturers, mobile application developers, OEMs and channel partners. The application ecosystem is expected to act as a key differentiator, and telecom service providers are opening application stores to attract end-customers.

Mobile phone manufacturing involves design of handset, assembly of components and manufacturing of the device. With nearly 300 mobile handset and accessory manufacturing units in India, only top players have end to end manufacturing capabilities. Since its release, smartphones have drastically changed the way consumers communicate, educate, and entertain themselves. In addition to global manufacturers such as Samsung, Oppo, and Vivo, Indian manufacturers such as Lava, Micromax and others are establishing a presence and gaining market share. The majority of OEMs are now outsourcing manufacturing to EMS providers.

Mobile phone manufacturing includes distinct value chain segment, which constitutes handset design with four key component categories such as ICs, passives, modular components (camera module, sim tray, antennae, etc.) and plastic parts. It involves three steps in manufacturing - PCB assembly, box build assembly and testing of handset. Each step requires distinct skill sets, technology and investments by the manufacturer. Initially the design is conceived in board-room discussions along with top management and operations team. After considering various options, it is then passed on to the research and development team, which develops the prototype of the mobile handset. Next, the engineering team takes decision on the processor, memory, display, camera and other required specifications, with potential components matching the design of the mobile handset. The software team then tests the model and decides on the compatible operating system that has to be loaded in the handset. It is then tested rigorously for quality, performance, rigidity and other parameters. The testing is done for both hardware and software. Various tests such as drop test, bend test, and water tests are carried out to check its performance. The final model is then taken to the top management for final approval before mass production.

Industry overview of mobile phones in India

The Indian mobile phone market consists of both feature phones and smartphones. India is one of the fastest growing smartphone markets in the world with a CAGR of 7.3% between FY17 and FY22 in volume terms (113 million smart phones in FY'17 to 160 million smart phones in FY'22). The smartphone market was growing at a healthy rate till FY'20 but got stagnated in the last two financial years, first due to Covid and then because of supply side issues such as shortage of chipsets. Experts believe that once supply side issues are sorted by the end of Q1FY'23, Indian smartphone market will gets its mojo back and grow at a CAGR of 13-15% till FY'26. Introduction of 5G will aid in this growth. However, inflationary pressure on consumer's purse will remain a concern for the later part of this year. Feature phone market, on the other hand, will remain flat or grow at less than 1% CAGR over next 3 – 4 years. Increasing utility of smart phones due to digital payment regime and IOT related applications, availability of new features at affordable prices and increasing disposable income of the Indian consumers will be the key driving factors for smart phone adoption in the coming years.

The mobile phone network user base in India is one of the largest in the world, with 1.14 billion subscriptions as of March 2022 (Source: TRAI). Subscriptions in urban areas contribute to 55%, while those

in rural areas contribute to the remaining 45%. There was a decline of 4% in mobile phone subscriptions from FY21. The drop in subscriptions is linked to Jio's loss of subscribers, as the company has removed inactive or non-paying customers from its network.

Current mobile phone penetration in India is around 55%, compared to the global average of 67% (Source: The Mobile Economy, 2022, GSMA), indicating that the market is underpenetrated and there is significant opportunity for every player in the mobile phone value chain. Smart phones gained market acceptance, with a volume CAGR of 7.3% between FY17 and FY22, while feature phone segment has experienced decline of 7.1% during the same period. Similarly, India's overall mobile tele-density (defined as number of mobile phone connections per 100 people) has declined from more than 91% in March 2018 to around 83% in March 2022 (Source: TRAI). With the availability of dual SIM options and MNP (Mobile Number Portability), less number of people is now keen on having more than one mobile phone.

Market size and outlook of mobile phones in India

Volume-wise, Indian mobile phone market size was 255 million units in FY'22, a marginal decline of 3%, owing mostly to the feature phone segment, which declined by 12% in the last financial year. Smart phone market though registered a growth of 4%, it was way lower than the market expectations. Experts have attributed issues such as shortage of chipsets, inflationary pressure etc. are the reasons for such paltry growth. The situation is likely to continue for few more quarters and hence most of the research agencies and market experts have revised their growth forecast downwards for FY'23. Indian smartphone segment is expected to grow at a CAGR of 13% in FY'23 and continue the similar growth momentum through FY'26 at a CAGR of 14.2%. On the other hand, feature phone segment will remain stagnant during this period. Overall, domestic mobile phone market is likely to grow at a CAGR of 9.7%, to reach 370 million units by FY'26. The smartphone market likely to see revival in demand one 5G rollout happens by the end of 2022. Share of smartphone segment is expected to increase by 3% year-on-year to gain three quarter of the market by FY'22. One of the key factors driving the growth of smart phones is shrinking price difference between feature phones and smart phones. In the rural market, smartphone penetration will be slower than in the urban market. Aside from aesthetics, the increasing popularity of smartphones can be attributed to advancements in higher RAM, high-quality cameras, processors for faster mobile phone operation, as well as other functions such as longer battery life, better applications, and larger screens.

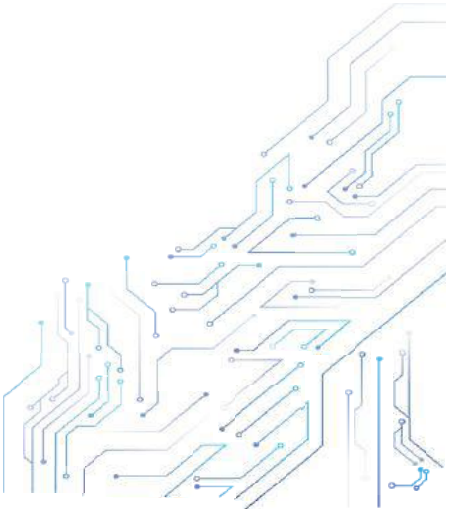
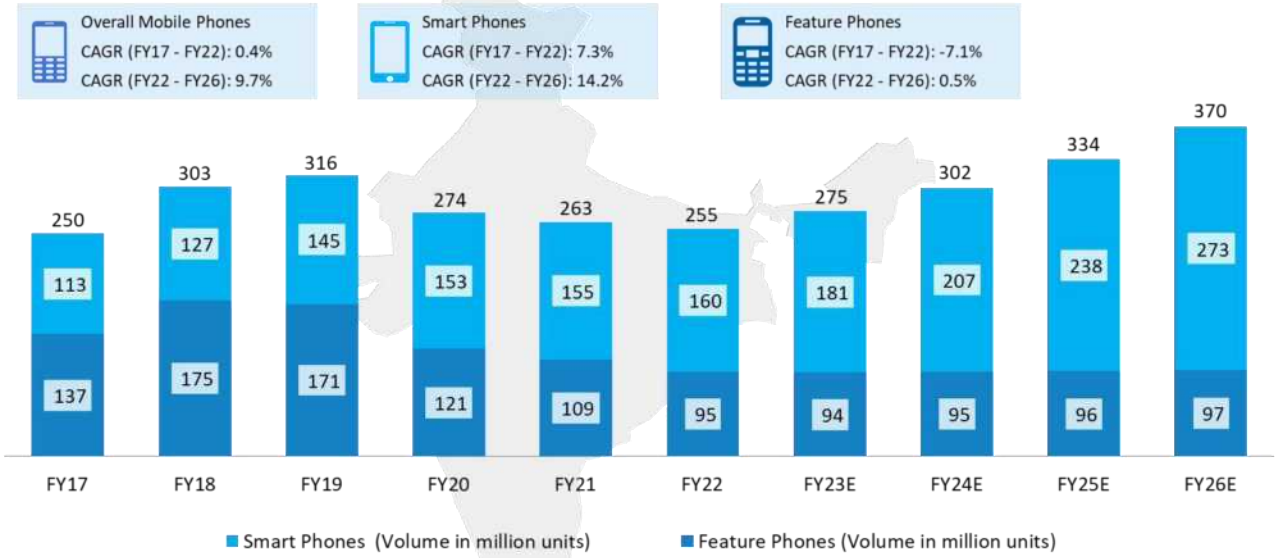


Chart 6.2: Mobile phone market, volume in million units, India, FY17-FY26E

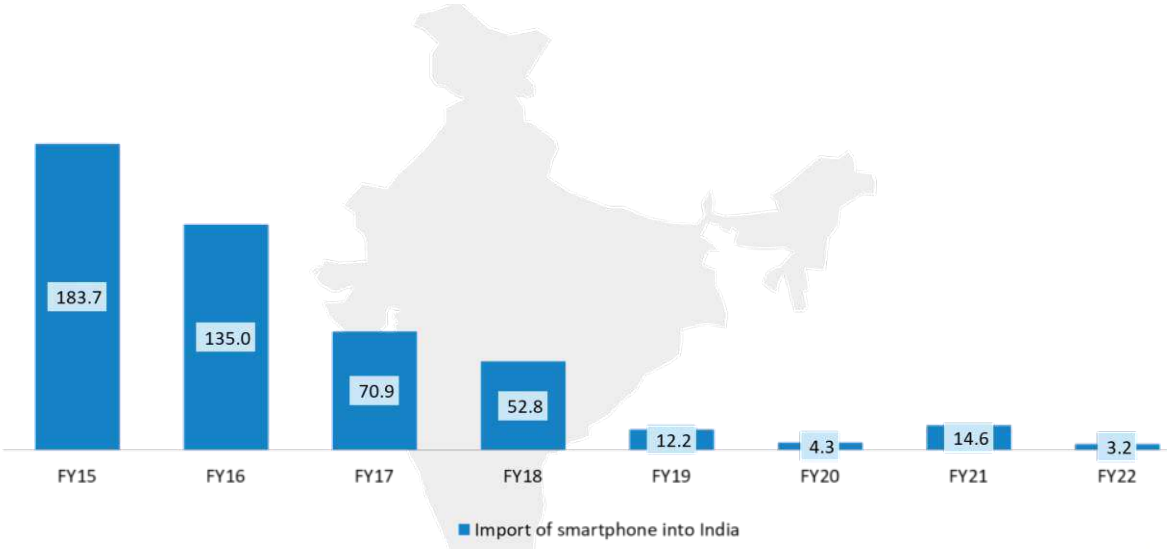


Note: E refers to Estimate

Source: Frost & Sullivan Analysis, Industry quarterly trackers

Import of smartphone in the country has exponentially declined over the years, which is a testament to the country's growing manufacturing / assembly capability. Smartphone import has touched a new low of 3.2 million units in FY'22 after peaking slightly at 14.6 million units in the Covid impacted year FY'21.

Chart 6.3: Import of smartphone into India; volume in million units, India, FY15 – FY22



Note: E refers to Estimate

Source: Frost & Sullivan Analysis, Ministry of Commerce (Export data bank)

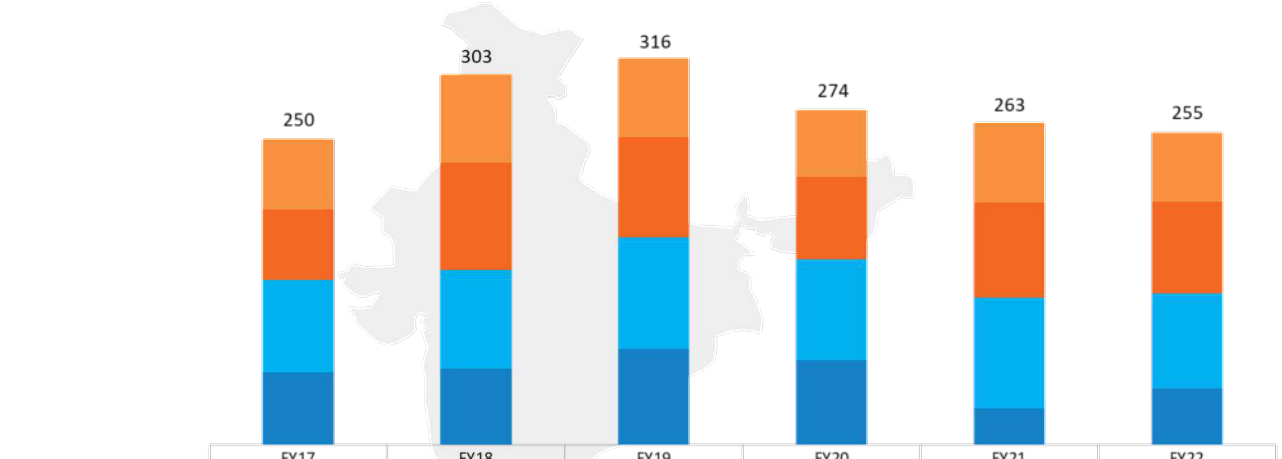
With the majority of suppliers using the Android operating system, product differentiation in terms of new application development, user interface, and built-in features remains challenging. As a result, marketing will become increasingly important for brand recognition, resulting in increased spending and consolidation

among small suppliers who cannot afford as much advertising as large, well-established brands. Among emerging economies, India has showcased the highest levels of development and innovation in the mobile phone segment. Furthermore, India is at the forefront of digital revolution, with the government's goal of making India a digitally empowered nation, with digital governance playing a critical role. Since the beginning of the last decade, smartphones have played a significant role in India's digital transformation, and the government is committed to providing services online. The OEMs' requirements in the mobile phone industry are ramp-up capabilities with scalability, cost efficiency and supply chain management

Competitive landscape of OEMs

The Indian mobile phone market is dominated by foreign players, especially Chinese and Korean companies. Xiaomi, Samsung, Vivo, Oppo, and RealMe are the market leaders in Smartphone segment whereas, companies such as Itel, Samsung, Lava, Nokia, Jio and Karbonn are the leaders in feature phone segment. Competitive intensity is on the rise due to increasing number of market participants and higher spending on R&D to create the differentiation According to FY22 data, Xiaomi is the market leader in smart phone sales in India and Itel is the market leader in feature phones. Bharat FIH is the largest mobile phone manufacturing and assembly services provider to Xiaomi, which is the leading supplier of smartphone in India with 27% and 24% volume share in FY'21 and FY'22 respectively. Samsung, one of the leading players with presence in both the segments, has decided to exit the feature phone segment by the end of 2022 and focus only on the smart phone category, particularly phones priced above INR 15,000.

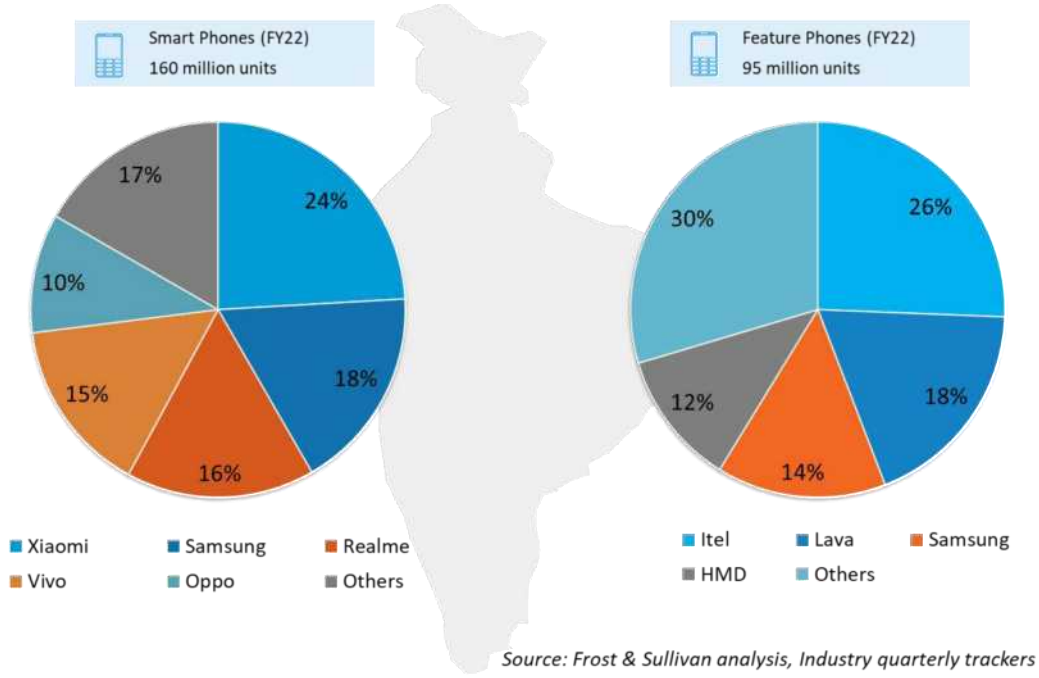
Chart 6.4: Quarterly mobile phone market, volume in million units, India, Q1FY17-Q4FY22



	FY17	FY18	FY19	FY20	FY21	FY22
Q4 (January - March)	58	72	64	55	65	57
Q3 (October - December)	57	88	82	67	78	75
Q2 (July - September)	75	81	91	82	91	78
Q1 (April - June)	59	62	78	69	30	46

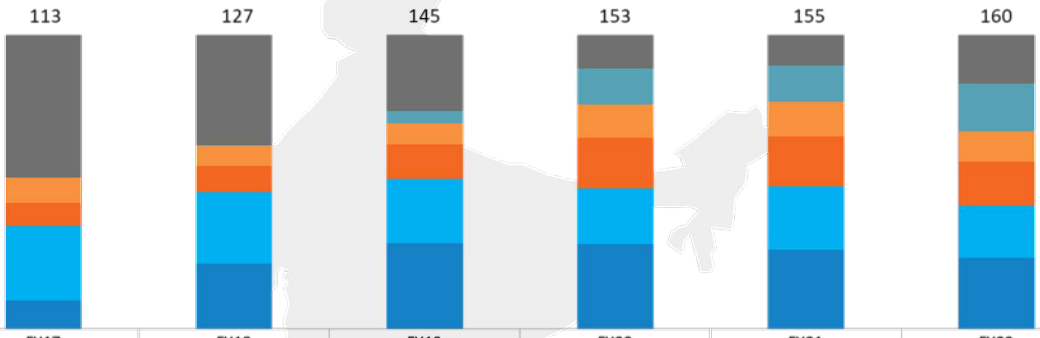
Source: Frost & Sullivan Analysis, Industry quarterly trackers

Chart 6.5: Mobile phone market share of Smart phone and Feature phone by key players, by volume, in %, India, FY22



Source: Frost & Sullivan analysis, Industry quarterly trackers

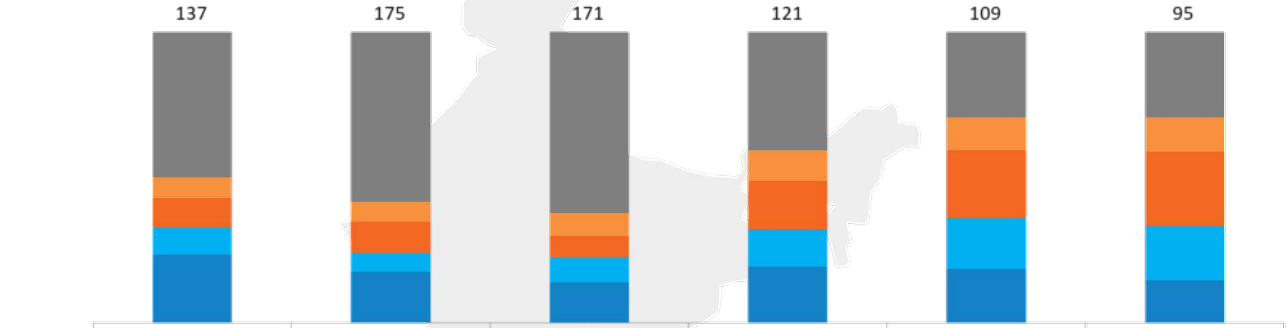
Chart 6.6 (a): Market share of Smart phones by key players, volume in million units, in %, India, FY17 – FY22



	FY17	FY18	FY19	FY20	FY21	FY22
Others	49%	38%	26%	12%	11%	17%
Realme	0%	0%	4%	12%	12%	16%
Oppo	8%	7%	7%	11%	12%	10%
Vivo	8%	9%	12%	17%	17%	15%
Samsung	25%	24%	22%	19%	22%	18%
Xiaomi	10%	22%	29%	29%	27%	24%

Source: Frost & Sullivan Analysis, Industry quarterly trackers

Chart 6.6 (b): Market share of Feature phones by key players, volume in million units, in %, India, FY17 – FY22



	FY17	FY18	FY19	FY20	FY21	FY22
Others	50%	59%	63%	41%	30%	30%
HMD	7%	7%	8%	10%	11%	12%
Itel	10%	11%	7%	17%	24%	26%
Lava	9%	7%	9%	13%	17%	19%
Samsung	23%	17%	14%	19%	18%	15%

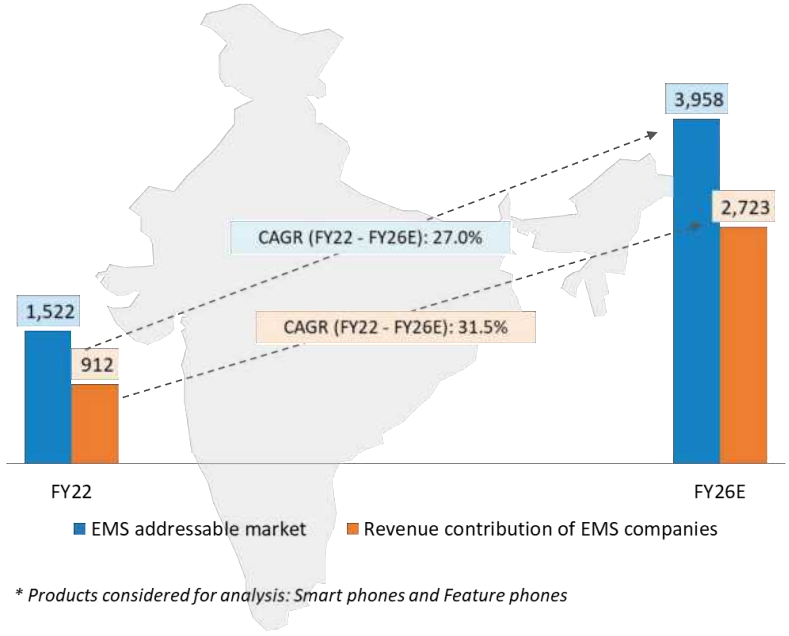
Source: Frost & Sullivan Analysis, Industry quarterly trackers

EMS/ODM market landscape

Mobile handset manufacturing involves the design of the handset, the assembly of components, and the manufacturing of the device. With nearly 300 mobile handset and accessory manufacturing units in India, only the leading players have complete, integrated manufacturing capabilities. Chinese OEMs like Xiaomi, Vivo, and Oppo have established themselves as competitors to market giants such as Apple and Samsung. Certain Indian manufacturers, including Lava, Micromax, and Intex, are also having significant presence as evident from their increasing market share.

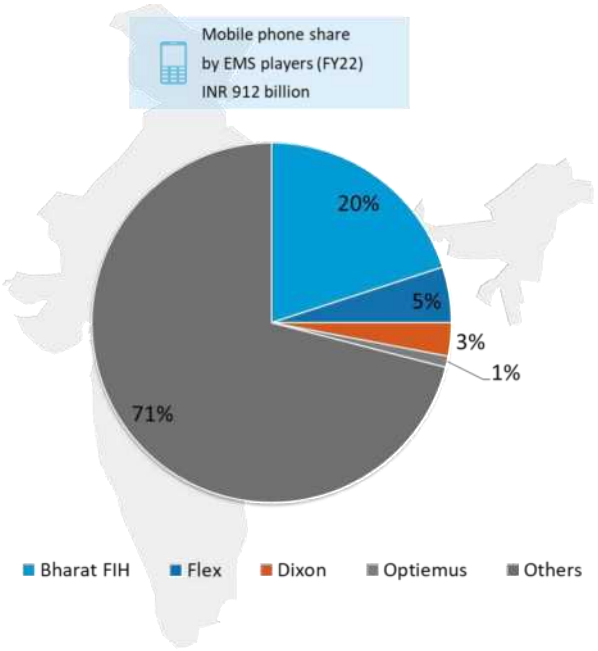
Mobile Phone is the largest EMS segment in India and BFIH is by far the largest EMS Company operating in the space. Bharat FIH, Dixon, Foxconn, Wistron, and Pegatron are the leading EMS companies in India at present. Bharat FIH dominates the mobile phone EMS market with 20% market share in FY'22. Cost-competitiveness, a burgeoning domestic electronics market coupled with favourable Government policies are expected to have positive impact on the EMS/ODM market in India. The contribution by EMS/ODM in the Mobile phone segment is expected to increase significantly in the coming years as many Global EMS majors setting up local manufacturing capabilities. Companies like Bharat FIH, Flextronics, and Dixon are already providing EMS to the leading mobile phone suppliers such as Xiaomi, Apple, Motorola, Lenovo, and others. Local EMS capabilities in terms of product assembly, packaging and reverse logistics (at present, only Dixon is offering this) are some of the attractive proposition for OEMs to consider EMS/ODM for local assembly. Multiple factors such as increasing logistics cost, raw material costs etc. are impacting and production cost of the OEMs which in turn will drive the ODM model.

Chart 6.7: EMS addressable market and revenue contribution of EMS companies for mobile phone segment, value in INR billion, India, FY22-FY26E



Note: E refers to Estimate *Source: Frost & Sullivan Analysis*

Chart 6.8: Mobile phone market share by EMS companies, by value, in %, India, FY22

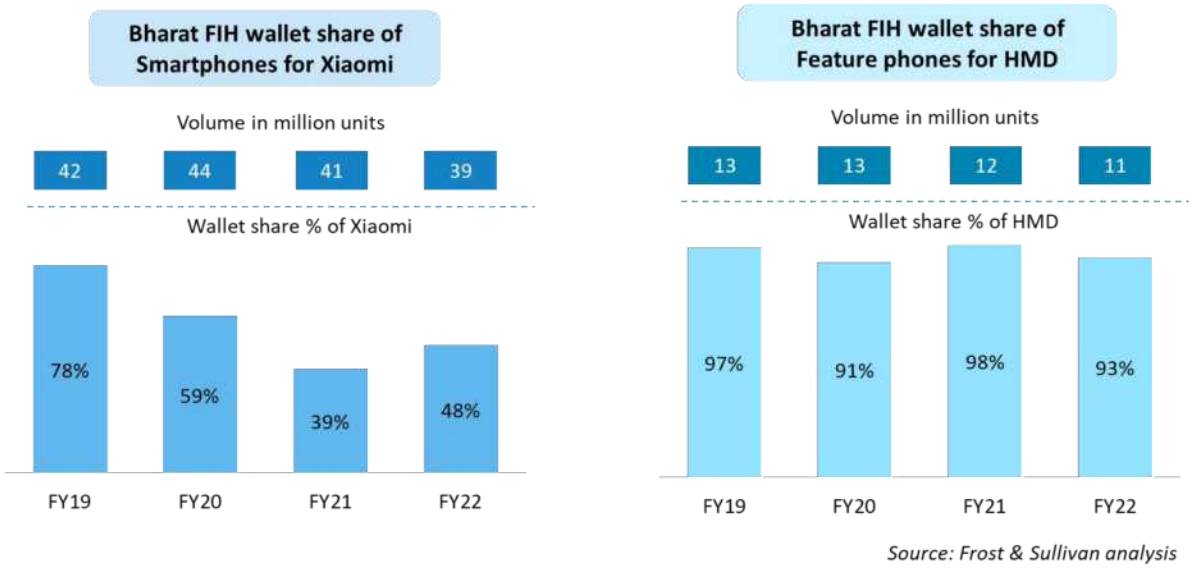


Source: Frost & Sullivan analysis

BFIH share of wallet[7] for Xiaomi and HMD[8]

Apart from BFIH, Xiaomi also has association with other EMS companies such as Flex and DBG India, and it has plans for expansion with addition of more assembly facilities., BFIH supplied 48% of Xioami's sales in FY22, with the remaining contribution coming in from the other players. According to industry estimates, around 1% of the total Xiaomi mobile phones are imported. Bharat FIH is also the major manufacturer of feature phones for HMD in India having wallet share of around 93% by sales volume in FY22.

Chart 6.9: Bharat FIH wallet share for Xiaomi and HMD, India, FY19 – FY22



Source: Frost & Sullivan analysis

Bharat FIH's sales volume and revenue declined in FY22 due to lower mobile phone sales as Xiaomi is diversifying its EMS provider base and HMD discontinuing sales of smart phones and experiencing lower sales volume for its feature phones. Both these factors put together, have resulted in lower order volume for Xiomi in FY'22.

EMS capability of competitors

Name of the EMS company	Product design & development	Component manufacturing & sourcing	Manufacturing	Logistics	Aftersales
Bharat FIH	✓	✓	✓	✓	✓
Dixon		✓	✓	✓	✓
Flex		✓	✓	✓	✓
Opteimus			✓	✓	
Bhagwati			✓	✓	

[7] Share of wallet / Wallet share of mobile phones refer to the percentage of OEMs' mobile phone volume sales contributed by EMS companies. It helps to understand the amount of business an OEM receives from an EMS company.

[8] HMD Global OY is the exclusive licensee of Nokia brand for phones and tablets. Nokia is the registered trademark of Nokia Corporation.

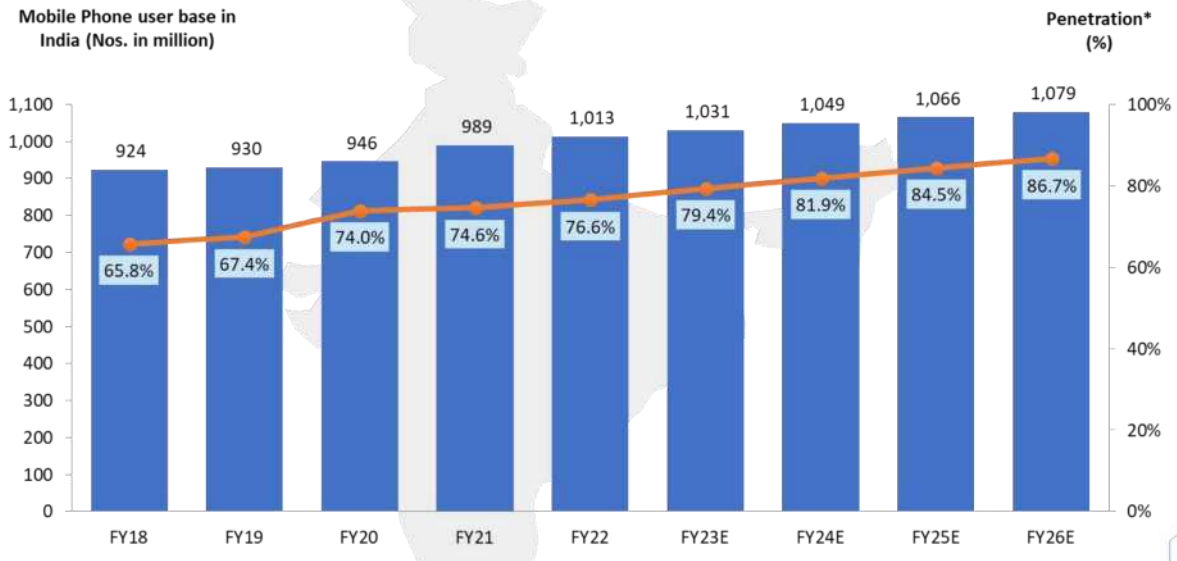
Analysis on changes in technology and average lifespan of mobile phones

It is estimated that nearly 493 million users are currently using smartphones in FY22, which has increased from 300 million users in FY18 (Source: Frost & Sullivan). This rise is primarily due to the increasing affordability of smartphones and improved mobile connectivity by service providers. The concept of budget smartphones and smart feature phones has shown a growing trend in the country driving in volumes and also cannibalizing the feature phones market.

The introduction of Reliance Jio in 2016 has disrupted the mobile industry resulting in an increased demand for 4G mobile handsets. The average revenue per user (ARPU) provides the most valuable insights in this context. In case of a feature phone the ARPU is INR 90-100 whereas for smartphones it is INR 170-200, making smartphones the preferred choice for service providers. Functional benefits and durability of feature phones, such as a long battery life, have been the driving factors for the higher demand for the feature phone segment. The larger part of the Indian consumer base especially in rural areas remains unexposed to the additional features of smartphones. Price is another factor wherein feature phones have an edge over smartphones. However, the advent of budget smartphones, smart feature phones and the extension of 4G coverage even in rural areas have changed the dynamics of the mobile industry in India.

Current penetration level of mobile phones in India and growth potential

Chart 6.10: Mobile phones user base and penetration, volume in million units, India, FY18-FY26E



*Penetration: is calculated by taking a ratio of unique mobile subscribers and total user base

Note: E refers to Estimate

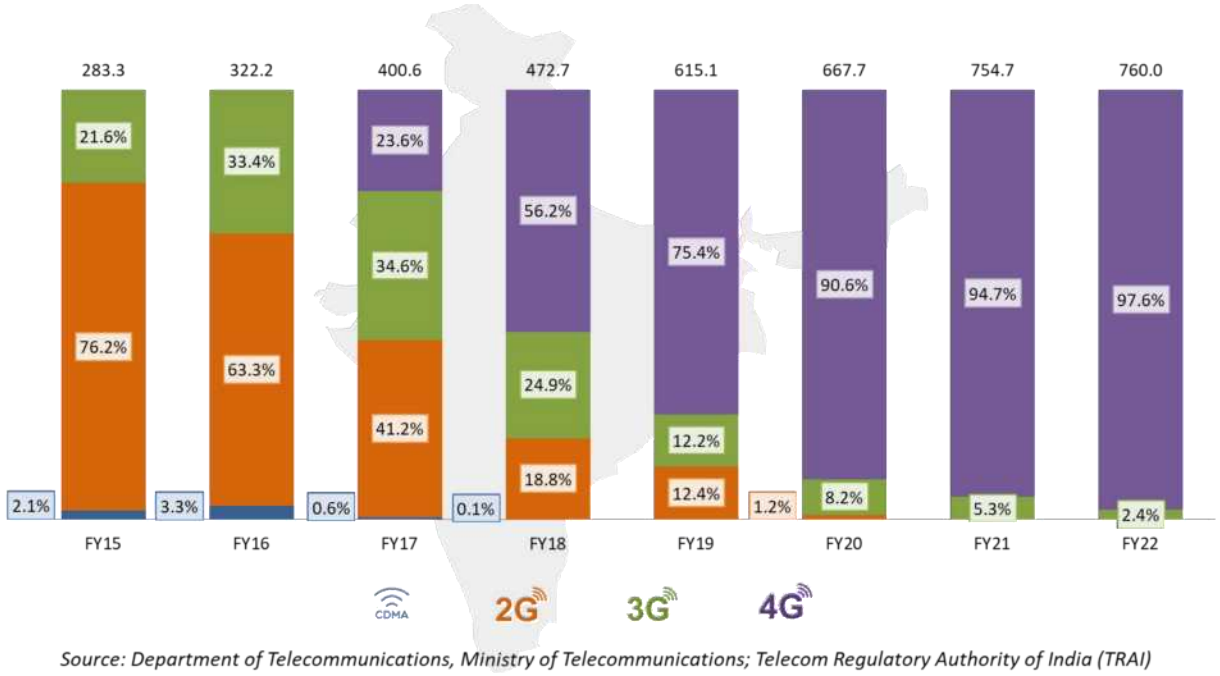
Source: Frost & Sullivan Analysis, Population data from Annual GDP estimates (MoSPI)

Overview and outlook on shift of technology from 2G to 4G & 4G to 5G

The first generation of wireless communication technology (1G) was introduced when NTT (Nippon Telegraph & Telephone) launched the first commercial cellular network in Tokyo in 1979. Successive generations have followed approximately every 10 years. Analog voice was the primary 1G service. 2G brought digital voice and began to introduce data services with SMS text messages. Internet access came with 3G and became much faster with the introduction of 4G in 2009. 4G itself continues to evolve, starting with 4G Long Term Evolution (LTE), and progressing with 4G LTE-Advanced (LTE-A) and 4G LTE-A Pro.

At present, the 4G network connectivity is dominating the market with nearly 95% share among the existing technologies. Although the current generation is entering the 5G era, there should be no expectations that previous generations of wireless technology will disappear. 4G LTE will remain the dominant technology around the world by number of subscribers till 2025. As per Frost & Sullivan analysis, in 2025, 4G LTE is projected to have the most global subscribers, followed by 5G NR (New Radio).

Chart 6.11: Technology-wise trend in number of mobile phone data subscription, Subscriptions in million, Technology split in %, India, FY15-FY22



Source: Department of Telecommunications, Ministry of Telecommunications; Telecom Regulatory Authority of India (TRAI)

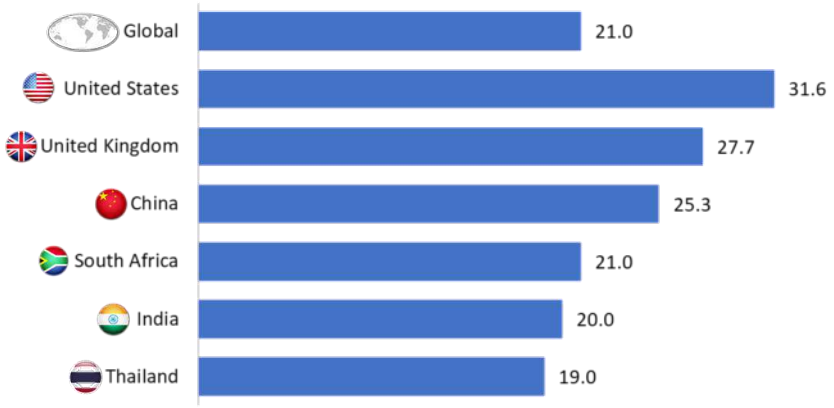
5G represents a fundamental shift in communication network architecture that will accelerate revenue generation through innovative services facilitated via 5G-enabled smartphones. 5G networks are significantly more dynamic than 4G networks, with services provided by logical network nodes distributed dynamically using distributed cloud computing. Mobile connectivity is considered important to bind rural and urban areas, widening market opportunities for business and also help government in gathering information and monitoring various inputs on growth parameters. Telecom service providers are taking various initiatives in terms of marketing, competitive pricing, migration to new technology, and network

coverage, all of which are expected to result in an increase in smartphone sales. Also, users demand greater functionality with improved network and technology.

Replacement rate of smartphones

India, with an average replacement cycle of 20 months for smart smartphones in 2021, will be comparable to the global average of 21 months. Previously, the replacement cycle in India varied between 24 and 27 months. Customers in emerging economies are more active in replacing their devices than customers in developed markets. Manufacturers providing higher-specification gadgets at lower price is one of the prime reasons for this shorter upgrade cycle.

Chart 6.12: Replacement period for smartphones by select countries, number of months, Global, 2021



Source: Frost & Sullivan Analysis

Growth drivers

- **The low-cost 4G network has increased the sale of smartphones:** India has one of the lowest mobile data prices in the world, with INR 50 (USD 0.68)/GB compared to the global average of USD 4.07/GB (Source: cable.co.uk). The low-cost 4G network along with improved network connectivity has increased the subscriber base and the sales of smartphones and 4G-enabled feature phones, which is evident from the growing domestic sales in the last few years.
- **India is becoming a manufacturing hub for mobile phones:** Currently, India is the world's second largest manufacturer of mobile phones, trailing only to China. India is expected to become a net exporter of mobile phones by 2025, a trend that is expected to continue. As the government of India offers initiatives and schemes to support the local manufacturing ecosystem, more players are establishing manufacturing units in India, and production and exports are expected to rise.
- **Market growth is being driven by entry-level mobile phone segments and higher sales in Tier 2 cities:** Increased internet and smartphone penetration aided the expansion of entry-level smartphones, and e-commerce website support encouraged the introduction of players such as Xiaomi, Samsung, and RealMe, even in Tier-2 cities.

- **EMI option as a key growth driver:** In recent years, easy EMI options combined with cash back on mobile purchases have been a significant growth driver for mobile sales in India. EMI options have given a push towards adoption of smartphones, as the average selling price of smartphones with advanced features is greater than that of feature phones.
- **Increase of 5G mobiles in India:** As the government prepares to launch 5G spectrum bands in 2022, mobile phone OEMs have started offering 5G model phones in India, a trend that is expected to continue in the coming years.

Key market trends

- **Smartphone manufacturing has become a pillar of the 'Make in India' initiative:** India now has approximately 300 manufacturers of mobile phones and accessories, up from four in 2014. Additionally, India has surpassed the US in smartphone sales and is the world's second largest producer of mobile phones, behind China. Moreover, measures such as the PLI scheme are expected to boost domestic manufacturing of mobile phones and components that attract foreign investment.
- **EMS model for OEMs:** Apart from OEM brands, India has EMS providers that manufacture mobile phones for leading brands. OEMs wish to concentrate their efforts on product design, finance management, brand development, distribution, and network management, leaving manufacturing to EMS partners. Additionally, EMS providers deliver additional benefits, such as assistance with frequent design changes, operational scale, and cost-effectiveness.

  Focus on exports to establish a global footprint: India exports to 24 countries, with some of those countries re-exporting to other markets, such as the UAE, allowing millions of consumers to use Made-in-India phones. India's mobile phone industry is well-established in the Middle East and North Africa (MENA) region, providing India with a sizable export market. Mobile phone exports swelled by 40% in the last financial year, from INR 229 billion in FY'21 to 357 billion in FY'22, and accounts for nearly 31% of the total exports from the country.

Market restraints

- **Mobile phone imports are creating a price war:** While fully imported mobile phones account for a negligible share of the Indian market, the budget's increased tariffs on components and other ancillaries have a cascading effect on mobile phone sales prices. The government increased the basic customs duty (BCD) on mobile phones and battery chargers from 0% in FY20 to 2.5% in FY22. BCD on imports of PCBA, camera modules, and connectors was increased to 2.5% on April, 2021. Other inputs and components of chargers will be subject to a 10% duty.
- **India is still in the developing stage of 5G Infrastructure:** The 5G ecosystem remains nascent in terms of applications and devices. It will take at least a few years before 5G has any meaningful significance in India. The fast technology transfer to 4G networks and smartphones in India represents a substantial improvement in 5G readiness in the next few years.
- **Manufacturing ecosystem:** While the mobile phones are assembled in India due to import taxes, the locally manufactured products are typically limited to headphones and chargers, which account for about 5% of the device's cost. 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. The government is attempting to address these issues and has launched the Phased Manufacturing Program in order for India to begin manufacturing mobile phones using locally manufactured components and gradual transition from assembly to manufacturing.

- **India lacks facilities to set up display manufacturing units:** The display, which is entirely composed of glass or plastic, is the only component of the smartphone that does not require a chip. Samsung is the manufacturer of Apple's iPhone display panels. LG and Sharp are also key players in this space; however these display panels are manufactured in South Korea, Taiwan, and Japan, respectively.

Regulations and incentives

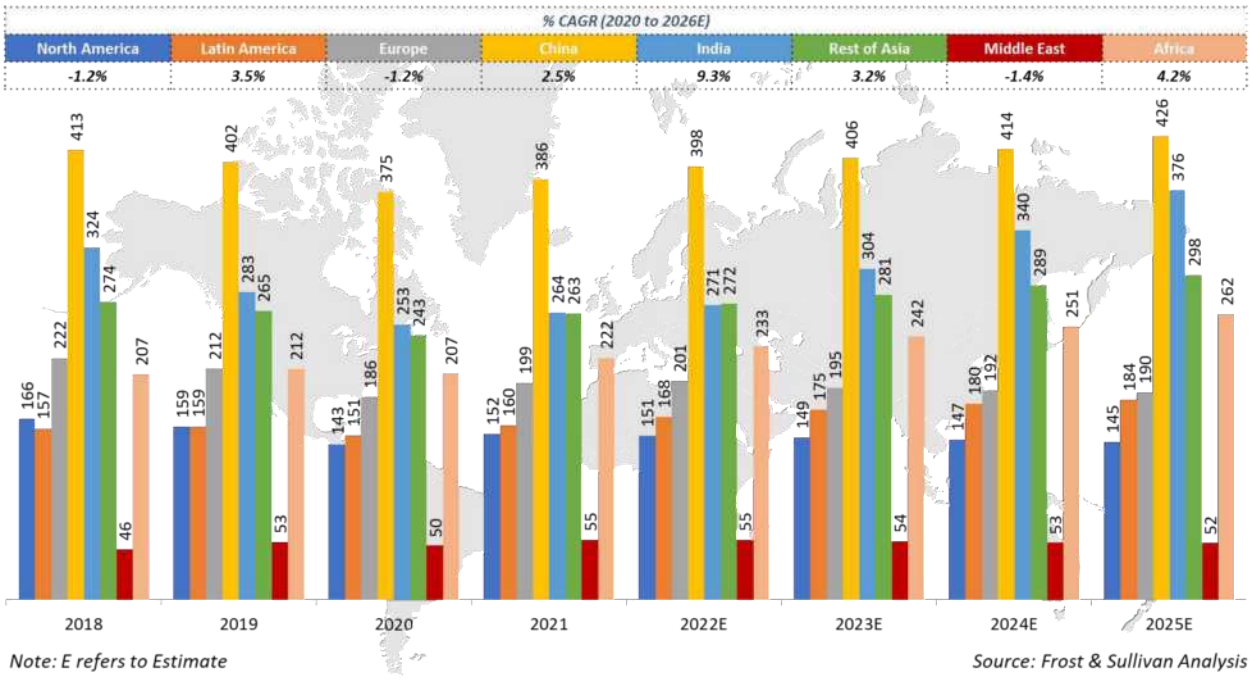
- **Make in India:** The Government of India initiated the 'Make in India' programme in 2014 to encourage companies to develop, manufacture, and assemble products in India and to promote committed manufacturing investments. It has helped India to become the world's second-largest mobile phone manufacturer.
- **Production Linked Incentive (PLI Scheme):** The PLI scheme is a government-funded incentive programme that was launched in 2020. It has distinct investment requirements for domestic and international businesses. The PLI scheme is a significant boost for India's mobile phone manufacturers. As part of the PLI, about INR 409 billion has been allocated for Mobile Manufacturing and Specified Electronic Components. The government has approved 16 mobile companies to participate in the PLI Scheme. Over the next five years, production of INR 10.5 lakh crore and exports of INR 6.5 lakh crore are expected.
- **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS):** The primary objective of this scheme is to strengthen the electronic component and semiconductor manufacturing ecosystem. The scheme helps to meet domestic demand, increase value addition, and promote job opportunities in this sector. Over an eight-year period, incentives worth up to INR 32.85 billion will be awarded under the Scheme.
- **Modified Electronics Manufacturing Clusters Scheme (EMC 2.0):** It helps to strengthen the infrastructure base for the electronics industry and deepen the electronics value chain in India. The scheme provides financial incentives for creating quality infrastructure as well as common facilities and amenities for electronics manufacturers. Financial Incentives of up to INR 37.62 billion will be disbursed over a period of 8 years.
- **Electronics Development Fund (EDF):** was being set up as a "Fund of Funds" to participate in the professionally managed "Daughter Funds" which provide the risk capital to those companies developing new technologies in the area of Electronics, Nano-electronics & Information Technology. This fund is fostering R&D and innovation in these technology sectors. EDF permits creation of an ecosystem for providing the risk capital to industry to undertake R&D in these technology areas (Source: MeitY).

Market trends of US, Europe, Middle East and Africa

The volatile economic situation and the supply chain restrictions negatively impacted the pricing of smartphones in the last two years which is expected to exert a pressure on overall market revenues. Buying preferences, especially across the developing regions of the world, have been shifting towards purchase of low to mid end devices driven by rising cases of unemployment and job uncertainties. While pricing related pressure on mobile phones is a global phenomenon, the impact is more pronounced across developing regions like Asia Pacific, LATAM and Middle East & Africa, which are also expected to be the fastest growing markets for smart phones during the forecast period. Frost & Sullivan estimates the low to mid-range segment to be the key driver for the smartphone market as products in this pricing segment have been known to offer a better value for money.

The Asia Pacific region has one of the largest customer bases for mobile phones and hence the unit shipments are high, driven largely by growing demand from China and India. India, one of the fastest growing global economies has been witnessing increased penetration of mobile phones and smart phones alike, driven primarily by reducing prices of these devices and also increases in disposable income. The Asia Pacific region together accounts for over 54% of the total mobile phone shipments globally.

Chart 6.13: Mobile phone market by region, volume in million units, Global, 2018-2025E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

In terms of revenue, however, there is a contrast where the developed economies account for a larger share of the global market primarily due to higher penetration of smartphones and an appetite for mid to high end devices that sell at a premium. While North America, Europe and the Middle East account for an estimated 23% of the global mobile shipments, these regions account for an estimated 47% in terms of revenue generated through sale of mobile phones. Frost & Sullivan estimates that the number of mobile phone subscriptions in North America and APAC is estimated at approximately 6.1 billion in 2021, which is nearly 71% of the total global mobile phone subscriptions.

According to Frost & Sullivan, African market is similar to Indian market in terms of purchasing power and demographics. Going forward, Frost & Sullivan anticipates Africa and India to emerge as key global markets for mobile phone manufacturers where penetration of mobile phones and smart phones are currently much lower than the global averages. These economies are evolving and have witnessed some of the highest urbanization trends recently. As economies evolve and more job opportunities are created, the per capita income levels in the region are set to improve significantly, creating a market initially for feature and entry level smart phones, gradually evolving towards mid and high range smartphone segments. Emerging mobile handset market, which includes Latin America, India, Middle East, Africa and Rest of Asia, is projected to grow from an estimated total of approximately 895 million handsets sold in 2020 to approximately 1,176 million handsets sold in 2025, according to Frost & Sullivan.

Middle East & Africa are expected to remain key export destinations in the forecast period as penetration of smartphones are relatively less over there and can be a key growth opportunity for Indian OEM and EMS players going ahead.

Overall export sales globally and key countries contributing to exports

China is the world's leading mobile phone manufacturer, followed by India, Vietnam, Indonesia, the United States, and Brazil. These top five nations account for 70% of all mobile phone production worldwide. With nearly 300 mobile phone and component manufacturing plants, India produced over 320 million units in 2019. This was lowered to around 280 million units in 2020 due to the COVID-19 pandemic, and increased to around 300 million units in 2021. Nearly 50% of the mobile phones manufactured in India are for the export market. The production of mobile phones is projected to increase in the near future as a result of numerous government initiatives in India.

China continued to dominate the global market in terms of the value of the total mobile phones manufactured and shipped across the global demand centres. Overall, the country accounted for 50% (in value terms) of the total mobile phones shipped followed by Vietnam and Hong Kong at 14% and 11% respectively. Put together, the top 5 mobile phone exporting countries account for an estimated 83% of the value of the mobile phones shipped globally.

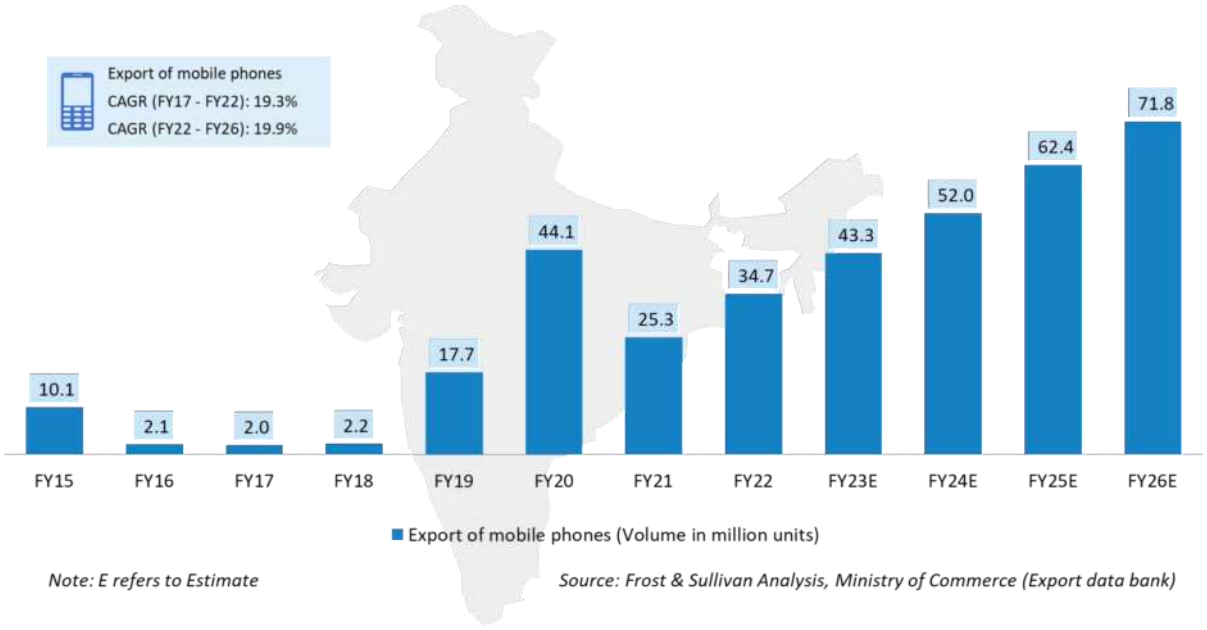
India is transforming to a global manufacturing hub, adding to the country’s GDP and balance of trade. Current export market of overall mobile phones in FY22 is around 34.7 Million units, with smartphones contributing to 32.6 Million units, which is around 94% of the total mobile phones market. India is expected to achieve a breakthrough and become a net exporter of mobile phones by 2025 and consolidate this trend in the future. Numerous investment announcements are made by Global Smartphone manufactures after support from government of India to boost the domestic manufacturing ecosystem through various initiatives and schemes. As more players are setting up manufacturing units in India, the production is expected to rise and hence the exports.

India has attracted interest from companies such global giant Samsung and Chinese OEMs in the mobile phone segment driven by the right set of incentives for manufacturing. The large domestic market, which was underpenetrated for long, has provided an opportunity to these players to address local demand as well as set-up base.

A major economic conflict that erupted in mid-to-late 2019 was the trade war between the United States of America (USA) and China, which included the sales ban on USA made components and software to Huawei. Apple and Samsung found their global sales challenged by Huawei until the trade war impacted global handset unit shipment by slowing economic growth in China, raising some component and material costs, and generating uncertainty over Huawei's fate. The on-going US-China trade war has created an uncertain environment for handsets markets. Major global players are looking to diversify their supply chains away from China.

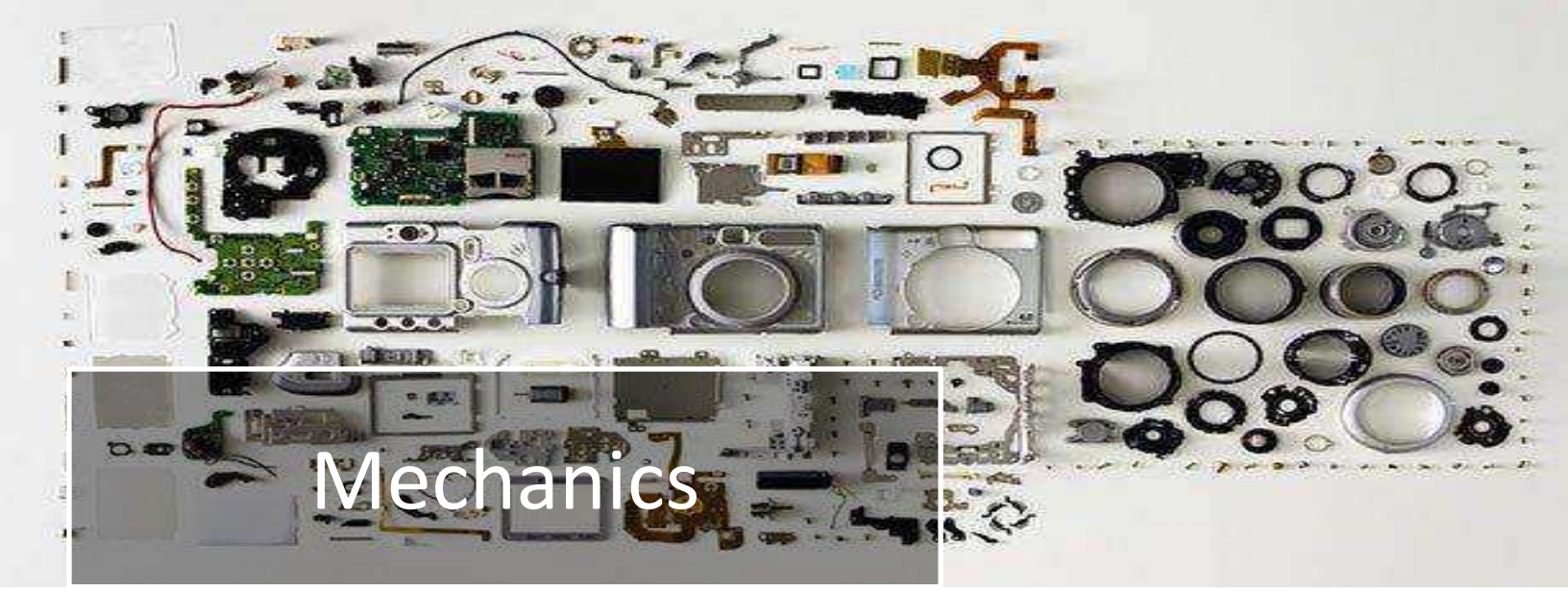
In the light of US-China tariff war, and part of China+1 strategy, India is expected to make efforts to position itself as an alternate manufacturing destination. All investments in China with prime focus on the US market may seek relocation and India would definitely be one of the options. There is a need to move aggressively to woo such investors because other countries like Vietnam pose a challenge to India. Tax holidays, Capital subsidies and re-imbursements on investments should be looked at to attract companies to choose India as their alternate manufacturing destination.

Chart 6.14: Mobile phone export market, volume in million units, India, FY15-FY26E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis, Ministry of Commerce (Export data bank)



Mechanics

Industry Overview

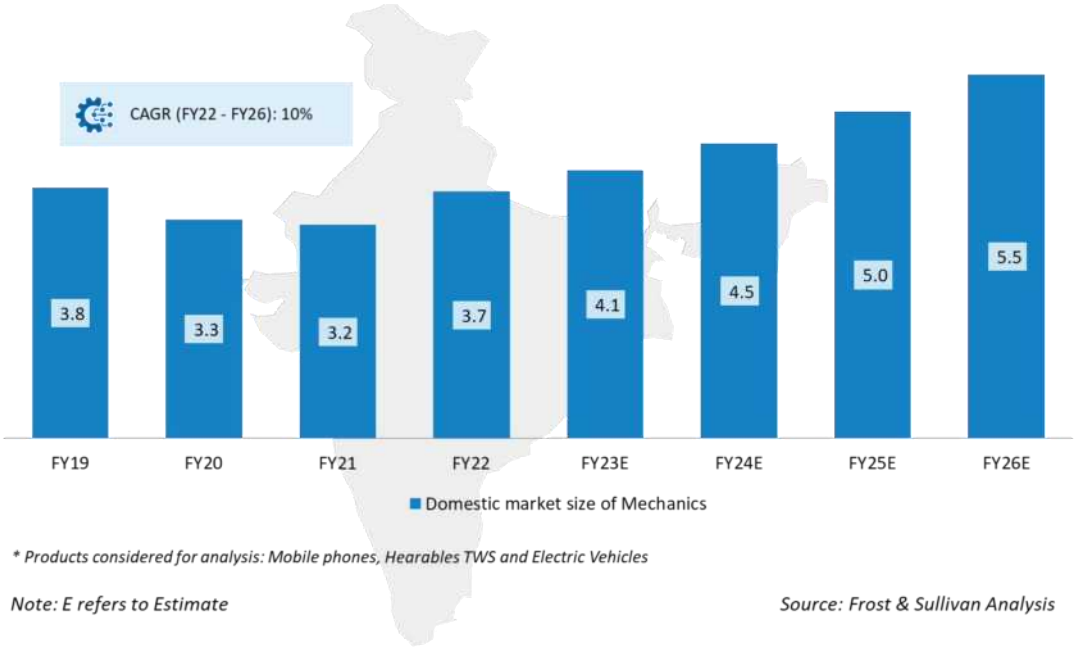
Electronics is a very large and diverse industry that serves countless residential, industrial, and commercial needs. Mechanics encompasses the various parts or components of an electronic device, which include both metal and plastic-moulded components. Mobile phones, IT hardware, telecom equipment, and home appliances, all contain metal and plastic-moulded components. Metal components in mobile phones include UI shield, frame, antennae, and camera lens holders. It involves various processes such as metal stamping, forging, casting and machining for manufacturing metal components. There are numerous metal stamping applications within its varied subsets. Plastic moulded parts in a mobile phone, for example, include front and rear covers, side keys, LCD support, and other similar parts or components. Plastic moulding involves processes such as injection moulding, blow moulding and extrusion. Metal and plastic components as part of mechanics are identified across product segment.

India is slowly establishing its manufacturing ecosystem for mechanics, especially in specific product segments such as mobile phones, automotive, consumer electronics, telecom equipment, and others, as the industry has grown significantly in recent years. Segment such as IoT, wearables, EV, and others are emerging and will have a large opportunity in the near future as the industry grows.

Market size and Competitive outlook

In FY22, the Indian mechanics market was estimated to be 3.7 billion units by sales volume. The market is expected to grow at a CAGR of 10%, from FY22 to FY26 to reach 5.5 billion units by sales volume. In terms of sales volume, the mobile phone segment has the largest market share, accounting for around 96% of total sales in FY22, followed by wearable and Electric Vehicle. Due to the increase in procurement of mechanics by manufacturers and the increasing indigenization of EMS/ODM players, the segment is transforming and is expected to grow at a rapid pace. Rising metal and raw material costs and high capital requirement are a challenge in this industry. The OEMs' requirements in this industry are speedy and high-quality manufacturing, cost efficiency and supply chain management

Chart 6.15: Domestic market size of mechanics, volume in billion units, India, FY19-FY26E

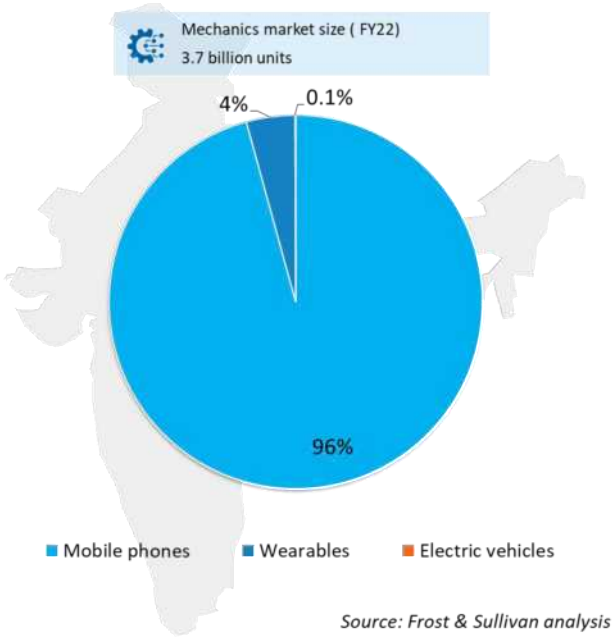


** Products considered for analysis: Mobile phones, Hearables TWS and Electric Vehicles*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

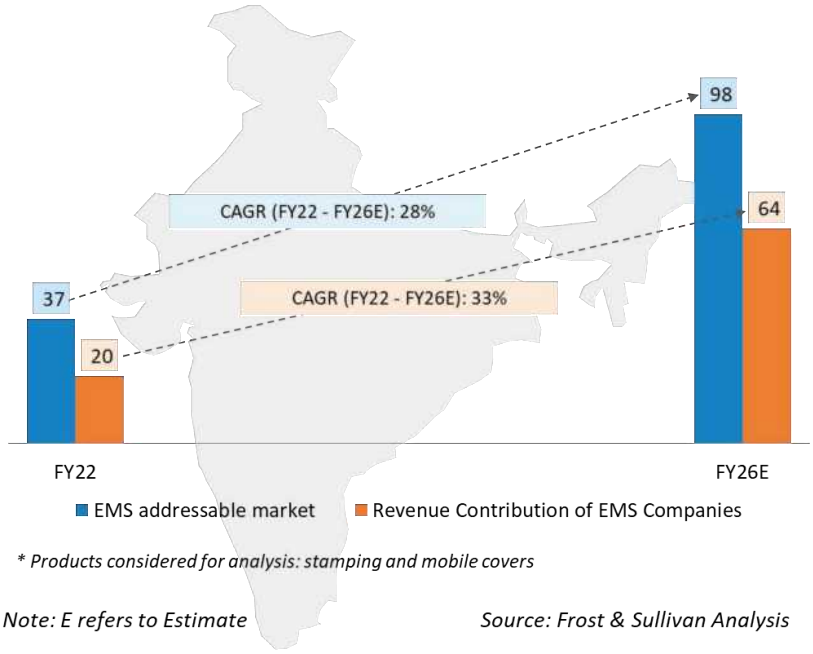
Chart 6.16: Mechanics market split by segments, volume in billion units, India, FY22



Source: Frost & Sullivan analysis

In India, the mechanics business, notably stamping, moulding, painting, machining, although having a manufacturing base is heavily reliant on imports, with relatively few companies producing locally. The great majority of imports come from China and Taiwan. In India, the market is in its infancy, and there is considerable possibility for growth in the future. Some of the key global players include Sunwoda, JGP Wuxi, Bharat FIH and Lingyi Tech. There are around 8-10 companies based in NCR region, such as Sunwoda, Subros, Lemei and others. Only few players are supplying to OEMs, while others cater to the aftermarket.

Chart 6.17: EMS addressable market and revenue contribution of EMS companies for Mechanics segment, value in INR billion, India, FY22-FY26E



Note: E refers to Estimate *Source: Frost & Sullivan Analysis*

JGP Wuxi Stamping (China) specialises in the manufacturing of mobile phone-related components, fine punching dies, digital camera-related components, precision cavity dies, and mould standard components. Apollo specialises in the stamping of metal components with tight tolerances, high precision, close pitch, and light gauge. While the company specialises in precision metal stampings, it retains a strong internal tooling capability to ensure that all of their progressive stamping tools fulfil customer specifications.

Growth Drivers

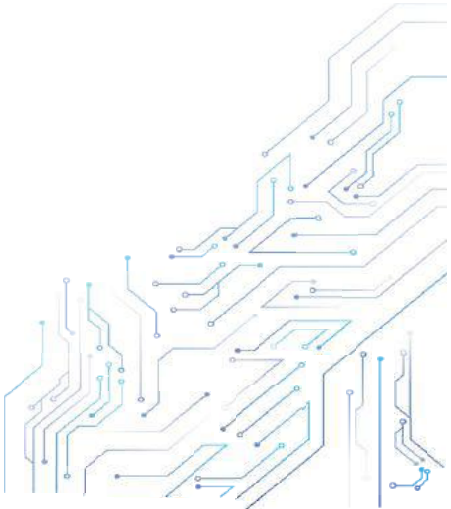
- Telecommunications a significant component of foreign direct investment inflows, is considered as the key driver for development & growth in the Indian economy as it has grown in leaps & bounds as. The telecommunications sector has attracted large chunk of FDI in India, and the amount invested in the telecommunications sector broadly has been more than double each consecutive year. Currently the mechanics segment in India is very much limited to a few companies only with a very low base so growing smartphone and feature phone market in India is going to give a late push to this industry which is yet to operate on full scale basis
- Mobile phone stamping and moulding component production capability development across industries like automotive which also produces mechanics component is going to open up a win-win situation for both the industries.
- More localization of mechanics and continuously reducing import dependency by inviting local and foreign companies to avail PLI facilities and giving them tax relief is also going to be one of the essential key drivers for the mechanics.

Key Market Trends

- Emergence of 3D printing & additive fabrication is one of the crucial metal stamping market trends which have been gaining a lot of traction.
- Additive manufacturing can augment material use & reduce wastage. Additive fabrication technology used to create 3D designs is also very cost-effective as it removes certain manufacturing processes, which else would need heavy investment.

Market Restraints

- Metal fabrication is a customized procedure, based on the project-based orders that constraints the standardization of manufacturing process beyond certain level. This constraint keeps the manufacturing cost relatively high and increases the pressure to reduce the costs in a competitive market.



Electric Vehicles

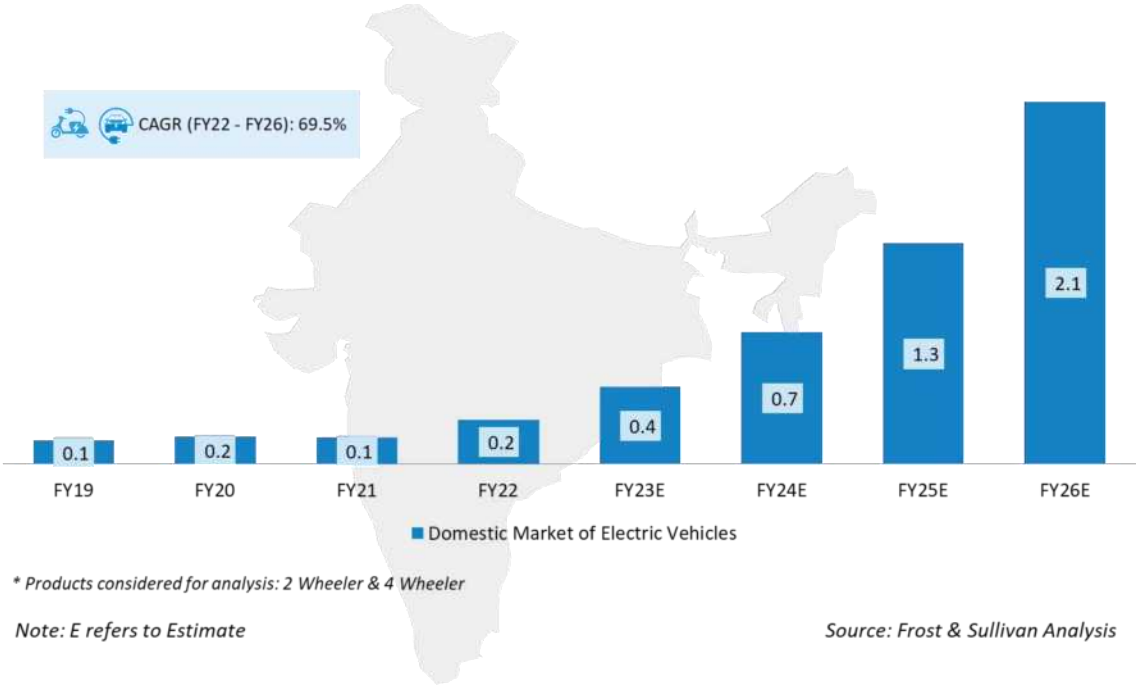
Industry Overview

The Indian Electric Vehicles (EV) market is still in a nascent stage, but there have been recent developments from both the government and OEMs. The market includes electric two-wheelers (e2Ws), electric four-wheelers (e4Ws) (BEV, PHEV, and HEV), eRickshaws, eCarts, and electric buses. Start-ups like Ather, Ola, and Tork, as well as fleet services like Vogo and eBike, are driving the growth of the e2W segment. Most of the growth is in the e2W segment and eRickshaws. e4Ws are picking up pace and are expected to occupy a significant share by FY26. Many start-ups such as Ather, Ola, and Tork, as well as fleet services like Vogo and eBike, are driving the growth of the e2W segment. Battery swapping is witnessing a huge success in the country and, in turn, is driving the EV market, especially in smaller vehicle segments such as e2Ws and e-rickshaws. Charging infrastructure has also grown in recent years, reaching over 400 public charging stations and increasing, including more than 20 fast-charging stations. Emission standards are another significant driver promoting electrification in the country, as several OEMs such as Tata, Mahindra, and Hero are expanding, as are start-ups.

Market size and outlook of EVs in India

In FY22, the Indian Electric Vehicles market was estimated to be 0.2 million units by sales volume. The market is expected to grow at a CAGR of 69.5%, from FY22 to FY26 to reach 2.1 million units by sales volume (2-wheeler and 4-wheeler). At present, EV sales in India are mainly dominated by e3Ws followed by e2Ws. Commercial vehicles and passenger vehicles will follow suit in the further growth of the EV segment; as both these segments presents practical business case to switch to Electric Vehicle. Government incentives and policies have been a major driver of activity in the Electric Vehicles industry. Lithium-ion batteries have been familiarized since last 2-3 years and have been incorporated in the government's subsidy programme. There have been initiatives to set up public charging stations in order to promote the growth of the Electric Mobility segment however; there is still ample gaps to be filled in in the EV infrastructure area.

Chart 6.18: Domestic market size of Electric Vehicles, volume in million units, India, FY19-FY26E



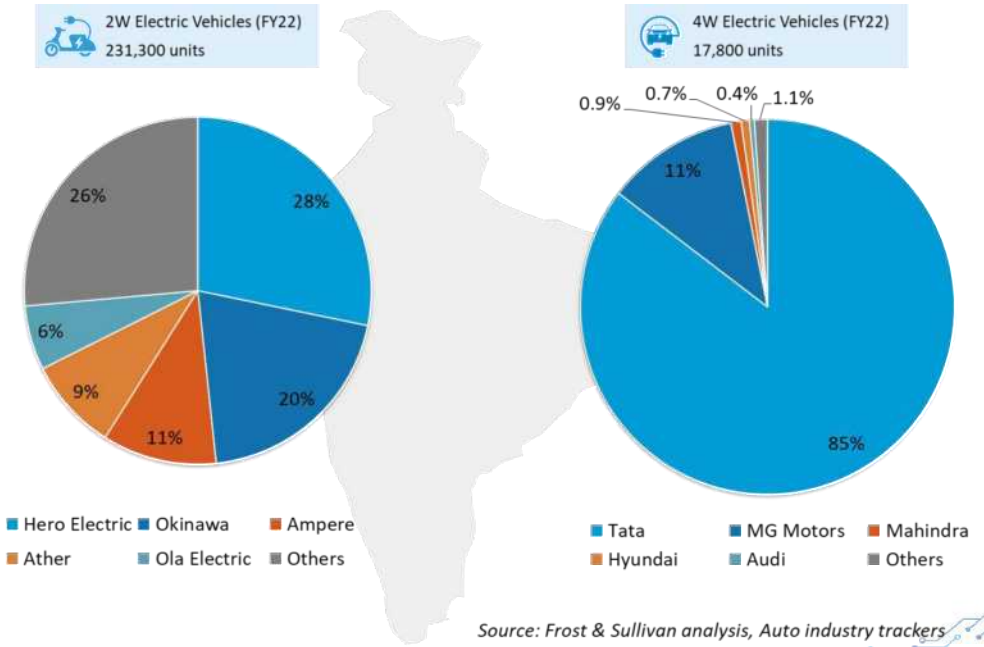
** Products considered for analysis: 2 Wheeler & 4 Wheeler*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Competitive landscape of OEMs

Chart 6.19: Electric Vehicles market share of 2 wheeler and 4 wheeler by key players, by volume, in %, India, FY22



Source: Frost & Sullivan analysis, Auto industry trackers

EVs are steadily gaining traction, owing to favourable government policies and the participation of global players such as Honda, Suzuki, Volvo, and Hyundai. Hero electric, Okinawa, Ampere and Ather are the leading players in the e2W segment, while Tata Motors, MG, Mahindra and Hyundai are the automotive giants which are currently leading the Electric Vehicle revolution in the e4W segment. Tesla has planned to start a manufacturing unit in India. EV has typically been dominated by the premium carmakers while small, low-priced EV car is a rarity. Around 20 players in the e-scooter market are active now and around 8 firms are active in e-bike segment, priced relatively lower new entrants in this field. Ather, Yamaha and Honda are key participants in this category and aiming to increase footprint here. The OEMs' requirements in this industry are speedy and high-quality manufacturing, supply chain management and prototype development

In the two-wheeler 2W and 3W segment, EVs are relatively more economical than their Internal Combustion Engine (ICE) counterparts. For commercial use cases, with an anticipated daily utilization of 75km for 2W and 100km for 3W, all electric models considered have a lower Total Cost of Ownership (TCO) per km than the ICE variants. For private utilization of 2Ws, with an anticipated daily utilization of 25km, it can be found that the lower-cost electric models are still economical against the petrol models while the higher-cost electric models have a marginally higher TCO per km. The current TCO of 2W commercial high cost vehicle is INR 1.14/ km where for the low cost vehicle it is INR 0.67/ km. The TCO of 2W private high cost vehicle is INR 3.18/ km where for the low cost vehicle it is INR 1.88/ km. Based on the market potential, vehicle utilization, OEM investment, and ease of charging, e2W and e3W will be the key target segments for electrification in India. Two- and three-wheelers account for close to 50% of the model share in India.

Cost Breakup of EVs

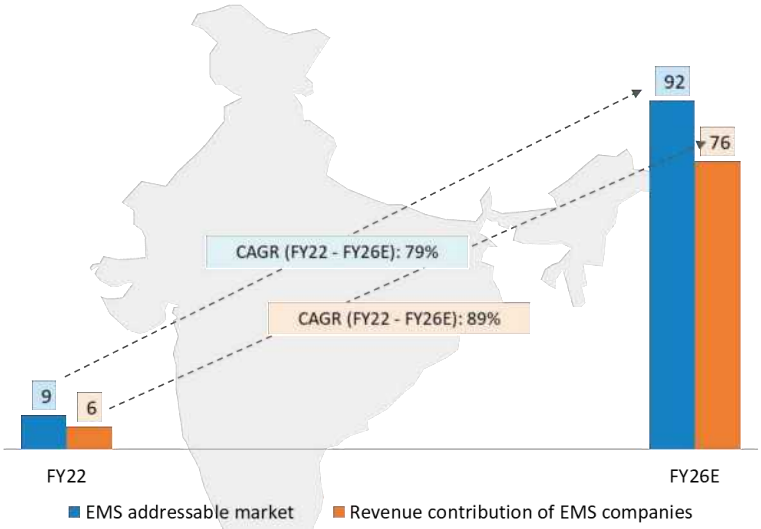
All mechanical components and target- or mode-specific localization is the way forward for EVs in India. Mechanical components should be of immediate priority, as they constitute 30% of the total vehicle cost. Electrical & electronic components value share is around 55% to 65% for (2W) while mechanical component value share is around 35% to 45%. The cost structure of the BEV is different from that of an ICEV. Battery costs alone can account for up to one-third of the total vehicle costs. In 2020, an ICEV was still significantly cheaper than the BEV, while, by 2030, falling battery prices will reduce the price difference to only 9%.

The major cost for the Electric Vehicle is the battery cost, which is half the vehicle cost. A uniform demand incentive of INR 10,000 per KWh for all vehicles including the plug in hybrid EVs and the strong hybrid has been proposed in FAME II Scheme. Additionally, the maximum subsidy cap has been increased to 40% of the cost of an electric two-wheeler, up from 20% previously.

EMS/ODM market landscape

The EV segment is in a growth phase and India is equally competing with the global leaders. The electric mobility market, specifically for products such as carry and static chargers, controllers, and battery management systems (BMS), has very good potential. India is on a continuous growth path in the EMS market in the EV / Electric mobility segment. All leading companies are looking for India as an option. There are also Indian companies who are into this segment. Solectron, Bharat FIH, Syrma SGS and Frontline are some of the most prominent players in the EMS market in the EV category.

Chart 6.20: EMS addressable market and revenue contribution of EMS companies for EV segment, value in INR billion, India, FY22-FY26E



** Products considered for analysis: Vehicle control unit / Power control unit, Battery management system, Head unit and others*

Note: E refers to Estimate *Source: Frost & Sullivan Analysis*

EMS capability of competitors

Name of the EMS company	Product design & development	Component manufacturing & sourcing	Manufacturing	Logistics	Aftersales
Bharat FIH	✓	✓	✓	✓	✓
Kaynes	✓	✓	✓	✓	
Syrma SGS		✓	✓	✓	

Growth Drivers

- **Incentives and Subsidies for EV market:** As part of the "Make in India" initiative, the government is providing incentive schemes and subsidies (FAME I and II) for domestic companies, which they can use to partner with global companies and establish manufacturing facilities, thereby increasing local market growth and lowering the final cost of the vehicle.
- **Reducing carbon emission:** Increased fuel costs will play a significant role in increasing the adoption of Electric Vehicles, beginning with e2Ws in India. The Electric Vehicle, with its zero-emission assurance, is the transportation mode of the future. For a country having a population of 1.3 billion, ease of transportation is a requisite. Transportation in India accounts for approximately 10% of the country's carbon emissions. India is poised to pioneer a new sustainable mode of transportation via the Electric Vehicles.
- **Emission norms:** Stringent emission norms to improve the air quality and reduce carbon emissions are mainly forcing OEMs to launch more Electric Vehicles. The government has committed to cut

down on the air pollution concentration. Government is embracing expensive technologies for the purpose of achieving the target which is been committed under the COP 21 Paris agreement.

Key Market Trends

- **Installation of EV public charging stations** may reduce concern among users about achieving comparable performance to IC engine vehicles. Hence, charging infrastructure needs to be established on the high-transit routes with an in-depth survey of the availability of all the required essentials within its vicinity.
- Across India, **high-level rapid charging stations** are being installed. Regarding the security of charging stations, government should consider installing charging stations beneath hotspots. As flyovers are erected at the intersections of national and state roads, these stations should reduce right of way concerns. Hence, extensive customer access reduces total start-up costs.
- Innovations like **light EV charge points, streetlight charger and other low-cost Electric Vehicles Supply Equipment solutions** are providing inexpensive solutions for the charging infrastructure in India.

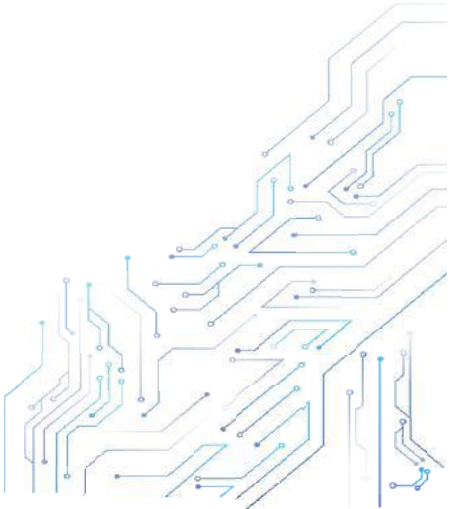
Market Restraints

- **High initial cost of acquisition:** The current price of Electric Vehicles is 20% to 30% higher than that of conventional vehicles of respective segments. (E.g. - The price of the e2W (Ola S1) is around INR 99,000 and an ICE 2W (Honda Activa) is around INR 82,000). High upfront prices of EVs have impacted demand and EV sales remained less than 1% of conventional vehicle volumes. However, more e-scooters were sold in the H1 of 2021 than in all of 2020, with the likes of Hero Electric & Ather Energy emerging on top. Presently, with both FAME II and the highest state subsidy taken into consideration the competitors are providing at a competitive price. In long term, TCO of e2W compared to ICE will be a benefactor for the EV segment.
- **Insufficient charging Infrastructure:** Lack of charging infrastructure is a major restraint. Public charging infrastructure is often being perceived as requiring high capital investment with low initial returns. High cost, requirement of additional electrical grid infrastructure upgrades and new distribution transformers, makes power charging a costly proposition and the total number of charging stations remains low.
- **Battery performance, replacement cost, charging duration:** The life of the battery and charging time is as high for passenger cars, which is restricting the faster adoption of EVs among end-users.

Regulations and Incentives

- **FAME II—Incentive Structure:** FAME II primarily focuses on driving the electrification of public transportation and vehicles with lithium-ion or other advanced batteries. The government has increased the budget allocation for FAME II by eight times compared to FAME I. The primary focus is to increase localization and domestic manufacturing. The policy states that to be eligible for upfront incentives, OEMs have to ensure that at least there is 40% localization for buses and 50% localization for 2Ws, 3Ws, and passenger cars.

- **PLI Scheme:** To improve India's manufacturing capabilities, the Union Cabinet approved an INR 26,058 crore PLI scheme for the auto, auto-components, and drone industries in September 2021. The government stated that the scheme would be available to companies that manufacture advanced automotive technology (AAT), such as Battery Electric Vehicle, and meet the performance criteria of the FAME II scheme. Over 100 AAT components, including hydrogen injection systems, hydrogen fuel cells, EV electric motors, MCUs, lightweight cryogenic cylinders, and fuel pumps for gasoline direct injection, have been identified by the Ministry of Heavy Industries as eligible for incentives under the PLI scheme.
- **Government Incentives**
    - Tax exemption under Section 35 AD of the Income Tax Act and other indirect tax benefits to the EV component manufacturers
    - Cost subsidies ranging from INR 7,500 to INR 6,100,000 on 2W, 3W, buses, and cars to the OEMs
    - Incentives between 50% to 100% of costs and State government subsidies on tariff on power supplied to charging stations
    - Interest paid on EV loan to act as Income tax rebates with a total exemption benefit of INR 2.5 lakh



Televisions

Industry Overview

The televisions (TV) industry has seen dramatic technological advancements over the last decade, with the introduction of panel televisions resulting in the phase-out of CRT televisions. TV penetration in India is approximately 65%, which is the highest among the consumer electronics. Television is one of India's fastest growing consumer electronics products. This is demonstrated by the fact that while the total number of houses in the country increased by just 3% in FY20, the TV market expanded by 8% during the same period.

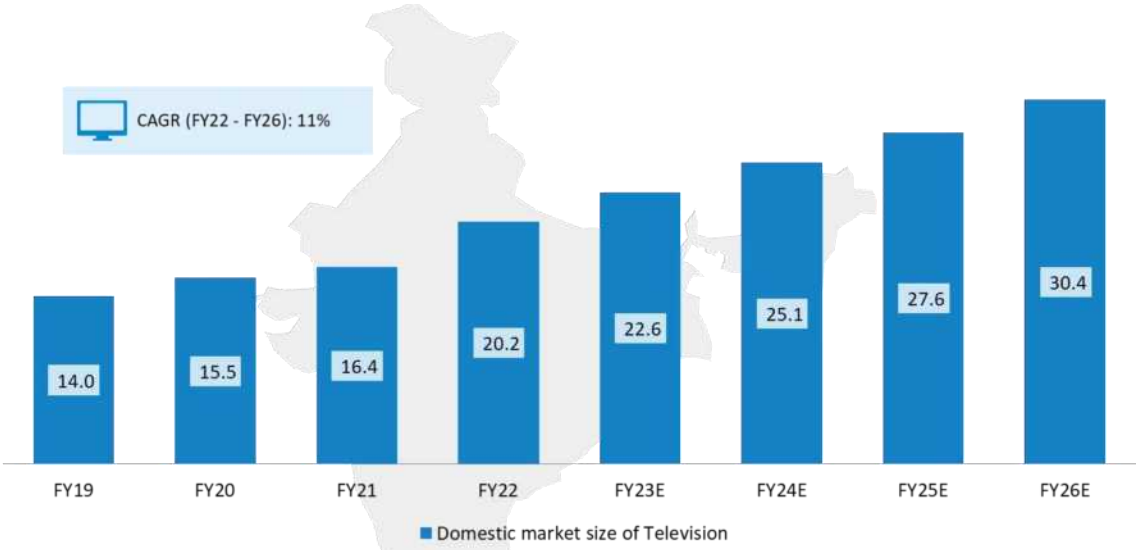
Television's increasing penetration in Indian households can be due to lower manufacturing costs and increased customer affordability. Households in India are on the verge of a transformation, with a shift in choice away from conventional television sets toward smart television sets. The middle-class population's lifestyle is changing as a result of rising income levels, increased awareness, acceptance of new technology, and increased internet coverage.

Market size and outlook of TV industry in India

In FY22, the Indian television market was estimated to be 20.2 million units by sales volume. The market is expected to grow at a CAGR of 11%, from FY22 to FY26 to reach 30.4 million units in terms of sales volume. The Indian television market is composed of sets equipped with light-emitting diode (LED), liquid crystal display (LCD), high definition (HD), and ultra-high definition (UHD) technologies. Smart TVs are gaining market share over non-smart TVs. Smart TV share in total TV shipments in India reached 84% in 2021, compared to just 67% in the year 2020. Consumers in the TV segment are being driven by the rapid growth of OTT, the availability of high definition content, high speed broadband, and declining price points. Advanced display technologies are gaining grip with the launch of numerous devices by different brands. Above 40” TVs are becoming more popular with growing affordability and attractive features. They now contribute more than 42% of the shipments.

Domestic manufacturing is a low-value-added activity due to the fact that panels are imported and final assembly is performed locally. Lack of a supporting ecosystem, high panel manufacturing costs, and the technology-intensive nature of panel manufacturing all contribute to an assembly-intensive industry. Due to the increasing smart TV demand, OEMs are rapidly increasing smart TVs in their portfolios.

Chart 6.21: Domestic market size of Television, volume in million units, India, FY19-FY26E



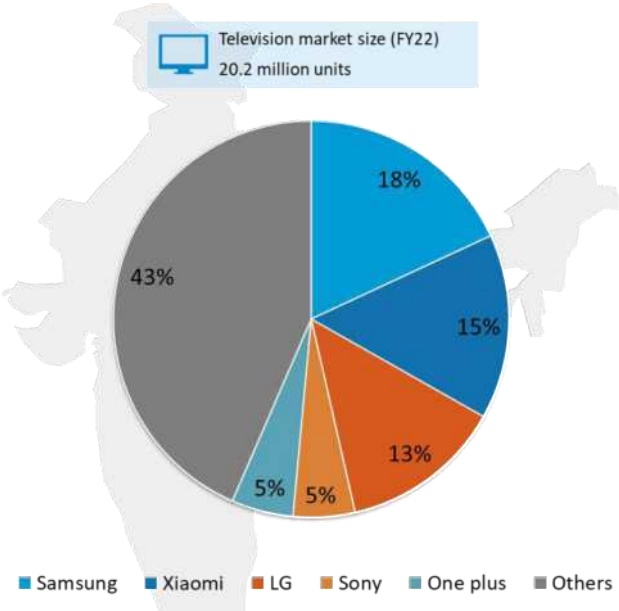
** Products considered for analysis: FPD - LED, LCD, OLED; Smart & Non-smart TV*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Competitive landscape of OEMs

Chart 6.22: Market share of Television by key players, by volume, in %, India, FY22



Source: Frost & Sullivan analysis, Industry quarterly trackers

The Indian television market is highly competitive and is dominated by significant number of players. While there are numerous television brands, LG, Samsung, and Sony account for nearly one-third of the market. Xiaomi, Panasonic, Videocon, Haier, Micromax, Intex, and Lloyd are also significant players in the market. In the “Others” category, there were many brands that performed very well in 2021, like Nokia, TCL, BPL, Panasonic, Kodak and Blaupunkt, which were able to make a mark through portfolio expansion. The well-known players offer a diverse range of options within each TV technology, whereas smaller players typically offer a more limited selection and focus primarily on LED and UHD TVs. The last two years have seen the entry of new brands as well as more adoption of Smart TVs, further increasing the industry's competitiveness. Numerous brands are targeting the price-conscious Indian consumer with discounts of up to 35%. While all players continue to place a premium on innovation and technology, the industry is transitioning from being solely a hardware product to integrating content (such as Netflix, Hotstar, and Eros) into the product to gain a competitive edge. Moreover, the online sale of television sets has increased considerably in the past few years, posing a threat to conventional sales channels. The OEMs’ requirements in this industry are dedicated capacity, high-speed and -quality manufacturing, cost-effective solutions, as well as stable supply of finished products and reliable manufacturing. Newer models from the existing players, entry of fresh new brands, enhanced features, bigger display and attractive price helped in increasing the penetration of the smart TVs in 2021. India’s smart TV market is typically offline-driven, with 69% of the shipments coming from offline channels.

The smart TV market continued to grab share from the non-smart TV market since last 3-4 quarters. Contribution from smart TV market touched 84% by volume by end of June 2021. Xiaomi, Samsung, LG and Sony held the lion’s share in the smart TV market in Q2 2021. Non-smart TVs from Samsung and LG has some traction in the market. The smart TV market grew at 55% YoY in 2021 and 65% YoY in Q4 2021 to reach its highest ever shipments for a particular calendar year. Due to the increasing smart TV demand, OEMs are fast increasing new models in their product portfolios.

EMS/ODM market landscape

Television manufacturing is currently a more lucrative business than it has ever been. Domestic and global manufacturers have started to focus more on this segment as a result of the "Make in India" initiative. The industry's most popular manufacturing method is open-cell production, which involves manufacturing directly from the panel stage. Some of the value-added items in TV manufacturing include packing boxes, cabinets, and bezels. Domestic OEMs and EMS providers are focusing on both domestic demand and exports to neighbouring countries.

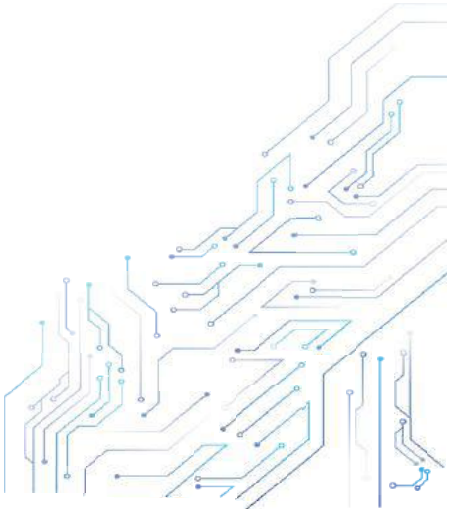
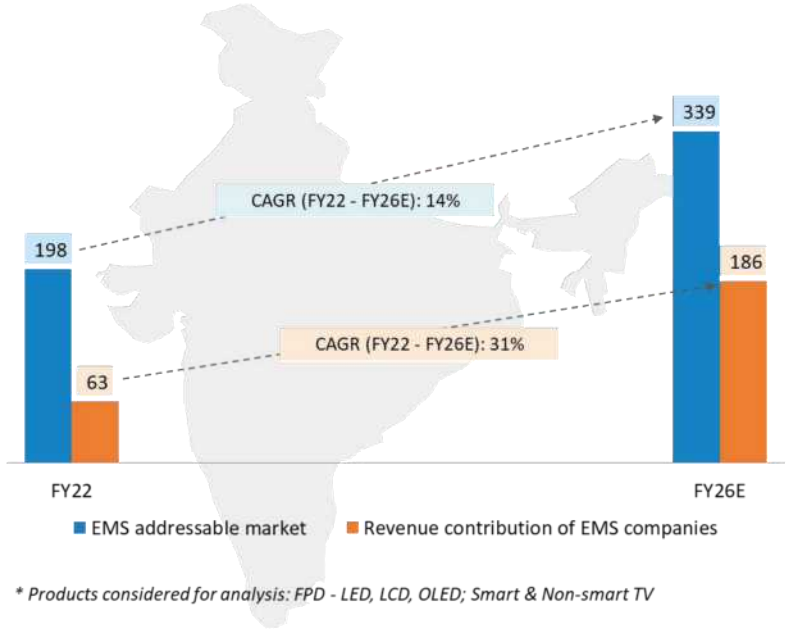


Chart 6.23: EMS addressable market and revenue contribution of EMS companies for Television segment, value in INR billion, India, FY22-FY26E

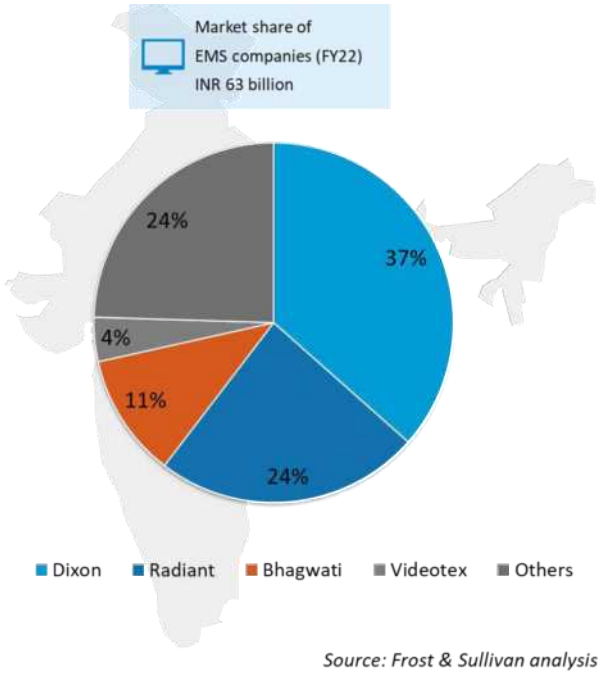


** Products considered for analysis: FPD - LED, LCD, OLED; Smart & Non-smart TV*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Chart 6.24: Television market share by EMS companies, by value, in %, India, FY22



Source: Frost & Sullivan analysis

Leading OEMs such as LG, Samsung, Haier, and Sony have their own production facilities in India. However, OEMs are increasingly seeking EMS providers to outsource manufacturing. Dixon, Videotex, Bhagwati, Wingtech, Radiant, and Trigur are among the leading EMS players in the Indian TV market. Bharat FIH partnered with Vu to produce televisions, which is one of the key players in the premium television and 4K televisions in India; similarly, Sony partnered with Foxconn to manufacture televisions locally, while Panasonic partnered with Dixon and Skyworth partnered with Resolute Electronics to contract manufacture FPDs. Westinghouse, based in the United States, is entering the Indian television market through its partner, Super Plastronics Pvt. Ltd. (SPPL). Numerous firms, including Salora, Oscar, Zebronics, T-Series, Panorama, BPL, Haier, and Skyworth, are rapidly outsourcing their operations. These trends point to a shift toward outsourced manufacturing as a result of increased trust and confidence in EMS/ODM players.

EMS capability of competitors

Name of the EMS company	Product design & development	Component manufacturing & sourcing	Manufacturing	Logistics	Aftersales
Bharat FIH		✓	✓	✓	
Dixon	✓	✓	✓	✓	✓
Radiant		✓	✓	✓	✓
Bhagwati			✓		
Videtex		✓	✓		

Growth Drivers

- **Advanced Smart TV models in varied price ranges:** Sale of smart TV is sparked by the availability of advanced smart TV models at varied range of pricing points. The rising resolution of televisions (from HD to 4K and beyond) increases average sales prices (ASPs) of TV. A 32-inch smart TV costs on average between INR 10,000 and INR 35,000, depending on the available features. Customers have also shown interest in UHD models which has also boosted the TV unit sales.
- **Penetration in rural market:** Due to the sheer rising penetration of television across the country, having a television set at home is no longer restricted to urban households. By 2020, more than 99 million homes in rural India will have a Television set, according to industry estimates.
- **Growth in television broadcast content:** Smart television market is predicted to rise across segments as a result of the increasing broadcasting material from over-the-top (OTT) platforms such as Netflix, Amazon Prime and others.
- **Rise in disposable income and easy financing schemes:** Increased discretionary income and easy financing have resulted in shorter product replacement cycles and evolving lifestyles in which consumer electronics, such as televisions, are viewed as utility items rather than luxury items. In comparison to metro cities, non-metro markets, have grown rapidly in terms of consumption, establishing themselves as key target markets and posing a massive opportunity to transform themselves into new business hubs.

Key Market Trends

- **Increasing adoption of smart and connected devices:** Smart TVs have evolved into a one-stop destination for all entertainment needs. It assists consumers by suggesting them to watch next

on online to avoid repeated contents. The sharing of content between televisions and mobile devices via Wi-Fi, Bluetooth, and NFC is accelerating. Apart from powering on and off and adjusting the volume, Smart TVs enable voice commands to search for and change channels.

- **OLED and 4K technologies** are two of the most recent developments in TV industry. In addition to providing a high-quality video experience, OLED panels combined with 4K technology have lower power consumption and greater durability when compared to LCD and QLED screens.
- **Adoption of advanced technologies:** The increasing internet penetration in India can also be viewed as a contributing factor to the widespread adoption of Smart TVs. Additionally, the development of advanced technologies such as augmented reality, virtual reality, and artificial intelligence (AI) is boosting the significance of 3D features in smart TVs.

Market Restraints

- **Increase in R&D expenses:** Growing technological advancements in television market has resulted in increased R&D spending among major market players, which are coming up with new technologies such as curved panel display, OLEDs & 3D televisions in the market. Samsung has earmarked 100 plus early & growth-stage ventures in the country. The investment is going to be strategic in nature, and the company will make a minimum of 100 such investments, of a ticket size in between USD 1 to 5 million.
- **Pandemic induced challenges:** Due to pandemic and shut down manufacturing plants were not operating fully & there was major shortage of parts which led to increased overall import & production cost which ultimately affected on consumer to buy the products at higher rates. Now as the impact of COVID is slowing down and economy is on a recovery mode the price pressure in the television industry is going to ease out in short to mid-term.
- **Import and regulatory challenges:** Dependency on imports for critical parts is the major risk to business. Regulatory restrictions were there earlier but currently it is been eased out to a certain extent in order to promote this business.
- Gradual shift from television to smartphone for viewing the content are hampering the growth of the Television market in India.

Regulations and Incentives

- **Digitization of DTH:** The Indian government's digital transformation initiatives, such as the digitization of cable television and Direct-to-Home (DTH) services, are promoting the adoption of Smart TV in the country. The IPTV landscape in India is changing as a result of the advent of the network services provider, which offers its customers free IPTV live subscriptions.
- **Make in India initiative:** Government is promoting made in India products and asking companies to start manufacturing here in India by giving them ample growth opportunities, tax benefits and bringing them under incentive schemes. .
- **PLI scheme:** Manufacturers in India are looking forward to the implementation of the PLI programme for television, which would allow them to scale up their production to meet the needs of the global market. OEMs are soon eyeing for the scheme to be expanded to TV segment.

Hearables

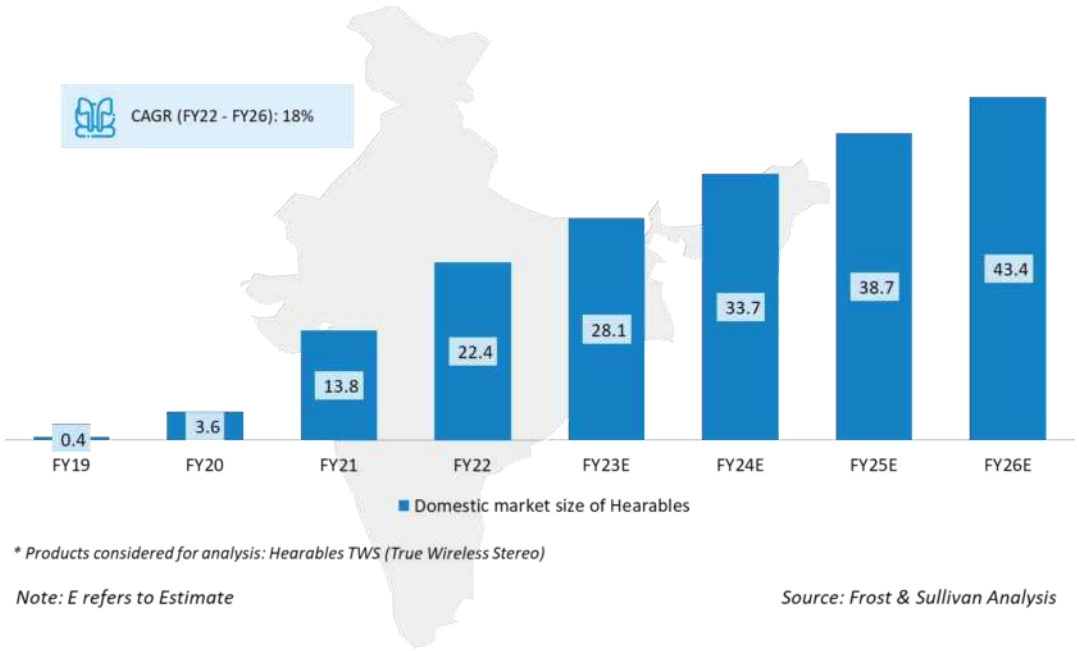
Industry Overview

Wearable technology is an emerging trend that integrates electronics into daily activities and addresses changing lifestyles. Wearable technology is gaining popularity due to features such as internet connectivity and data exchange between a network and a device. India is currently the world's third largest wearable market. In FY22, India's wearables market grew more than 60% YoY. This growth was majorly driven by increasing acceptance of the earwear devices and upgrades to watches from the wrist bands, both of these recorded their highest annual shipments in the year 2020 and 2021. Indian brands' shipments more than doubled in Q4 FY22 to capture more than 70% market share in the overall India TWS (True Wireless Stereo) market. The top three positions were taken by India-based brands, which captured half of the total TWS market in FY22. Indian brands were very quick in terms of upgrading their product portfolio. They released some of their new models having the most popular Active Noise Cancellation feature. Indian brands put more emphasis on targeting the low-price segments which is less than INR 2,000 and forming partnerships to market their devices.

Market size and outlook of Hearables industry in India

Hearables TWS (True Wireless Stereo) a part of wearable segment has shown a tremendous growth in the last 2-3 years. In FY22, the Indian hearables TWS market was estimated to be 22.4 million units in terms of sales volume. The market is expected to grow at a CAGR of 18%, from FY22 to FY26 to reach 43.4 million units by sales volume. The latest version of the hearables TWS is much better in terms of managing the increased audio usages and improved aesthetic and design of the hearables also made them the trendsetter. The hearables TWS market will continue to see technological advancements such as high-resolution streaming audio, AI-enhanced utility and user experience, and noise cancellation features for improved audio quality during voice calls. The OEMs' requirements in this industry are localised/domestic manufacturing, speedy and high-quality manufacturing, as well as cost-effective solutions

Chart 6.25: Domestic market size of Hearables, volume in million units, India, FY19-FY26E



** Products considered for analysis: Hearables TWS (True Wireless Stereo)*

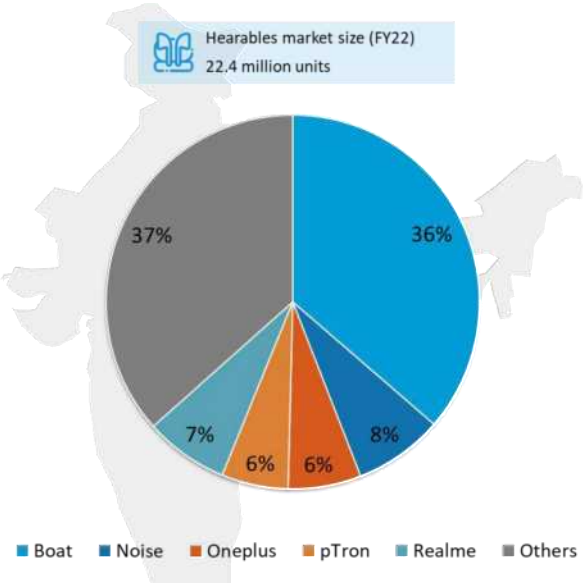
Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Although product prices are declining due to growing competition, the increasing adoption of hearables will lead to higher revenue growth for market participants. The introduction of new brands has resulted in fierce competition for advanced features and technology offerings, which has benefited the end users.

Competitive landscape of OEMs

Chart 6.26: Market share of Hearables by key players, by volume, in %, India, FY22



Source: Frost & Sullivan analysis, Industry quarterly trackers

Boat, One Plus, RealMe, Noise, and pTron are the prominent brands within hearables segment in India. Xiaomi and Apple are the other leading players in the market. Affordability has been the key for Indian brands, and these brands have been immensely successful in gaining a significant portion of the market. The earwear market grew more than threefold in 2020 compared to the previous year. This was mainly due to affordable options becoming available, and also because demand for such devices rose as virtual meetings and e-learning became the rule in COVID times.

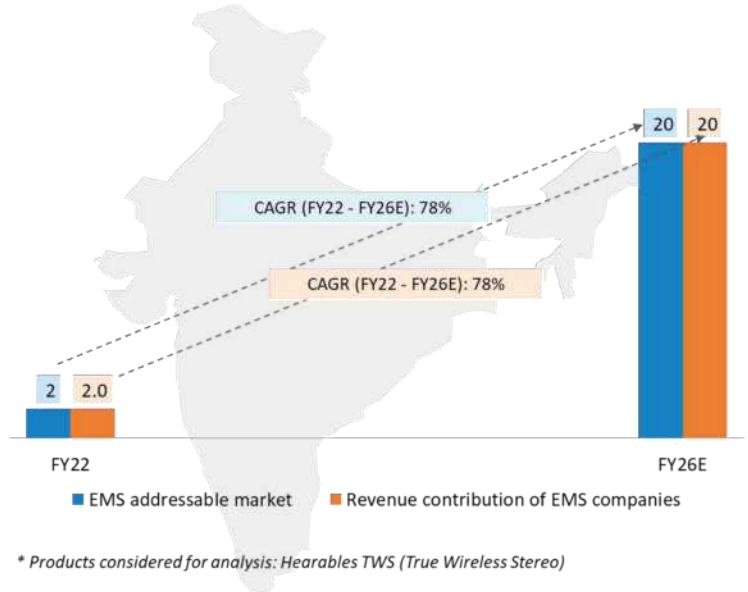
Boat led the market for the seventh consecutive quarter with nearly 100% YoY growth in Q1 2022 driven by the new launches, many celebrity endorsements and discount offers. Boat TWS Airdopes 131 was the most popular TWS earbuds and took more than 30% share in the brand's portfolio.

Noise maintained its second spot for the second quarter in a row with more than 200% YoY growth driven by numerous sales events and the introduction of the new model in the low-priced VS series. The Noise Airbuds mini was the best TWS model for the brand, capturing nearly 40% of its portfolio. Other emerging brands in TWS space includes Mivi, Oppo, Apple, Nothing and Online-centric local brand Truke.

EMS/ODM market landscape

The entry of new players and frequent new model launches has resulted in a phenomenal change in India's TWS market, with more than 40 brands entering this market since 2017. 10 new brands entered this segment in Q1 2022, in order to capture a larger share of the market. Low-cost offerings have given this segment a much-needed boost.

Chart 6.27: EMS addressable market and revenue contribution of EMS companies for Hearables segment, value in INR billion, India, FY22-FY26E



** Products considered for analysis: Hearables TWS (True Wireless Stereo)*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Till late 2020, hearables TWS were imported into India by companies such as Boat, Noise, and others from their facilities in China and other overseas locations. Companies have begun to look for opportunities in the domestic market via EMS providers. Domestic manufacturing stood at 14% in Q4 FY22 which was almost negligible in Q4 FY21. In India, the leading EMS providers in the hearables TWS segment are Bharat FIH, Kaynes, and Optiemus. Boat, which is the fifth largest hearables brand globally, is an Indian consumer electronics brand that previously manufactured all of its products in China, is gradually shifting manufacturing to India with the support of EMS providers. Over 15% of their current products are manufactured in India, and they intend to manufacture more than 40% of their products in India by 2024. Aiwa, the most recent entrant, is also looking into a similar opportunity in India.

EMS capability of competitors

Name of the EMS company	Product design & development	Component manufacturing & sourcing	Manufacturing	Logistics	Aftersales
Bharat FIH		✓	✓	✓	
Opteimus		✓	✓	✓	✓

Growth Drivers

- **Income growth and rising purchasing power** has led to an increase in sales of consumer electronics. With aesthetic design, improved battery life and better connectivity hearables are evolving from a nice to have device to one that positively impacts in the lifestyle.
- **Favourable demography with a large young population base** has resulted in the adoption of hearables. The growing trend toward the adoption of technology gadgets by the tech-savvy Indian youth population will drive the wearables market during the forecast period.
- **Increasing internet penetration and sales through eCommerce will augur well for market growth:** Wearables are preferably purchased online by consumers due to the high discounts provided by eCommerce platforms. High discounts and festive sales will boost the growth of wearables market in India.

Key Market Trends

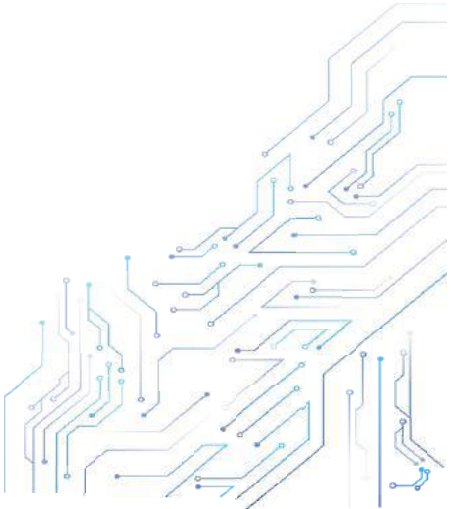
- **Increasing urbanization:** With increasing urbanization and more adoption among the Gen Y population, the demand for aesthetically appealing advanced featured products such as TWS has driven the market for hearables.
- **Connected homes:** The advent of Internet of Things (IoT) and the increase in connectivity features in consumer appliances and electronics present an opportunity for suppliers.
- **Noise cancellation:** Apart from audio quality, battery life, and aesthetics, noise cancellation is gaining traction with customers. OEMs are progressing in noise cancellation technology and providing a better experience to end users through their innovation and advanced technologies.

Market Restraints

- **Ensuring compatibility** with currently available devices is a challenge for hearables manufacturers. There is a lack of seamless integration of wearables with the currently available devices which discourages consumers to purchase devices which lag in their function.
- **Counterfeit and grey market products pose a challenge for branded products:** The Indian market, particularly the hearables market, is plagued by low-cost counterfeit and grey-market products. Counterfeit products make consumers doubt the technology and its benefits.
- **Lack of usage in rural market will stifle market growth**: India has a large rural population with lower disposable incomes. Despite the government's push for financial inclusion, broadband access and smartphone penetration, the rural population's interest in tech-related products is low.
- **Issue with battery drain:** Battery-powered systems do require extreme caution in terms of partitioning, space utilisation, and charge utilisation. It is critical to enable additional functionality while delivering power more efficiently and for a much longer period of time in a very small space. Standby, sleep, power saving, hibernation, and shutdown functions are critical for wearables designers to minimise power consumption and maximise battery life.

Regulations and Incentives

- **PLI scheme for wearables/ hearables:** The government intends to introduce a PLI system for wearable/hearables gadgets in the coming months. The objective is for the country to produce roughly 25% of worldwide output. Given the nascent nature of the industry and the time it will take for the ecosystem to grow, the industry is pushing for incentives in the range of 7% to 8%.



Telecom and Networking products

Industry Overview

The Telecom and Networking Products industry primarily comprises of telecom service providers, telecom equipment manufacturers and suppliers, and passive infrastructure providers. India is currently the world's second largest telecommunications market with a subscriber base of around 1.16 billion. Over the next five years, increased mobile phone penetration and reduced data prices will add 500 million additional internet users in India. The Government has eased market access for telecom equipment and provided a fair and proactive regulatory environment to ensure consumer access to affordable telecom services. The growth of direct and indirect competition in the telecommunications market has impacted revenue growth and profit margins. While telecommunications penetration is high, IT and VAS infrastructure is still developing. Long-term growth requires a shift from traditional revenue streams to cloud alternatives.

The base transceiver station (BTS) is the telecommunications equipment that enables wireless network devices to communicate with one another. Wireless communication equipment included in a BTS includes antennas, duplexers, transceivers, and amplifiers. A base station controller is in charge of the BTS. The lifting of lockdowns in various parts of India resulted in the realisation of numerous enterprise projects that had been stalled in previous quarters. GPON is a critical sub-product of the Indian Telecom and Networking Products sector due to its low cost and ease of maintenance. Enterprise routing revenue increased considerably in 2021 over the previous year.

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. 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. Currently, 5G Spectrum Trials are being conducted in India to confirm proliferation of 5G technology across the country.

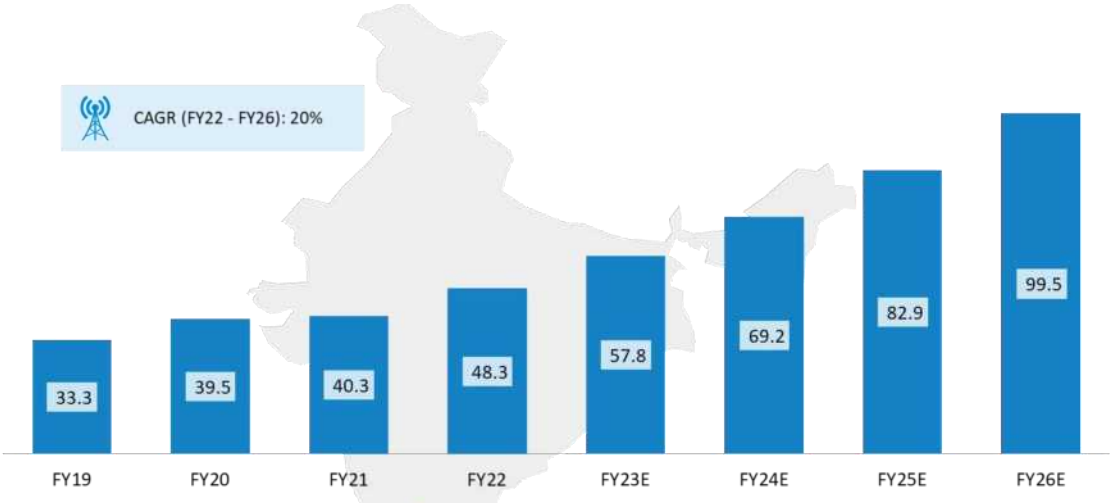
India added over 500 million new smartphone users over the last decade. India is expected to have more than 850 million smartphone users by 2026, representing nearly 55% of the total population. The Department of Telecom is targeting a combination of 100% broadband connectivity in the villages, 55% fiberisation of the mobile towers, average broadband speeds of 25 mbps & 30 lakh kilometres of optic fibre

rollouts by end of December 2022. By December 2024, it is aiming at 70% fiberisation of towers, average broadband speeds of nearly 50 Mbps and 50 lakh kms of optic fibre rollouts at pan-India level.

Market size and outlook of Telecom and Networking Products industry in India

In FY22, the Indian Telecom and Networking products market was estimated to be 48.3 million units in terms of sales volume. The market is expected to grow at a CAGR of 20%, from FY22 to FY26 to reach 99.5 million units in terms of sales volume. A lot of growth potential exists 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. India plans to roll out state-of-the-art 5G telecom services in 2022. The new technology provides the advantages of massive connectivity and low power consumption and boasts of download speeds and capacity that can enable autonomous vehicles, drones, remotely assisted surgeries, and traffic control. 5G connectivity will be used in emerging technologies and technology-enabled markets such as IoT, smart cities, and smart agriculture. 5G, due to its greater speed, would also enable next-generation IoT and machine-to-machine (M2M) applications such as autonomous vehicles and virtual or augmented reality. The OEMs' requirements in this industry are technical expertise in the manufacturing of large and complex PCBAs and quick ramp-up capabilities

Chart 6.28: Domestic market size of Telecom and Networking Products, Volume in million units, India, FY19-FY26E



** Products considered for analysis: Base Transceiver Station (BTS); Digital Subscriber Line Access Multiplexer (DSLAM); Gigabit Passive Optical Networks (GPON); Internet Protocol Private Branch Exchange (IP PBX); Media gateways; Modems; Enterprise routers; Synchronous Transport Module (STM)*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

The Indian Telecom market, which has over 900 million mobile subscribers, 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,

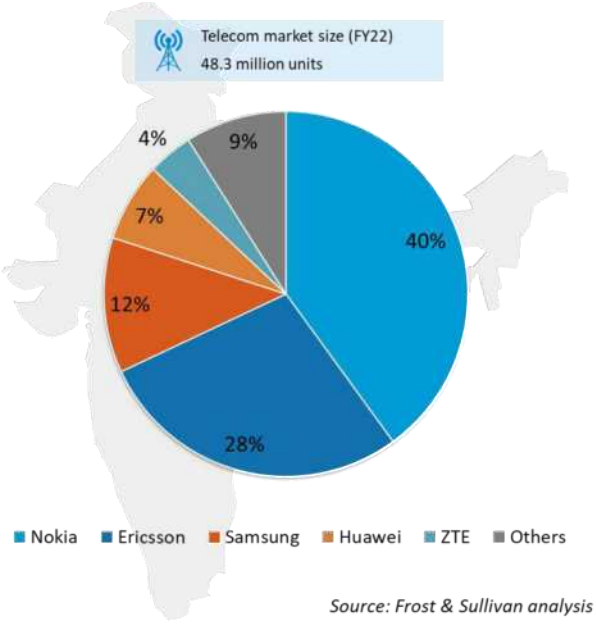
as well as growing demand for wireless data services, 4G, and broadband wireless access networks, as well as development into new circles and rural areas. As the importance of coverage and capacity grows, telecom infrastructure service providers have expanded potential to assist Telco's. Services are becoming crucial for everything from network deployment to network benchmarking and optimization.

Competitive landscape of OEMs

Global players like Ericsson, Nokia, Samsung, ZTE and Huawei dominate the telecom equipment market. Other players may be trying to build their capabilities and do some trials with the operators, so it will be interesting to see how that eco-system develops in the country over time. To maintain a competitive Telecom and Networking Products market, the Telecom Regulatory Authority of India (TRAI) and the government must encourage new entrants and prevent unnecessary exits. Syrotech, Netlink, Tejas, Alcatel Lucent, Bharat FIH, Syrma SGS, Tejas Networks, Speech & Software Technologies, HFCL, Coral Telecom and Alphion India are key telecom and EMS players.

Indian firms need direct help to compete globally. This could include low-cost capital, land, and intellectual property support (IP). Self-sufficiency, or "Atmanirbhar," is desirable and possible. As part of the PLI, about INR 122 billion has been allocated for Telecom and networking products. The government's recent announcement, in which 31 proposals were approved, is expected to boost telecom equipment production. Also, this is the first PLI scheme which has also included MSMEs.

Chart 6.29: Market share of Telecom and Networking Products by key players, by volume, in %, India, FY22



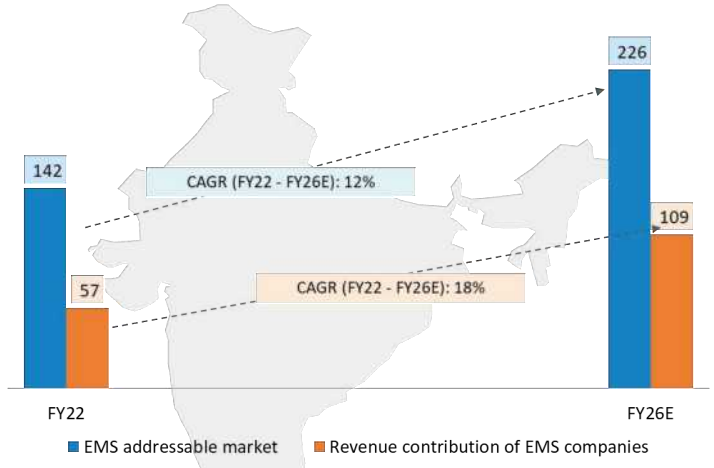
Source: Frost & Sullivan analysis

EMS/ODM market landscape

EMS companies provide a variety of core manufacturing and ancillary activities, allowing OEMs to focus on their core competencies while improving overall efficiencies. The technologies allow for the efficient manufacture of telecom equipment, and India aspires to become a major manufacturing hub. The ecosystem is an important and strategic component of constructing a secure telecom infrastructure. 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 Alphion India are key telecom and EMS players.

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 Alphion India are key telecom and EMS players. The incentive scheme such as the PLI, for Telecom and Networking Products will boost manufacturing in the midst of the 5G construct. Akashastha Technologies, Dixon Electro Appliances, HFCL Technologies, ITI, Neolync Tele Communications, Syrma Technology, Tejas Networks, and VVDN Technologies are some of the winners of the PLI scheme. The MeitY has approved Indian companies in the telecom segment, including Lava, Bhagwati (Micromax), Padget Electronics, UTL Neolync, and Optiemus Electronics (MeitY). AT & S, Ascent Circuits, Visicon, Walsin, Sahasra, and Neolync were among six other companies approved under the Specified Electronic Components Segment.

Chart 6.30: EMS addressable market and revenue contribution of EMS companies for Telecom and Networking Products segment, Value in INR Billion, India, FY22-FY26E



** Products considered for analysis: Base Transceiver Station (BTS); Digital Subscriber Line Access Multiplexer (DSLAM); Gigabit Passive Optical Networks (GPON); Internet Protocol Private Branch Exchange (IP PBX); Media gateways; Modems; Enterprise routers; Synchronous Transport Module (STM)*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

EMS capability of competitors

Name of the EMS company	Product design & development	Component manufacturing & sourcing	Manufacturing	Logistics	Aftersales
Bharat FIH		✓	✓	✓	
HFCL		✓	✓		
Syrma SGS	✓	✓	✓	✓	✓

Growth Drivers

- **Removal of duty exemption on imported products:** In line with the 'Make in India' initiative, exemption from the basic customs duty, special additional duty and countervailing duty has been removed on select components. This is intended to benefit domestic manufacturers by increasing the cost of imports. Import tariffs on inputs that contribute to the manufacture of such parts and components have also been removed to encourage local production.
- **Capex Optimization:** 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.
- **4G and 5G Infrastructure in India**: While Airtel, Vodafone and Jio have concluded the roll out of its 4G services on pan-India basis, service providers are gearing up for 5G roll out in India, which will boost the customer utilization of high-end data products. 5G is required to create new economic value in India and globally. The business opportunity for 5G in India is huge and it will encourage investors to participate, manufacture, sell and export to the global market.
- **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. Over the last seven years, the Indian Telecom Tower industry has grown significantly by nearly 65%. The number of mobile towers increased from 0.4 million in 2014 to 0.66 million in 2021.
- **Telecom equipment from trusted sources:** 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 even as Huawei and ZTE is been kept on hold till now.

Key Market Trends

- **Optical fibre connectivity:** India's current market penetration in optical fibre connectivity is not more than 30% of the mobile towers and 7% of the total households. Significant fabrication and infrastructural improvements are required to bring in 5G and high-speed connection, and this will be a key focus area in 2021 and beyond. In the global index comparing fiber development index

analysis on a country by country basis study showcases India is currently situated at the bottom of the FDI but is one of the world's largest and fastest growing telecom markets.

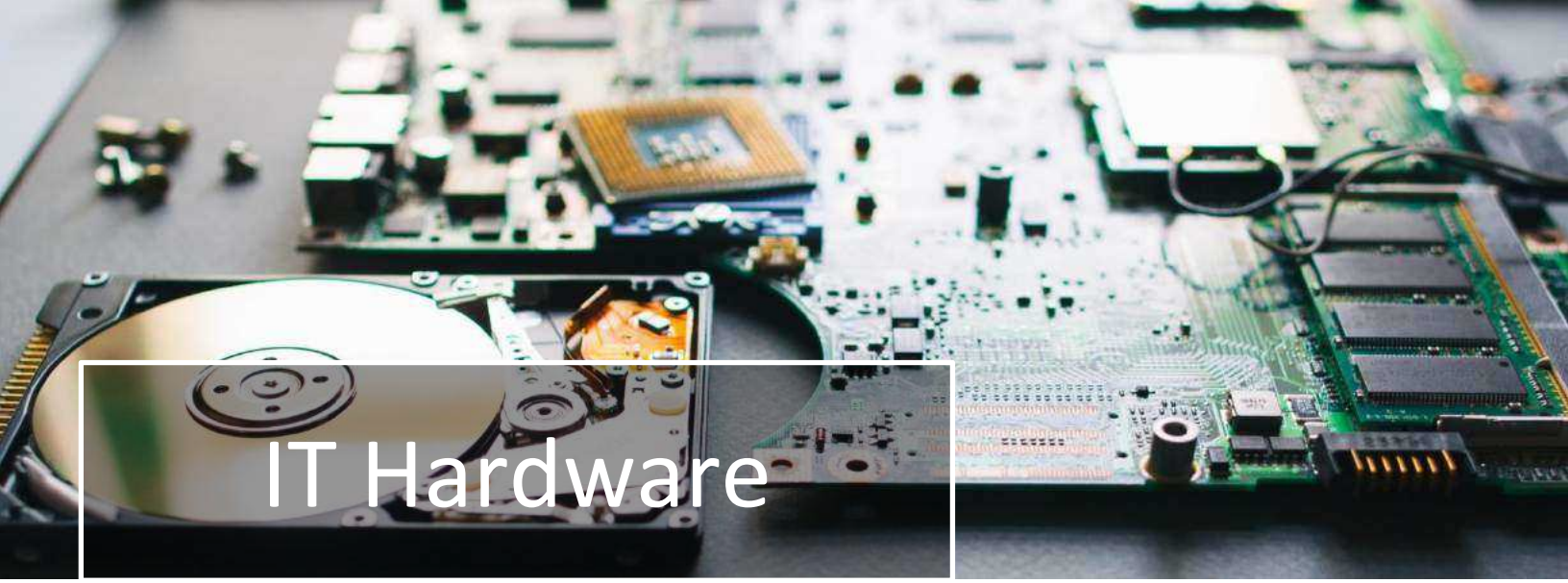
- **Advancements in Technologies:** Industrial Internet of Things (IoT), smart homes, connected mobility and autonomous appliances and gadgets are all deeply reliant on the hyper connectivity. This trend is expected to continue to rule in 2022 and beyond. Smart cities would also need a robust digital neural network for the purpose of functioning seamlessly.
- **Hyper connectivity:** 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, security is going to become tremendously important. There will be imminent threats, and henceforth, the complete device, application, and the network infrastructure eco-system require developing security mitigation strategies.

Market Restraints

- **Lead time and price are exorbitantly high**: Importing telecom components and assembling them is a significant challenge. The government is expected to examine and subsidise basic custom duty (BCD) on devices such as specific telecom components, till the entire eco system is developed in India.
- **Telecom package:** The government has now unveiled a telecom package for providers of Telco's. The adjusted gross revenue (AGR) was suspended for four years, which was agreed by the majority of operators. Among them are Vodafone, Idea, and Airtel Bharati. Due to the difficulties Vodafone and Idea are experiencing with AGR, the government has approved a four-year payment suspension. Sustained by the government package, Vodafone Idea is currently eyeing for fund infusion of INR 20,000 crore (including INR 10,000 crore in equity and remaining as fresh loans from banks). The company might opt for a fresh round of fund infusion from the investors only after a marginal enhancement in its average revenue per user.

Regulations and Incentives

- Site acquisition is one of the major operational challenges with respect to tower installations. To ease the site acquisition process, the government has rolled out an initiative whereby tower providers will be allowed to install telecom towers on government sites.
- The government is currently levying 22% duty on most of the finished products that are imported, but it varies by product and access code. They are also bringing in a component duty structure that matches the country's ecosystem.



IT Hardware

Industry Overview

The IT hardware market encompasses all physical components that includes computing hardware (desktop PCs, notebook PCs, tablets, adaptors and workstations), all of which are produced by global companies such as Samsung, Apple, Acer, and Lenovo, with the majority produced in China. Challenging macro-economic outlooks, along with the rising demand for PCs has slowed down the PC sales in India. Notebook PCs saw very high level shipments in the year 2019 to 2021. Desktop category also witnessed more than 5% growth on y-o-y term mainly driven by the refreshed buying from the banking & financial institutions. The Indian tablet PC market is being driven by features such as portability, lightweight, quick start-up, and easy online browsing. Furthermore, government digital education initiative requiring the use of tablets in schools and colleges for educational purposes, as well as the growing use of hybrid-tablets in business will provide significant growth prospects for the industry in the future. With an emphasis on innovation and customer centricity, the sector will continue to move toward providing better technologies. Supporting the government's "Digital India" programme, educational transformation, fast-moving consumer goods (FMCG) delivery network, travel and tourism, and hospitality are all major priority areas for the IT hardware sector.

The Indian PC market shipped over 4.3 million units in the fourth quarter of FY22, registering YoY growth of 37.7 per cent. Of the entire shipments, notebook shipments amounted to 3.1 million units, and the desktop category saw more than a million units for the first time since Q3 of 2014. The market of laptop was very good in last 2 quarters of FY22 and in last quarter HP was leading the PC business by ~33% followed by Lenovo, Dell and Acer.

Massive shipment came into India in last 2 quarters although things have slowed down a bit currently because most of the MNCs and the corporates have already bought the PC in last 1 year post COVID. The rotation of the PC business particularly laptop is getting slowed down in comparison to the tablets which is getting traction from the government education space but not in assembly, corporate or general distribution business.

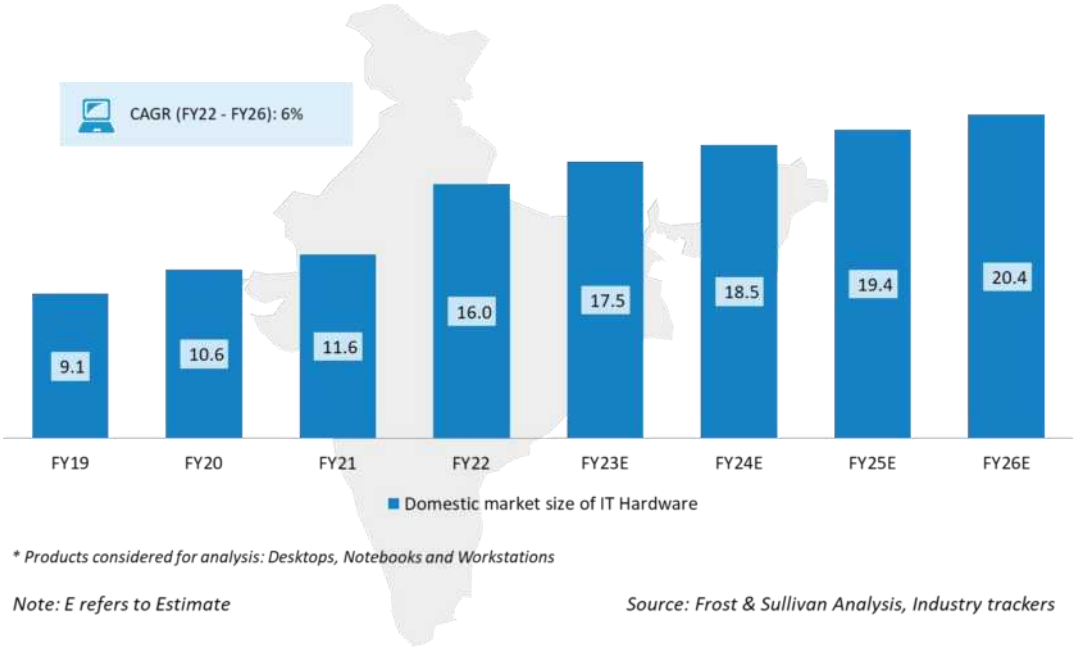
The supply will again get impacted in near term if Chinese factories will get closed and if they start working on shifts. Majority of the OEM like HP, Dell and Lenovo have sufficient material for upcoming next 6 months for the market. HP, Dell and Acer are assembling in India; 50% of the raw materials are purchased from local OEMs currently.

Market size and outlook of IT Hardware industry in India

In FY22, the Indian IT Hardware market was estimated to be 16 million units in terms of sales volume. The market is expected to grow at a CAGR of 6%, from FY22 to FY26 to reach 20.4 million units by sales volume. The enormous demand in the consumer category is mostly driven by online education, which has resulted in the laptop/notebook PCs' better performance. Similarly, gaming laptop PCs were one of the fastest-growing categories, demonstrating the country's growing popularity with gaming. The OEMs' requirements in this industry are PCBA, testing and packaging and box build capabilities, as well as supply chain management

Consumer demand does not appear to be slowing down anytime soon, and businesses continue to place new orders. Additionally, government education arrangements are being discussed, which might lay the groundwork for a very prosperous year in 2022.

Chart 6.31: Domestic market size of IT Hardware, Volume in million units, India, FY19-FY26E

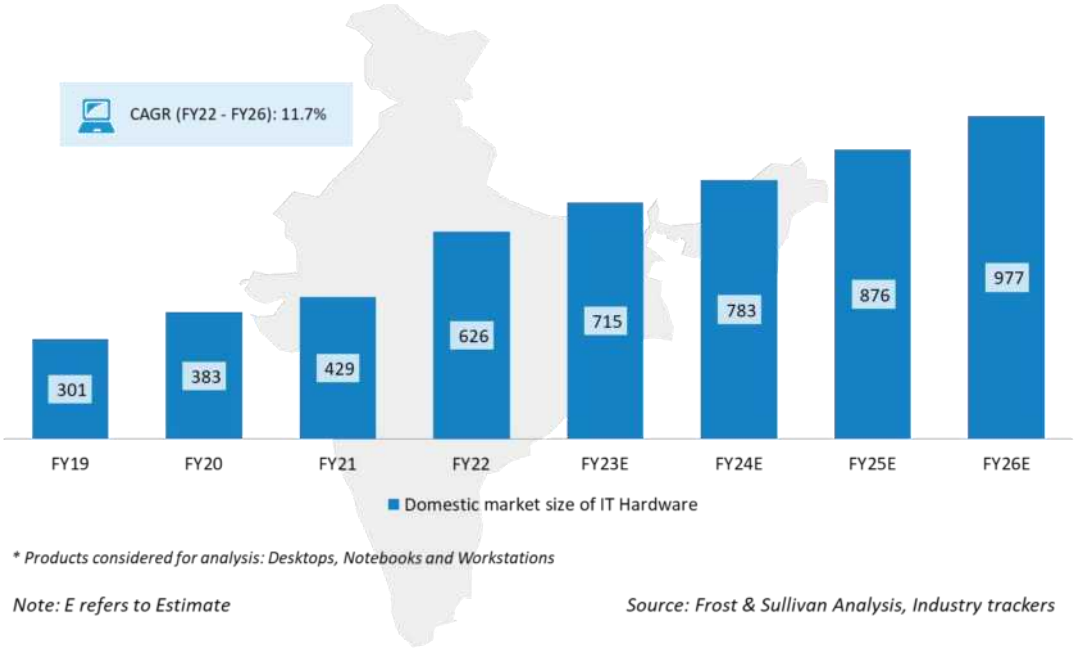


** Products considered for analysis: Desktops, Notebooks and Workstations*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis, Industry trackers

Chart 6.32: Domestic market size of IT Hardware, Value in INR billion, India, FY19-FY26E



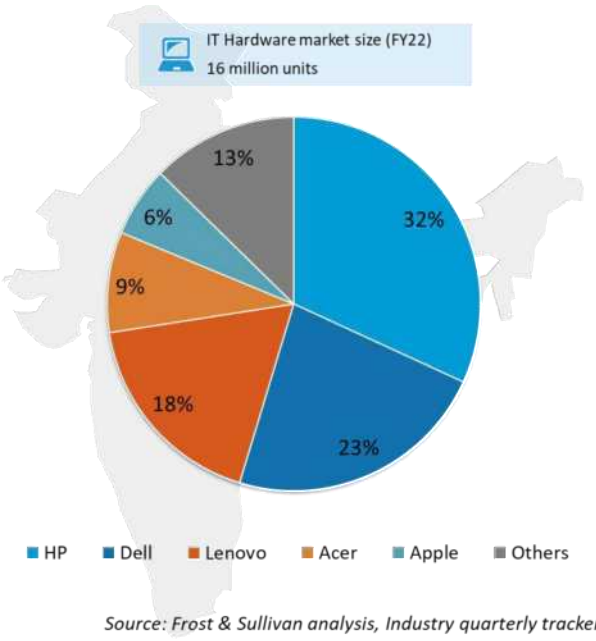
** Products considered for analysis: Desktops, Notebooks and Workstations*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis, Industry trackers

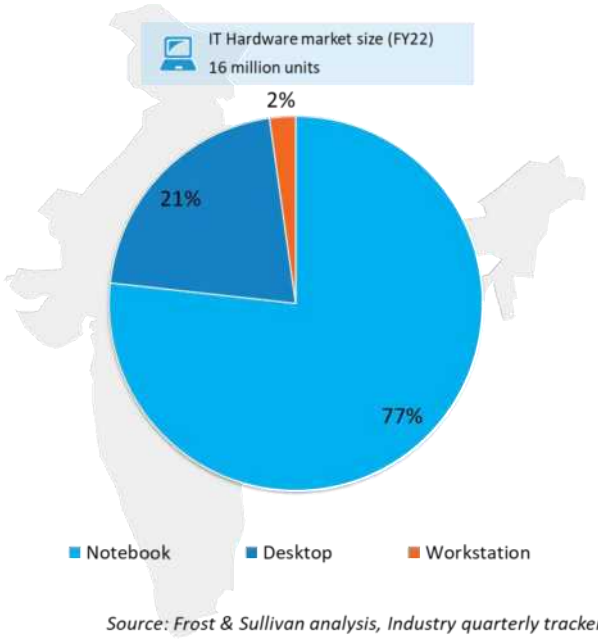
Competitive landscape of OEMs

Chart 6.33: Market share of IT Hardware by key players, by volume, in %, India, FY22



Source: Frost & Sullivan analysis, Industry quarterly trackers

Chart 6.34: Market share of IT Hardware by types of products, by volume, in %, India, FY22



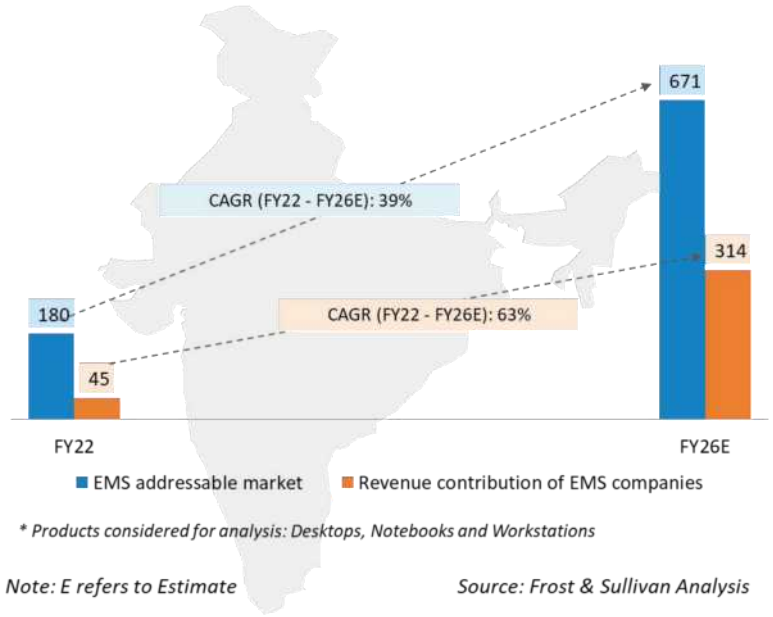
Source: Frost & Sullivan analysis, Industry quarterly trackers

In FY21, demand for IT hardware increased as a result of work-from-home opportunities and the need to be connected remotely. Individuals purchased computers and tablets; businesses invested in data centre infrastructure (to service work from home and online B2B dealings). IT/computer hardware is a highly competitive market both globally and in India. The market's leading players include Dell Technologies, HP, and Lenovo, which collectively hold 74% of the market and are increasing their shipments year over year. The other key players include Acer, Apple and Asus among others.

While the market carry on to see the momentum in the consumer and the commercial segments, channel inventory is slowly getting back to the pre-pandemic levels. With enterprises started opening up and heavy recruiting has started happening across numerous sectors, the enterprise segment is anticipated to stay upbeat in the coming quarters. Government and the education procurement is also slowly picking up, so the commercial segment may witness high single digit growth in 2022. However, high rate of inflation is a matter of concern, primarily for the SMEs and the consumers.

Lenovo, Samsung, Acer are major players in the tablet PC market. Datawind (Aakash) is a leading Indian company in the tablet PC market. Students have benefited from Datawind's (Aakash) strategy of keeping its products affordable. Historically, the retail market has been dominated by Datawind (Aakash) and iBall, which are absent from the B2B market.

Chart 6.35: EMS addressable market and revenue contribution of EMS companies for IT Hardware segment, Value in INR Billion, India, FY22-FY26E



Growth Drivers

- **Faster adoption of virtual lifestyle:** The rapid adoption of the virtual lifestyle by large enterprises, small and medium businesses, and start-ups is cited as the primary driver of increased PC demand. In addition, millions of students purchased personal computers to use for online learning. As the amount of time spent on screens increased, a large number of millennial and youth who previously used mobile phones and laptops for computing began to prefer PCs. Increasing adoption of tablets and notebooks in the Gen Y population especially in the 25-to-45-year-old demographic will help the sales grow.
- **Notebooks and tablets leading the growth path:** Falling prices and subsidies relationships with carriers are set to drive sales of tablet devices. Rising demand from the enterprise segment gives notebooks and tablets a place in schools, offices, and in the field.

Key Market Trends

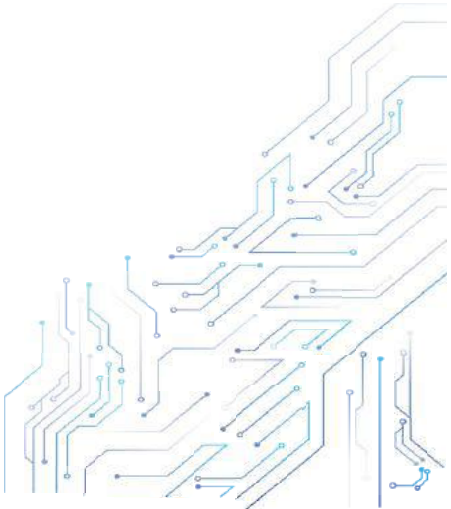
- **Competitive pricing through online channels:** Aggressive competition on pricing and discounts due to online retailing and associated offers.
- **Replacing point of sale systems:** Traditional checkout systems with old cash registers and long line-ups at cashiers are obsolete. Budget-friendly tablet makers can design gadgets that benefit both buyers and retailers.
- **Market restructuring and consolidation:** among vendors is expected going forward as they evaluate the market's future in the context of macro computing and mobility trends.

Market Restraints

- **Change in buying preference:** Changing consumer buying preferences and extended replacement cycle will have high impact on the market in mid to long term. On an average, a desktop computer will live at the peak performance for 3-5 years and any deviation on replacement buying will act as a market restraint for the business.
- **Alternate devices:** Stiff competition from alternative consumer devices like smartphones and smart feature phones which comes at a relatively cheaper price and easily affordable for lower income group people can also be market restraint.
- **Shrinking margin:** for the vendors in a highly competitive hardware market.

Regulations and Incentives

- **Production Linked Incentive Scheme (PLI) for IT Hardware:** The IT Hardware manufacturing sector has received PLI scheme for product segments such as laptops, tablets, all-in-one PCs and servers. Around INR 70 billion has been allocated on IT Hardware over the next four years as part of the PLI. MeitY has approved 14 qualified applicants for this programme. Some of the key players selected under the segment include Dell, Flextronics, ICT (Wistron) and Bharat FIH.



CHAPTER 7 – COMPANY PROFILES

Bharat FIH Ltd

Company Overview

- Bharat FIH, a Foxconn Technology Group Company, is the largest Electronic Manufacturing Services (EMS) provider in India, with approximately 15% market revenue share in Financial Year 2021 and more than twice the revenue of the second largest EMS provider in the country in Financial Year 2021.
- Formerly known as the Rising stars Mobile India, the company entered and established their presence in India in the year 2015 at Sri City, Andhra Pradesh. By 2017, the company had expanded their capacity to Sungavarchatram and Sriperumbudur near Chennai, with added capabilities. It recently setup an R&D Centre at IIT Madras Research Park, Chennai to provide product design and development services.
- BFIH's service offerings are aimed at enabling its customers to reduce manufacturing costs, improve supply chain management, reduce inventory obsolescence and product fulfilment time, and accelerate their time-to-market and time-to-volume requirements.

Key Products Manufactured

- Smart Phones and the Feature Phones
- Mechanical components (metal & plastic) for mobile phones
- PCBA

EMS/ODM services capabilities

- Research & development
- New product development
- PCB Assembly
- Complex machining
- SMT
- Final assembly

Key Business Segments

- Mobile phones
- Telecom
- Television

- Electric Vehicles
- Hearables
- IT Hardware
- Mechanics

Strengths

- They have successfully capitalised on their manufacturing skills by partnering with their global teams in product design, cost optimization, customer experience, sourcing, tooling, and manufacturing under the Foxconn Technology Group.
- The company began operations in India in 2015, and in a short period of time, it has risen to the ranks of India's top 50 enterprises in terms of size and revenue.
- Its three huge manufacturing facilities enable it to create more than 50 million electronic items every year.

Opportunities

- Bharat FIH, being one of the key EMS players, has an opportunity to expand its portfolio.
- By locating new manufacturing plants near areas of high demand, Bharat FIH will be able to better capture the market.
- Bharat FIH has established a research and development centre at the IIT Madras Research Park in Chennai, which will be among the first in India to design end-to-end 5G devices and provide customers with end-to-end services such as product design, tooling and moulding, global sourcing and manufacturing services for smartphones and other products and services in the electronics segment

Manufacturing Capabilities

- The company has 3 manufacturing campuses and 12 factories in overall
- 50+ mobile assembly lines
- Company’s manufacturing operations are spread over three campuses in at Sri City, Andhra Pradesh, at Sriperumbudur and Sungavarchatram, Tamil Nadu with on-going R&D centre at IIT Research Centre, Chennai.

Future Business Outlook

- To enhance the value chain, Bharat FIH is continually ramping up their production architecture from L1 to L10 capabilities. These operations are being supported by developing an environment of world class local suppliers to support the value chain.
- The company also offer direct-order fulfilment & configure-to-order services for delivery of the final products.

Flextronics Technologies India Pvt Ltd

Company Overview

- Flextronics Technologies (India) Private Limited was incorporated on 12th January 2001. It is classified as Non-government Company and is registered at Registrar of Companies, Chennai.
- It is located in Kanchipuram, Tamil Nadu, India and is part of the Communications Equipment Manufacturing Industry.
- Using Flex's advanced testing, simulation and miniaturization capabilities paired with design for excellence services the company can help determine key design improvements to optimize manufacturing before the beginning of production.
- Flex has got unique capabilities to make sophisticated and highly regulated products and are equipped for innovative and complex manufacturing process.

Key Products Manufactured

- Mobile Phones
- Mobile Chargers
- Set-top-boxes
- LED Bulbs
- Automotive electronics
- Telecommunication equipment

EMS/ODM services capabilities

- Automation and robotics
- Digitization
- Simulation
- Design for excellence
- Industrial Design
- System Architecture
- Mechanical Design
- Embedded System Design
- Software Systems
- Product Launch/NPI
- DFx Services

Key Business Segments

Communications, Enterprise, and Cloud, Lifestyle, Consumer Devices, Automotive, Health Solutions and Industrial

Manufacturing Capabilities

- Additive manufacturing
- Optimized manufacturing
- PCBA
- Precision plastics
- Precision plastics for healthcare: precision injection moulding and mould fabrication for plastic components
- Machining and metal fabrication
- SMT Assembly

Strengths

- Long-term competitive advantage in the marketplace because of Flextronics ODM capabilities & resources
- Flextronics ODM's strong balance sheet and increasing Return on Sales (RoS) and other KPIs
- Superior product and service quality

Opportunities

- Changing Technology Landscape – Machine learning and Artificial Intelligence boom is transforming the technology landscape that Flextronics ODM operates in
- Improved supply chain operations through implementing e commerce and social media oriented business model to build excellent vendor partner relationship

Future Business Outlook

- Flex's mid-to-long term plan is to shift mix to a more differentiated, higher value portfolio
- The company is growing in specific, targeted markets where company's distinguished capabilities in the complex engineering-led programs create a win-win relationship
- Flex is expected to deliver higher margins & consistent earnings powered by a new operational model and emphasis on the business excellence
- Flex will be consistent and methodical in their capital allocation plans
- The company is in a strong position to lead the industry and deliver a top quartile financial enactment

Jabil Circuit India Pvt Ltd

Company Overview

- Established in the year 2005 in India, Jabil is involved in the manufacturing of various products ranging from the energy meters, power supply unit circuit breaker & PV modules to the imaging devices along with consumer electronics and lighting products.
- Indian manufacturing unit of Jabil is situated in the Industrial Development Corporation Industrial Zone of Ranjangaon in Pune, which at present houses manufacturers from an extensive variety of business, because of the easy access to both the sea and the air ports.
- Jabil India specializes in high-mix and low volume manufacturing, in tune with highly specific requirements of the Indian electronics companies.
- Jabil's Pune facilities span 858,000 square feet and are strategically placed in the centre of India's technological economy.

Key Products Capabilities

- Human-machine interface (HMI)
- LED lighting
- Connectivity
- Optics
- Robotics
- Miniaturization
- Printed OLED
- Fluidics
- Sensors
- Displays
- Reference software

EMS/ODM services capabilities

- Adhesives
- High Mix/Low Volume Manufacturing
- Large Form Factor
- Near-Field Communication Technology
- Power Electronics
- Precision Injection Moulding and Tooling
- Radio Frequency Identification Technology (RFID)
- Rapid Prototyping Services
- Sustainable Packaging

Key Business Segments

- Appliances
- Automotive
- Defence & Aerospace
- Printing
- Healthcare
- Networking
- Telecommunication
- Others

Strengths

- Jabil is excellent at developing Go to Market strategies for its products.
- The company has strong dealer portfolio and trustworthy suppliers
- Jabil Circuit has created a dependable distribution network that can reach the majority of its prospective market over the years.
- Jabil has made investments in technologies for factories of the future, including a network of connected factories, AI to analyse data in real time, and 3D printing
- It has a comprehensive design service portfolio, including chips, PCBAs, plastics, and other mechanical designs.

Opportunities

- New tax regime to boost the profitability of Jabil
- Logistics and supply related cost reduction can lead to a drop in product pricing which will lead to more sales or increase in market share by passing on the profit margin to the customer

Future Business Outlook

- Jabil announced plans to invest INR 20 billion in Pune by end of 2021, with plans to expand into smartphone, home appliances, mobile spare parts, and food packaging.
- Jabil's high velocity business primarily focuses on getting the business ideas from 'concept to market' in fastest time possible. It focuses on providing industries with the product design, materials know-how, validation and the supply chain management, along with after-market services.

Dixon Technologies India Ltd

Company Overview

- Dixon Technologies, located in Noida, is an Indian Electronics Manufacturing Services Company that was founded in 1993 and has been leading this space in India. Initially, the company began production of colour televisions.
- Dixon has now expanded its activities to numerous electronic sub-segments. The company offers design-focused solutions in consumer durables, home appliances, lights, mobile phones, and security systems, as well as repairing and refurbishing services for a wide range of products.
- Since its initial public offering in 2017, the company has been listed on the BSE and NSE.
- The company operates in ten production facilities in Noida, Dehradun, and Tirupati / Chittoor District.

Key Products Manufactured

- LED TVs
- Washing Machines
- LED bulbs, LED Drivers
- Feature Phone and Smart Phone
- CCT and DVR
- Micro PCR Analyser and Thermometer
- Set-Top-Box

EMS/ODM services capabilities

- Product Design
- Prototyping
- System Integration
- Quality & Testing
- Supply & Logistics
- After market

Key Business Segments

- Consumer Electronics
- Home Appliances
- Lighting Solution
- Mobile Phones
- Security surveillance system
- Medical Electronics
- Reverse Logistics

Manufacturing Capabilities

- Set Top Box
- Consumer Electronics
- Home Appliances
- Lighting Solutions
- Mobile Phone
- Security Surveillance System
- Medical Electronics

Strengths

- A Low-Debt Company
- Annual net profits have improved over the last two years.
- Corporation with a zero promoter pledge

Opportunities

- A booming consumption economy paving a way for the growth in the consumer electronics market, which is estimated to boost local manufacturing, providing growth opportunities for the company
- Highly experienced and dedicated management team enables to capture market opportunities, formulate & execute the business strategies, manage client expectations as well as proactively manage the changes in the market conditions
- Higher localization & domestic manufacturing to aid to growth opportunities for the EMS/ ODM companies

Future Business Outlook

- Strong customer base of Dixon is estimated to be a robust driver of Dixon's future growth and help them expand market share, develop new products and enter newer markets
- Dixon's financial stability and positive cash flow from the operations enable them to meet present and future requirement of customers

Sanmina-SCI Technology India Pvt Ltd

Company Overview

- Sanmina was founded in 1980 and is located in San Jose, California (USA); the company entered the Indian market in early 2000 with its head office in Chennai.
- Sanmina manufactures some of the world's most sophisticated and inventive optical, electrical, and mechanical devices.
- Sanmina, a technological leader, offers end-to-end design, manufacturing, and logistics solutions, as well as exceptional quality and support to OEMs.
- The company has global operations currently operating in 21 countries. In India, Sanmina has a complete end-to-end design service and a high-tech manufacturing facility located in Chennai

Key Products Manufactured

- PCB Circuit Boards & Assembly
- SMT capability
- Medical devices
- RF products & enclosures
- LED Lighting
- Cables

EMS/ODM services capabilities

- Design & Engineering
- Prototyping
- Test Services
- New Product Development
- Systems Manufacturing
- Global Services and Logistics
- PCB Assembly
- SMT

Key Business Segments

- Communications networks
- Computing and storage
- Healthcare
- Defence and Aerospace
- Industrial
- Automotive
- Clean technology sectors

Manufacturing Capabilities

- PCB & Backplane Design and Layout:
- ICT & ATE Development
- Sheet Metal and Plastic Enclosure Design
- EMC/EMI, Thermal, Cabling & Design for Level 3 Integration
- Modular solutions development (Memory modules – DRAM, Flash, SSD)

Strengths

- Key certifications held by the Sanmina's Chennai manufacturing facility include TL 9000, EN/AS9100, ISO 13485, and IATF 16949.
- Sanmina became India's first tier EMS Company to get FDA certified in 2018.
- Sanmina has been granted Domestic Tariff Area (DTA) status at its manufacturing facility, allowing the company to support the Make in India initiative, a government-led initiative to encourage the domestic production.
- With SEZ and DTA status, Sanmina is able to manufacture and distribute products for both local and export markets with zero customs duty.

Opportunities

- Entering new and emerging market as an outcome of government policy and free trade agreement
- The new technology provides an opportunity to Sanmina Corporation to practice differentiated pricing strategy in the new market.
- Lower inflation rate and economic uptick leading to increase in consumer spend

Future Business Outlook

- Continue to seek various cost savings and efficiency improvement methods and maintain extensive operations in lower cost locations, like India
- Plan to expand company’s presence in these lower cost locations taking into consideration tariffs and other factors, to meet the needs of company’s customers
- Create plants located near customers or their end markets to deliver products having high complexity with stringent certifications and government clearances

Company Overview

- Optiemus Infracomm, founded in 1993, is a diverse, award-winning telecommunications enterprise and a major player in the Indian mobility ecosystem.
- In India, the business has more than two decades of experience managing, distributing, manufacturing, and retailing mobile brands and other telecommunication products.
- To their credit, they sold the first official mobile phone in the country in 1995 and have since brought revolutionary technological items to Indian consumers through its extensive distribution and retail activities.
- The first Nokia distributor in the country, with a relationship that lasted a decade - from 1995 to 2006.

Product Portfolio

- Smartphones
- Tempered glass

Key Business Segments

- Mobile Phones
- IT & Hardware
- Telecommunications

Manufacturing Capabilities

- Capabilities include three individual production units, two state-of-the-art handset manufacturing machines with:
- A combined capacity of 1.5 million units per month, over 1.5 million square feet of production area, and 35 assembly lines.
- The third facility is a cutting-edge glass cutting and finishing factory with a monthly capacity of 500,000 premium tempered glass units.

Strengths

- Strong annual EPS growth
- Strong annual EPS growth
- Company with Low Debt
- Company with Low Debt
- A company that is capable of generating net cash - Improving net cash flow over the last two years
- FII / FPI or Institutions growing their holdings

Opportunities

- The robust and rapid rise of the smartphone business has been enabled by various policies and initiatives implemented by the Indian government, as well as massive customer demand.
- During FY 2020-21, the Ministry of Electronics and Information Technology introduced the Production Linked Incentive Scheme ("PLI") for the electronics sector in order to become the world's second largest mobile manufacturing country. The PLI Scheme is a production-linked incentive designed to encourage domestic manufacturing and attract substantial investments in mobile phone manufacturing and specific electronic components.

Future Business Outlook

- Optiemus Electronics Limited (OEL) is creating a strategic relationship in India with $30 billion iPhone manufacturer Wistron to jointly manufacture mobile phones, laptops, IoT and IT hardware devices, and Automotive-EV products. Under the terms of the agreement, OEL would invest INR 13.5 Billion over the next three to five years with the goal of generating INR 380 Billion in revenue across several product areas.
- Roadmap for Optiemus Electronics Limited’s future includes setting up an integrated Industrial Park under Indian government’s ‘Make in India’ MSIP scheme.
- GDN’s (Global Devices Network) future roadmap includes expansion of manufacturing portfolio to mobile accessories like Power Bank, Cables and Speakers.