ASSESSMENT OF SELECT HIGH END LED LIGHTING MARKET (EMS) IN INDIA

SUBMITTED TO

IKIO LIGHTING LIMITED

20TH April 2023

FROST & SULLIVAN

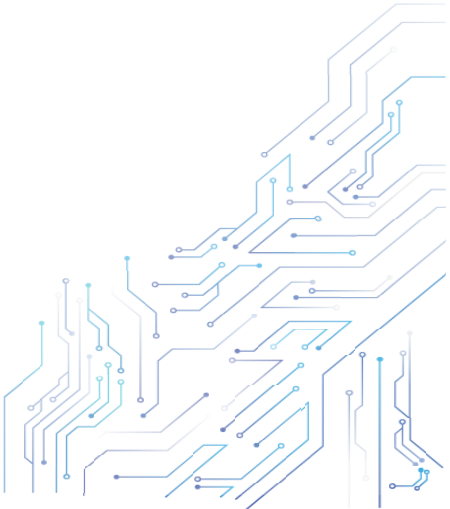
ACRONYMS

Title	Abbreviations	Title	Abbreviations
AI & ML	Artificial Intelligence & Machine Learning	NPE	National Policy on Electronics
BIS	Bureau of Indian Standards	ODM	Original Design Manufacturer
CAGR	Compound Annual Growth Rate	OEM	Original Equipment Manufacturer
CCTV	Closed-circuit Television	PCB	Printed Circuit Boards
CFL	Compact Fluorescent Lamps	PCBA	Printed Circuit Board Assembly
CR	Commercial Refrigeration	PLI	Production Linked Incentives
CY	Calendar Year	PMP	Phased Manufacturing Programme
EDFC	Eastern Dedicated Freight Corridor	PV	Photo Voltaic
EESL	Energy efficiency services limited	QSR	Quick Service Restaurant
EMC 2.0	Modified Electronics Manufacturing Clusters	RBI	Reserve Bank of India
EMS	Electronic Manufacturing Services	RV	Recreational Vehicles
EU	European Union	SLNP	Street Lighting National Program
EV	Electric Vehicles	SME	Small and Medium Enterprise
FDI	Foreign Direct Investment	SPECS	Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors
FMC	Fan Motor Controller	TCO	Total Cost of Ownership
FPD	Flat Panel Display	UJALA	Unnat Jyoti by Affordable LEDs for All
GDP	Gross Domestic Product	ULB	Urban Local Bodies
GOI	Government of India	USD[1]	United States Dollar
GPON	Gigabit Ethernet passive optical network	VAT	Value Added Tax
GW	Gigawatt	VOLTE	Voice over LTE
HVAC	Heating, Ventilation and Airconditioning		
IMF	International Monetary Fund		
IoT	Internet of Things		
kWh	Kilo Watt Hour		
LED	Light Emitting Diode		
Li-ion	Lithium Ion		
LTE	Long-Term Evolution		
MEIS	Merchandise Exports from India Scheme		
MNRE	The Ministry of New and Renewable Energy		
MSME	Micro, Small, and Medium Enterprises		
MW	Megawatt		
NMZ	National Manufacturing Zone		

[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)*

DEFINITIONS

Title	Definition
Ah	Ampere hours -- sometimes abbreviated as Ah or amp hours -- is the amount of energy charge in a battery that enables 1 ampere of current to flow for one hour
Box Build	Also called systems integration, can range from a simple PCBA housed in a small enclosure to a cabinet comprising an electromechanical system
Components	It includes active, wound, electromechanical, passive, LED lighting components, bare PCB, and other components
Electronic Manufacturing Services (EMS)	Companies that provide services such as design, manufacture, test, distribution, and servicing in the electronics sector for the OEMs
Feature phones	Feature phones run on 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 from 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
Smartphones	Mobile phones that run on a mobile operating system offering a variety of features that allows advanced computing capability and connectivity
Tier classification of cities	As per RBI, Indian cities are classified as tier 1, 2, and 3 based on the size of their population. Tier 1 (> 100,000); Tier 2 (50,000-100,000); Tier 3(20,000-50,000)



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CHAPTER 1 - GLOBAL MACROECONOMIC OVERVIEW

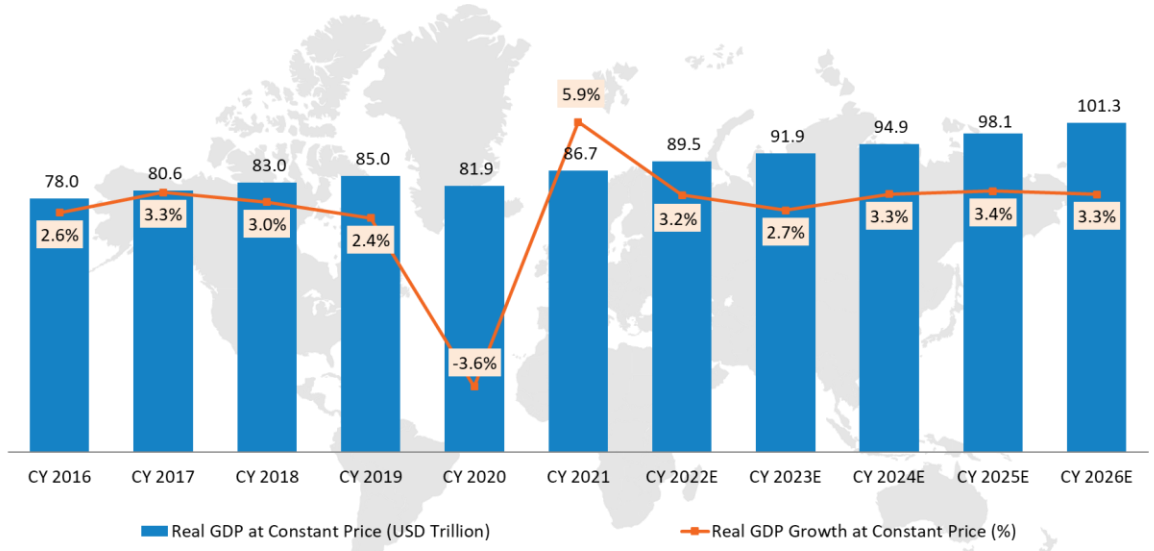
Global[2] real GDP and growth outlook

After almost one and half years of slowdown, most of the global economies have registered strong growth in CY 2021 and now it is on the path of stabilization and growth. Globally, economic sentiment remains largely positive, and economic conditions in their respective countries and around the world are improving. Global and domestic conditions are expected to improve in the months ahead.

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 past, all governments have taken the steps they need to deal with similar events in the future. Pent-up demand, caused by economic stagnation and improvement in the supply situation, has resulted in the most robust post-recession recovery.

Global economic powerhouses such as World Bank, IMF and others have projected a stable growth outlook for the global economy till CY2026. The global real GDP is expected to grow at a CAGR of 3.16% (real GDP) from CY2021 to CY2026.

Chart 1.1: Global 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

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. While global economic conditions are improving and sentiment remains largely positive, concerns regarding rising inflation remain widespread, as Russia invaded Ukraine at the start of CY 2022. One of the most important effects of this war would be on commodity prices. F&S further expects the war to spike global fuel inflation and cause recessions

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

in nearby regions. The impact of the above events has been estimated F&S' model to arrive at a realistic real GDP number by 2026.

Real GDP growth of Key Economies

Globally, business scenario has improved significantly 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 curb the spread of the virus and 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 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.

However, the ongoing conflict between Russia and Ukraine is having some consequences for the global economy, which is just recovering from the stress of the novel corona virus. Both Russia and Ukraine are major commodity producers, and disruptions there have resulted in soaring global prices, especially that of oil and natural gas.

United States of America - In USA a positive recovery of 6.2% in CY2021 was anticipated to be followed by subdued growth and saturation in economic activity where the market is expected to grow between 1.6% in CY2022 and 2.1% in CY2026. 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 CY2022. Household expenditure has been rising gradually since mid of CY2021. Retail sales and housing sales has also gathered pace and exceeded pre-crisis levels.

Europe - The European Union (EU) showed a recovery of 5.2% 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. Companies across Europe are embracing innovative business models and redesigning production to continue doing business. Most economies are now operating normally, and a positive mood prevails, buoyed by the European Union's historic agreement 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.

South East Asia – In South East Asia, the declining tourism and businesses have caused sharp downturn in the overall economy of the region due to the pandemic. The country slowly recovered to around 2.6% in CY2021. According to the recent International Monetary Fund (IMF) projections, GDP per capita in the region will stand at 5.0% and 4.6% in CY022 and CY2023. With the US China trade war and the economies are now gradually recovering 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.

After two years of lockdown and numerous Covid-19 variants, Southeast Asian governments have begun beginning 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 - China is the only large economy to register a positive GDP growth of 2.3% in CY2020. The country has shown its resilience during the pandemic year and registered 8.0% GDP growth in CY2021. China's economy has recovered well with the government focusing on supporting Small and Medium Enterprise (SME's). Though China's industrial economy showed positive signs, retail and investment industry remained weak and challenging. As the recovery gains traction, the composition of aggregate demand is likely to shift toward private domestic consumption. Real consumption growth is expected to eventually return to pre COVID-19 levels, aided by continued labour market recovery, growing household incomes, and increased consumer confidence. However, the recent lockdowns due to the wake of XE variant of COVID-19, has created some disruptions in select regions of China.

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.

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 tremendous resilience, and macroeconomic indicators have started improving gradually since Q3 CY2021. The country grew by 9.5% in CY2021 and is expected to grow by 8.5% in CY2022, owing to strong macroeconomic fundamentals such as moderate inflation, the implementation of key structural reforms, and improved fiscal and monetary policies. Among all large economies, India is likely to demonstrate rapid and sustainable growth post COVID-19, driven by strong manufacturing-led industrial expansion and consumption demands from the private sector.

Manufacturing has emerged one of focus area for the government. 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

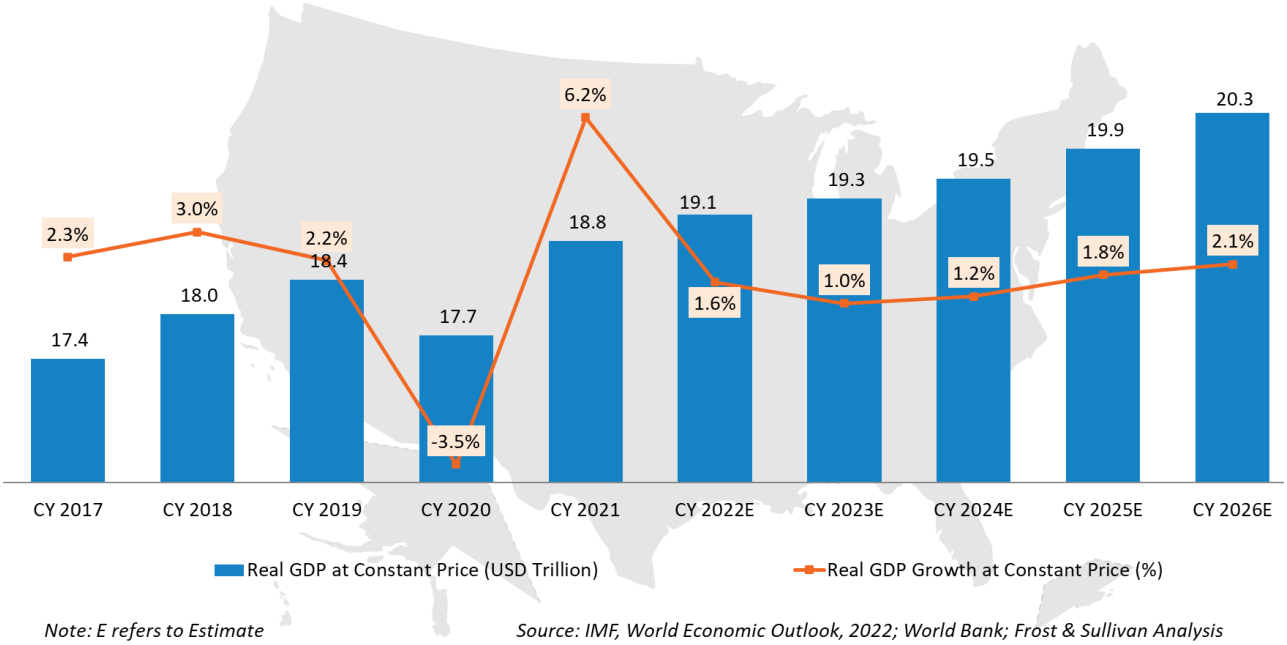
Recovery and Growth Forecast of Key Economies

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 6.2% in 2021 and is anticipated to grow between 1.6% in 2022 and 2.1% in 2026.

Chart 1.2: 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

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 the public health situation saw an 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 however commodity prices surge is pressuring higher inflation. The extent of the impact will also depend on how long elevated price pressures last and on how policymakers respond to anchor long-run inflation.

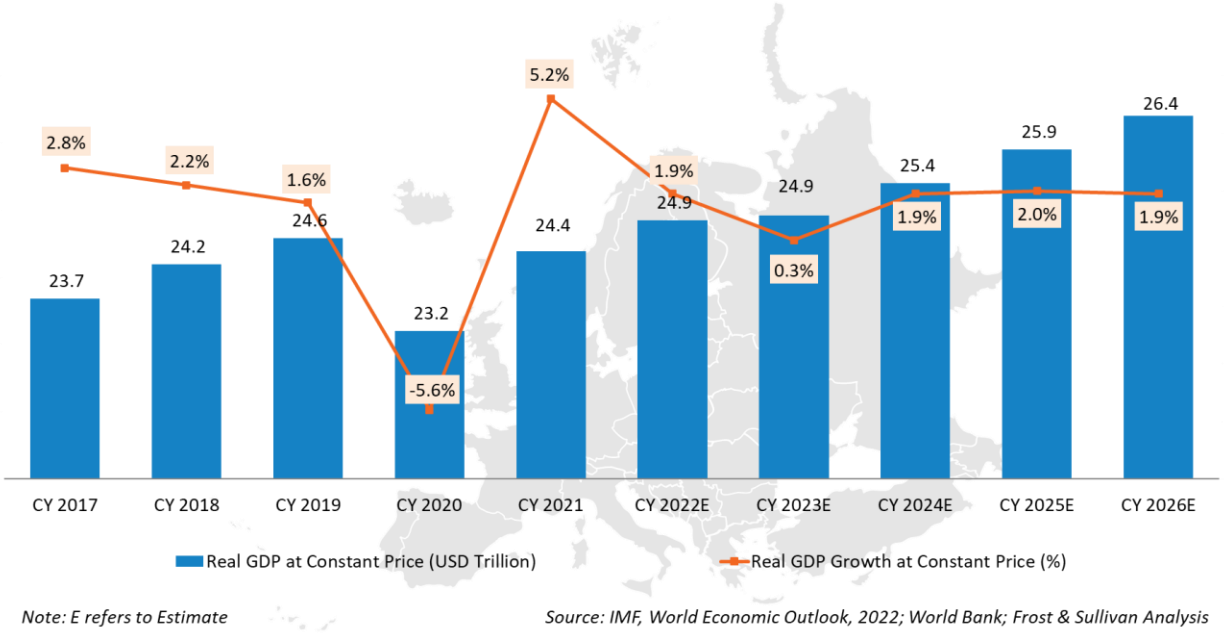
B) Europe

The European Union (EU) economy has shrunk by 5.6% 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 5.2% 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.

Chart 1.3: 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

The European Union is expected to grow at a rate of 1.9% 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 expects the European economy to grow at a slower pace in 2022.

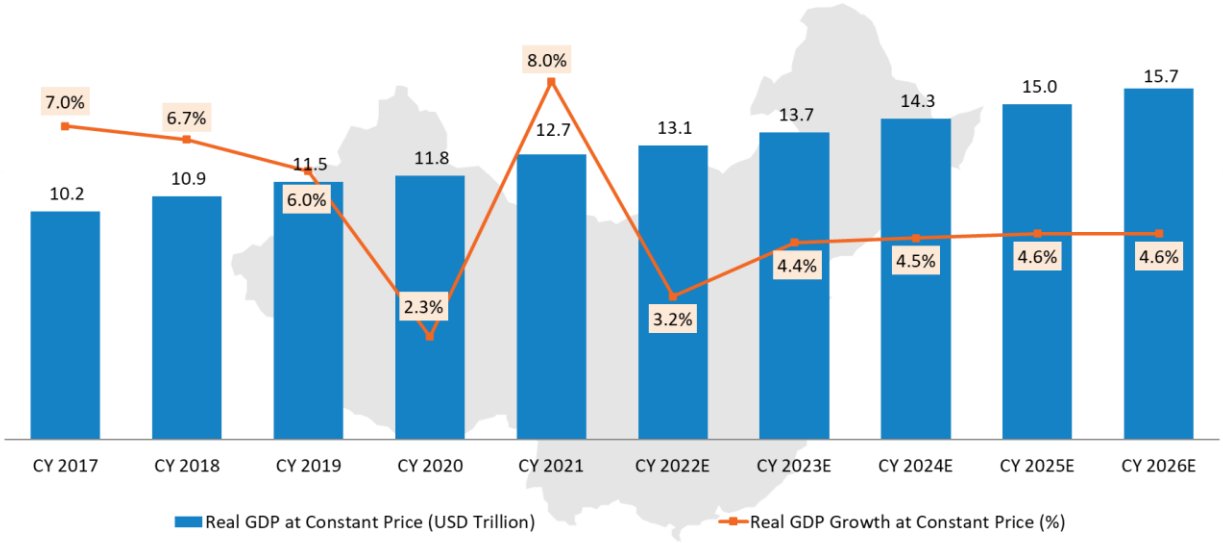
C) China

China is the only large economy to register a positive GDP growth in a year when the global economy contracted by 3.6 %. 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. The 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.

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.

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

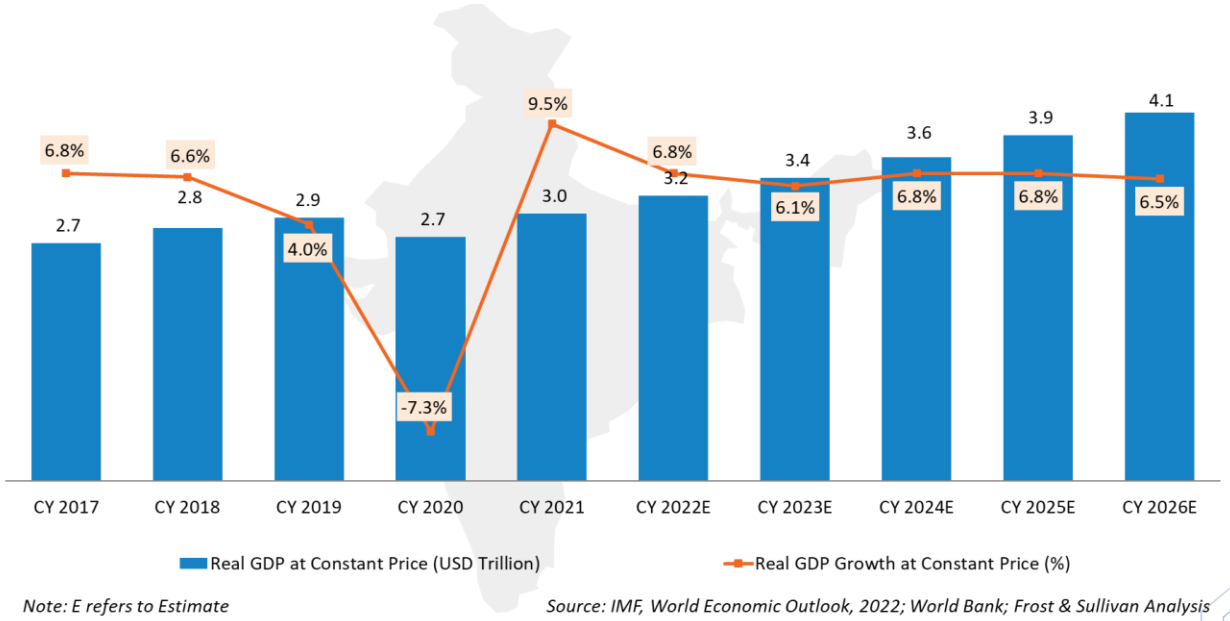


Note: E refers to Estimate

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

D) India

Chart 1.5: 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

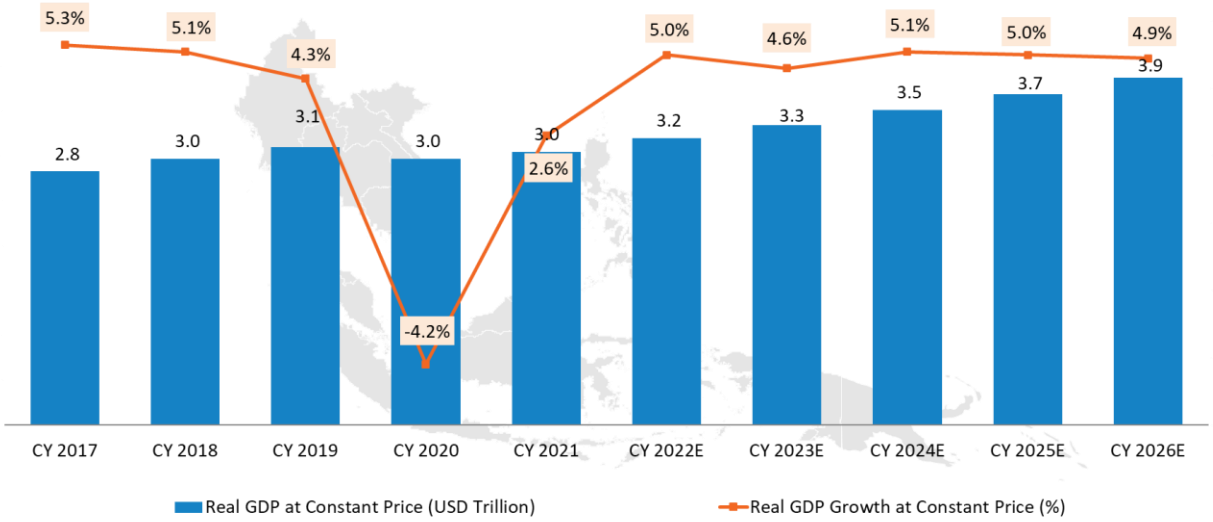
Indian economic growth ended on a positive note in FY22, outperforming many other major economies, as the pandemic faded. The government has been promoting structural reforms (as part of the FY22 budget), such as a focus on disinvestment and higher FDI limits, while also working on a national logistics policy. These reforms are critical for accelerating the post-pandemic economic recovery. The outlook for FY23 is also positive, with the real GDP of the Indian economy expected to grow by 6.6%. The government has implemented a slew of measures to get the economy back

on track. Through various policy initiatives such as Atmanirbhar Bharat and PLI schemes, there is emphasis on the growth of the domestic manufacturing sector. These initiatives will assist the economy in achieving medium-term stable growth by FY26. These initiatives will assist the economy in achieving medium-term stable growth by FY26. According to Frost and Sullivans 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.

Chart 1.6: 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

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. Low material movements and lockdowns affected countries dependent on trade and tourism especially Singapore, Vietnam, Cambodia, Malaysia, and Thailand. Also, reduced remittance has negatively impacted 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 5.0%, 4.6% and 5.1% 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.

CHAPTER 2 - GLOBAL ELECTRONICS MANUFACTURING SERVICES (EMS) INDUSTRY OVERVIEW

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.

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 a machine functions 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.

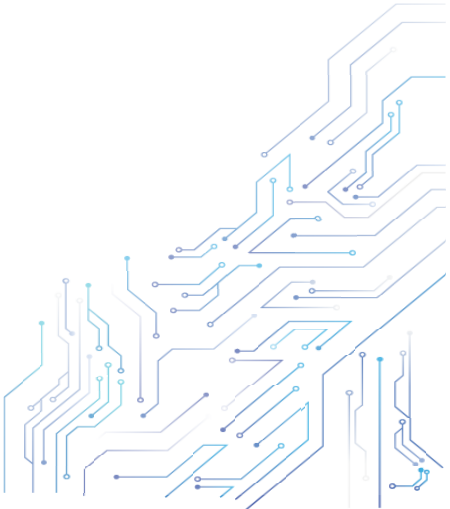


Chart 2.1: Evolution of EMS industry, Global, CY2022

< 1980

Electronic manufacturing services (EMS) began in the 1970s with the entry of the first EMS company, Solectron (Flex), in 1977. Prior to that electronics manufacturing and PCB assembly was done in-house by brand OEMs. EMS providers were primarily engaged in contract manufacturing.

1980 - 1990

As a result of downsizing by many brand OEMs during the economic recession in the late 1990s, the contract manufacturing business grew rapidly. EMS providers were able to enhance and expand their production capabilities to meet the growing demand.

1990 - 2000

Surface Mount Technology (SMT) for PCBs was developed in the early 1990s, allowing for faster assembly of electronics. More complex PCBs were ultimately manufactured through this technology benefitting the EMS industry manifold.

2000 - 2010

In 2000, the EMS industry witnessed enormous increase in demand. Consumer electronics, EDP equipment, and communications equipment industries saw increased competition. There were also major changes in the semiconductor with the usage of fabless semiconductors.

2010 - 2020

ODM providers have evolved and progressed at the front end of the value chain, involving in product design as well as assembly, testing, and mass manufacturing. In more established segments, such as telecommunications and consumer electronics, ODMs have grown rapidly.

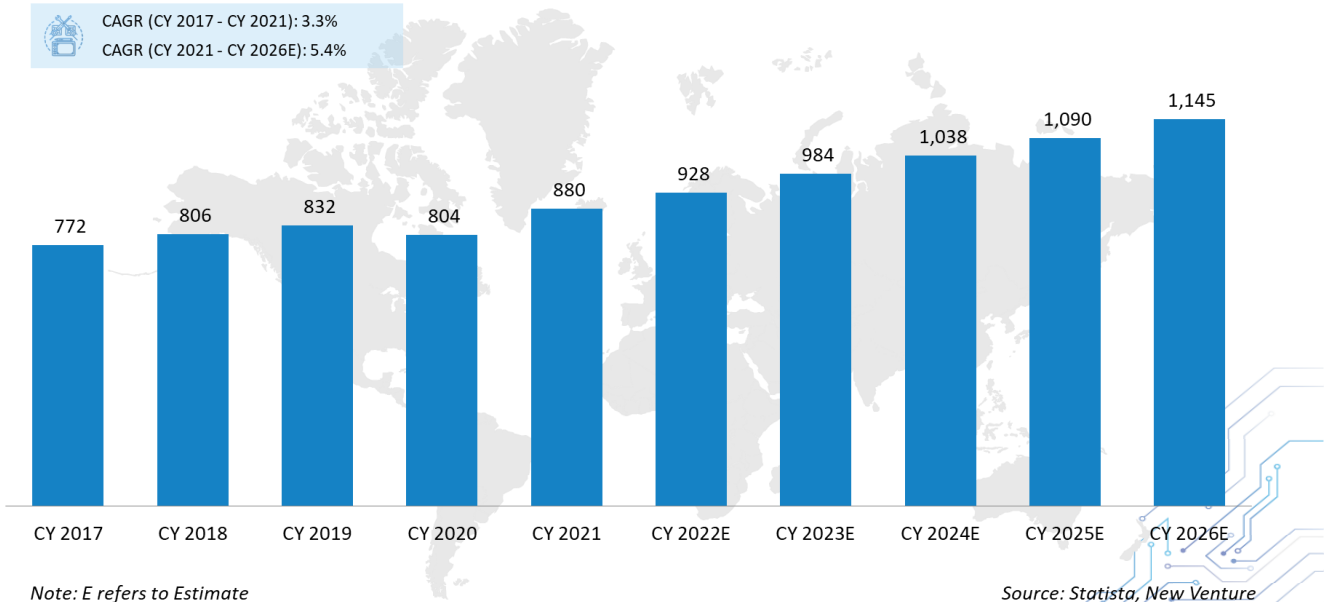
> 2020

Future EMS technologies will necessitate fundamentally new production methods. Manufacturers are being compelled to produce items in response to the increase of "greener" electronic devices and the need for recyclable products.

Source: Frost & Sullivan Analysis

Overview of global EMS industry

Chart 2.2: Global EMS industry market size, value in USD billion, CY2017-CY2026E



Note: E refers to Estimate

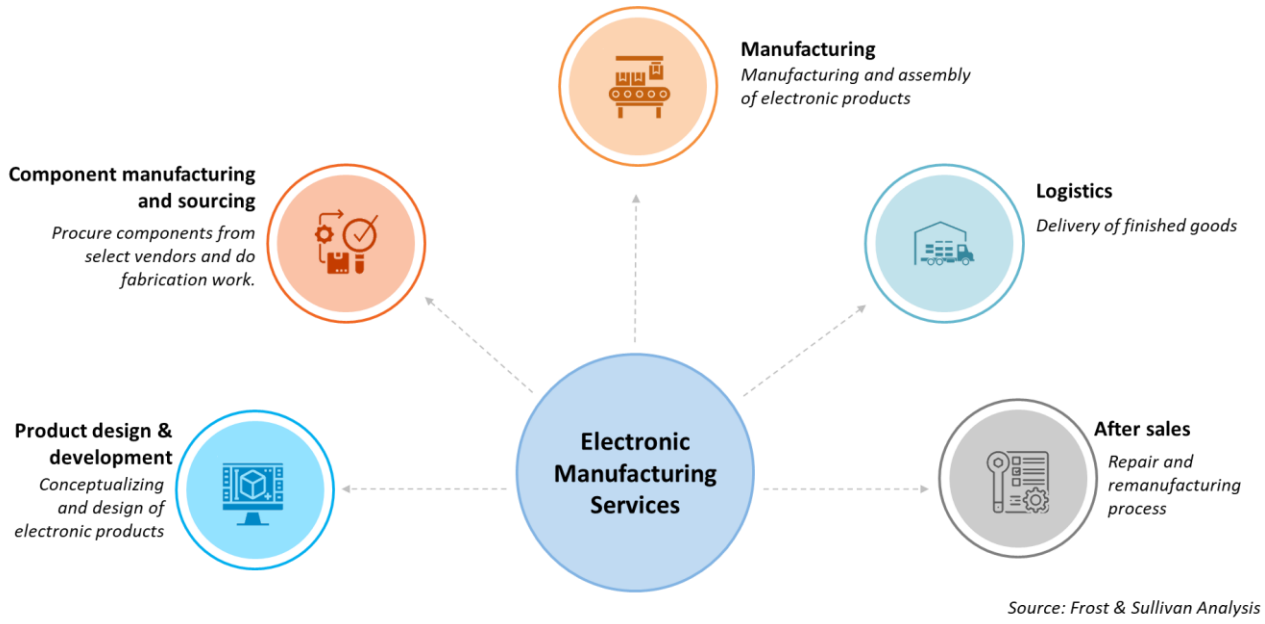
Source: Statista, New Venture Research, Frost & Sullivan Analysis

The global EMS market was estimated at USD 880 billion in 2021 and is expected to grow at a CAGR of 5.4% to reach USD 1,145 Billion in CY 2026. The global EMS market witnessed a period of steady growth till CY 2018, riding on the wave of increased outsourcing activities from OEMs and increasing electronics content. However, in CY 2019, the opportunities started stagnating due to multitude of factors, including (i) decline of global automotive sales and saturation of consumer electronic sales, (ii)supply chain restriction due to heightened trade tensions between the United States and China, and (iii) the COVID-19 pandemic. EMS industry recorded a 3.4 % decline in CY 2020. Impact on the industry was expected to be higher; however certain factors worked in favour of the industry. These factors include (i) the pent-up demand created by the need for life-sustaining medical devices, (ii) the work-from-home economy, which created demand for smartphones, tablets, and laptops, and (iii) the push for climate change, which created demand for digitalization or digital software/products/solutions that can track, monitor, measure and verify sustainability initiatives.

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.

Range of services offered by EMS companies globally

Chart 2.3 Range of services offered by EMS companies, Global



Source: Frost & Sullivan Analysis

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.

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.

Range of service offered by IKIO Lighting

- Ikio has a fully integrated manufacturing infrastructure, capable of producing ingenious LED lighting products.
- It has four manufacturing plants spread across NCR to Uttarakhand and has a combined manufacturing capacity of over 18 million fixtures annually and a huge area for product assembly with a surface mount technology assembly capacity of 4.8M pieces every twelve hours and a final product assembly capacity of 58 thousand pieces every twelve hours.
- Ikio also has advanced infrastructural amenities such as in-house injection moulding facility, state of the art test equipment's, in-house powder coating facility, ultra-modern tool room facilities clubbed with technological expertise.
- In addition to this, it also **performs power quality audits** and **delivers power quality improvement solutions.**
- It also provides **EPI (enterprise improvement services)** which includes supply chain optimization, operational excellence, energy solutions and cost containment solutions.
- Ikio's large manufacturing LED capacity along with their R&D has positioned it well to meet the further demand for LED lighting in India as LED lighting is considered an important and growing part of India's sustainability initiatives.
- Ikio offers high end home and decorative lighting to Signify, lighting solutions (lights, drivers and controls) to commercial refrigeration equipment suppliers such as Western Refrigeration and Frigoglass, a host of products (ABS pipes, solar panel, charge controllers, accessories, switches, sockets, interior and exterior lights) to US Recreational Vehicle (RV) suppliers such as Forest River and Rotary Switches to companies such as ABB, Honeywell, Anchor Panasonic, Legrand, Philips, GM Modular etc.
- It operates through original design manufacturers (ODM) model for Signify. It develops and delivers custom LED lighting products from its R&D and product development infrastructure along with financing options.

Drivers and Challenges for the growth of Global EMS industry

Drivers

- **Technological advancements and acceptance of smart home devices**
- **Greater Emphasis on Vehicle Electrification**

- **Technological upgrade of facilities**
- **Product development activities**
- **COVID-19 induced pent-up demand**

Technological advancements: 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. The use of smart lighting has also been on the rise in the past few years. The IoT technology in lighting has potential to grow not just in office buildings but also in warehouses, commercial parking areas, healthcare facilities, educational facilities, and retail outlets. As LED lights are naturally friendly to digital controls (they include a semiconductor to produce light), they are perfectly suited for IoT applications. Growth of the smart lighting market is owed to the government's push in terms of the 'Smart City Mission', and 'Digital India' programs, as well as rising adoption of smart homes across the country.

Major manufacturers are strengthening their R&D investment to differentiate their products and attract new end-use applications. The rising popularity of smart home devices raises very high expectations for EMS companies. In the United States, companies provide electronic manufacturing services that include developing optoelectronics, radio frequency and wireless devices, and microelectronics devices for the rapidly growing smart home sector. Key market participants are focusing on increasing production volumes by combining cloud computing, artificial intelligence, big data analysis, and 3D printing to produce connected devices for smart homes.

Greater emphasis on vehicle electrification: The (EV) Electric Vehicle 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. Across the world, incentives are provided by the respective government to encourage people to purchase electric vehicles. For instance, grants are highly popular in the United Kingdom, China, the United States, Germany, and even Norway, among other places, to reduce air pollution and promote a more sustainable way of life. As the number and complexity of PCBAs in electric vehicles are significantly higher than in typical ICE vehicles, this growth represents a huge potential for EMS businesses to offer electronic manufacturing and mass production services to automakers.

Technological upgrade of facilities: EMS companies are investing in the technological up gradation of their facilities by adopting digitization and industry 4.0 concepts. This will improve productivity and capacity, thus acquiring the capability to get more contracts. Many of the market participants are progressing in this direction; hence, this factor will evolve into a significant driver in the mid to long-term.

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.

COVID-19 induced pent-up demand for medical devices: Accelerated demand of medical devices 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 and 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

- **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**

Presence of market participants is high: 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: Most of the market participants face challenges with respect to the operating margin. In the EMS industry, profit margins are relatively low. A low operating margin is viewed as an impediment to growth and expansion plans. Currently, low profit margin is viewed as a significant restraining factor for the EMS market. However, in the long run, as overall demand increases, market participants are expected to be able to expand through technological investments.

Complex structure and delay in supply chain: Manufacturing businesses must adhere to global standards since they rely on a wide range of suppliers, both local and international. The operational constraints are compliance with rigorous government and industry regulations, as well as the concern of traceability. It is uncommon for a product's components to traverse across several continents before reaching the market. Supply chain delays causing shortage of components are likely to impact the revenue in the short term. 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. An active new product launch procedure is required for EMS companies. To launch the items on schedule while fulfilling quality and volume objectives, a collaborative effort across difference sections is required. Production is always based on the customer demand, which can be both unstable and cyclic. 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.

Size of global electronics industry and outlook

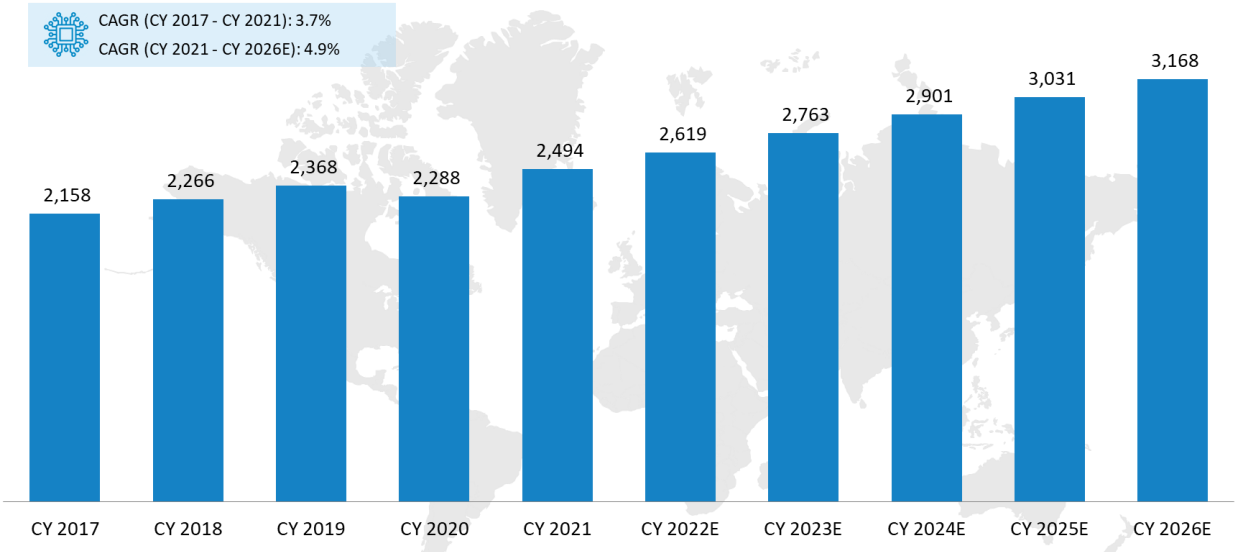
The global electronics industry has evolved tremendously over the last 60 years. Global demand for electronics industry is created by emerging and multiple disruptive technologies. The overall electronics

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% from CY2021 to reach USD 3,168 billion by CY2026. Some of the critical factors driving this growth are expected to be: -

- Increasing disposable income and rising demand for electronics from rural markets.
- Inclination of youth towards next gen technologies.
- Emergence of e-commerce.
- Pent-up demand created by the need for life-sustaining medical devices.
- Prevalence of the work-from-home economy, which created demand for smartphones, tablets, and laptops and improved acceptability of audio and video conferences.
- Increasing use of data has resulted in increased demand for large domestic servers and growth in data analytics also increased growth of use of data servers, which in turn creates demand for electronics.
- Adoption of Industry 4.0 across manufacturing segments.
- Higher internet broadband penetration and 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.

Chart 2.4: 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

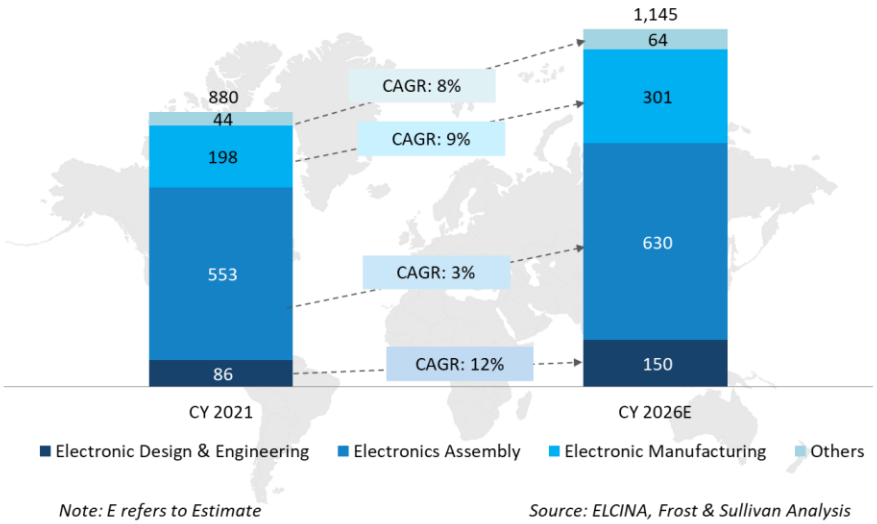
Global EMS market dynamics

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

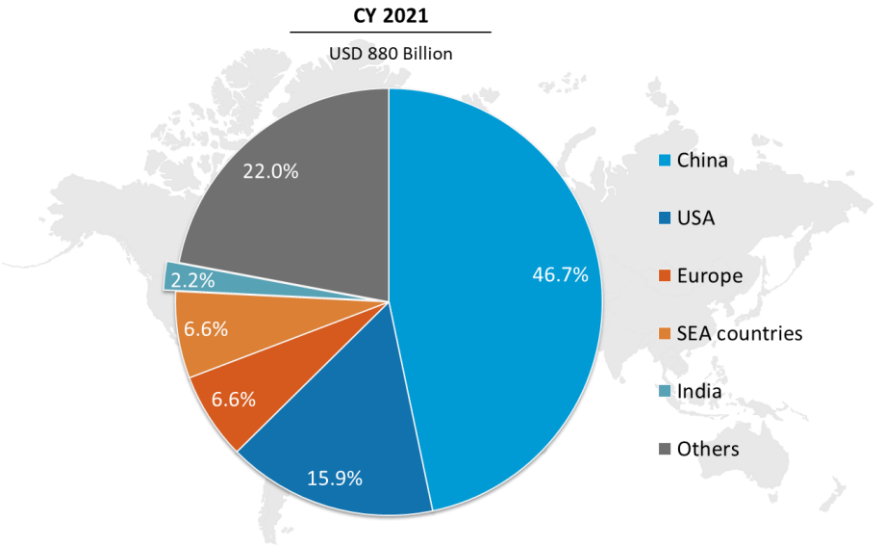


Note: E refers to Estimate

Source: ELCINA, Frost & Sullivan Analysis

B. By geography

Chart 2.6: EMS market break-up by select countries, Global, value in USD billion, in %, CY2021



Source: Frost & Sullivan Analysis

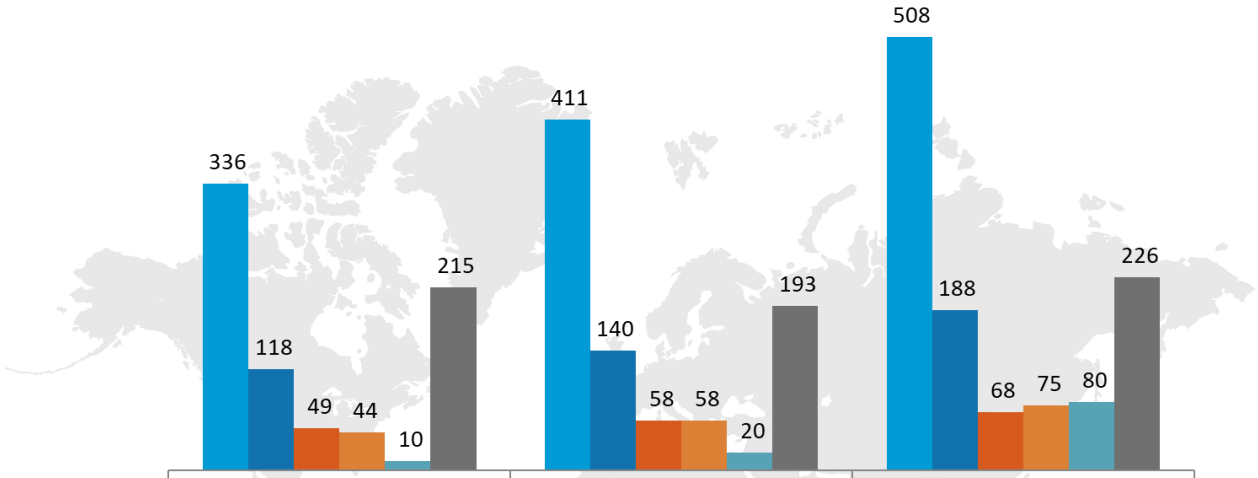
China leads the global EMS business with almost 46.7% share. Its dominance in the global market is attributed to a blend of cost effectiveness and technological leadership in electronics manufacturing. It is a high growth region due to operational cost benefits, availability of a large number of highly skilled personnel, infrastructure, logistical advantages, and proximity to the largest end-user base across all end-user verticals. 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 Modified Electronics Manufacturing Clusters (EMC 2.0), to enhance the infrastructure of electronics manufacturing and offer incentives to manufacture more products that promote EMS in India.

The production linked incentive (PLI) program, 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.

Chart 2.7: 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%

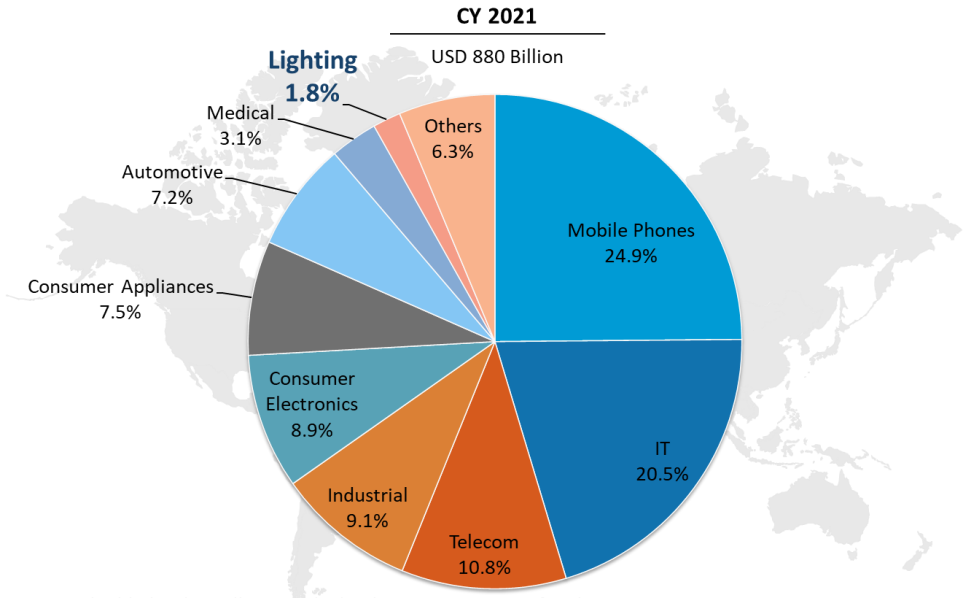
** Others include Rest of Asia, Latin America (LATAM), Middle East & Africa (MEA)*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

C. By end-user segments

Chart 2.8: 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.*

The use of LED lighting has grown from substantially over the last decade, mainly driven by energy efficiency regulations, widespread manufacturing, and reduced prices of LED light sources. Rising demand for smart solutions will fuel future growth. Smart LED lights have rapidly entered the residential market and achieved widespread commercial adoption.

Consumer appliances have had a consistent performance in the last few years, which is aided by economic growth in advanced economies and developing countries. EMS manufacturers have also profited from rising consumer spending and technological improvements. Furthermore, brands and EMS manufacturers are progressively supplying both premium and mid-range appliances in order to meet the growing demand for both product categories

Automotive is one of the key growth opportunity verticals for EMS providers in the next five 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.

Geopolitical situation and their 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 manufactured by over 4,500 EMS companies in the country. These imports from the United States are transferred from China to other countries due to the trade war between these two 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 India, decoupling from China policy is not a new phenomenon. In the last decade, 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 fiscal 2020, 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. As at CY 2020, 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 United States, United Kingdom 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.

Impact of Global chip shortage on EMS industry: The global chip supply shortage intensified in 2021 as a result of the COVID-19 pandemic, as major companies across industries have failed to meet the rising demand for electronic goods and components. The Russia-Ukraine war has certainly added to the impact of the semiconductor industry. Key reasons behind the global chip shortage include supply chain disruptions, geographic concentration of electronic manufacturing, rise in demand for digital and electronic products and digital adoption across the world, and a lack of investment in chip production capacity. 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. The strong order book of semiconductor companies shows strong demand for semiconductor chip. 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. The automobile industry is one of the most-affected sectors, along with electronics.

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. Several large brands have announced capacity diversification in India with an aim to expand their manufacturing base. This will certainly help widen their reach and operations across the globe, de-risk their growth potential and also to help maintain a certain level of control over production quality.

Impact of the Geopolitical situation on IKIO:

Shortage of chips has certainly put pressure on leading chipmakers. This gives a great potential for India to develop its own chip research and development system. The Indian Government has allocated funds for incentive schemes such as Modified Special Incentive Package Scheme (M-SIPS) as well as an Electronic Development Fund (EDF) to spur semiconductor manufacturing in the country. The biggest beneficiaries of this initiative will be companies like Ikio Lighting Private Limited that use semiconductors devices in reasonably large quantities. Making these chips locally can help reduce significant dependence on imports from China, Taiwan, Japan, USA, and other countries during situations like disruptions in supply due to natural disasters, trade disputes, pandemic etc.

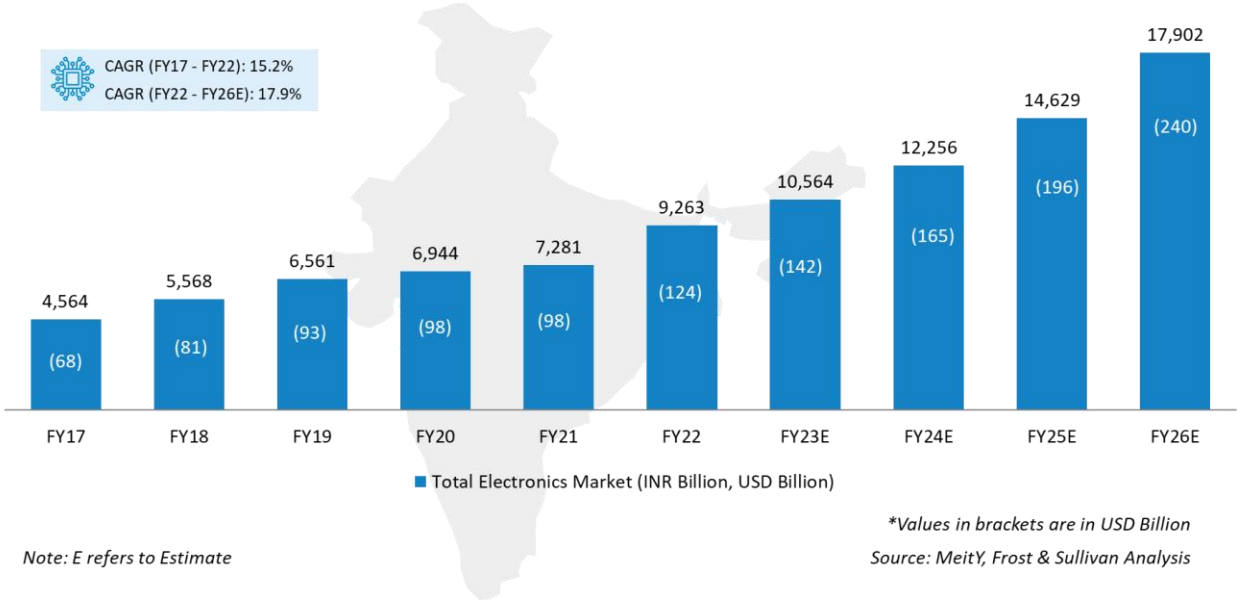
Indian companies that use semiconductors devices in reasonably large quantities are also expected to be benefited from the establishment of a semiconductor chip design and manufacturing ecosystem in India. These companies, such as Ikio Lighting Private Limited, will find proximity very useful for better planning of inventory turns. A local semiconductor fabrication plant will also help companies like Ikio Lightly Private Limited obtain semi-conductor chips at a much lower cost. Adding to the low cost of chips is also India's low-cost labour which gives it unrivalled edge in the global supply chain. The industrial competition between India and China comes down to the labour force. Though China has nurtured skilled workforce over the past decades, India is building its skilled workforce and continues to enjoy labour cost advantage over China which is still a significant part of assessing business success. In addition, as India is one of the fastest growing semiconductor markets in the world in terms of domestic consumption, there is an ever-growing consumer base in India, as disposable incomes are on the rise which presents an opportunity for these semiconductor companies to develop products for the electrical and electronics space such LED lighting, medical applications, mobile phones etc. for the domestic market, giving it the potential to build superior quality product that it can export out to other emerging markets as well.

CHAPTER 3 – 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 Fiscal 2022 and is expected to grow at a CAGR of 17.9% to reach INR 17,902 billion (USD 240 billion) in Fiscal 2026. Domestic production accounted for approximately 69% of the total Indian electronics market in Fiscal 2022, valued at INR 6,376 billion (USD 86 billion), and is expected to grow at a CAGR of 24.2% to reach INR 15,159 billion (USD 203 billion) in Fiscal 2026, 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 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 fuelling the rapid expansion of this industry.

Chart 3.1: Total Electronics market, value in INR billion, USD billion, India, FY17-FY26E



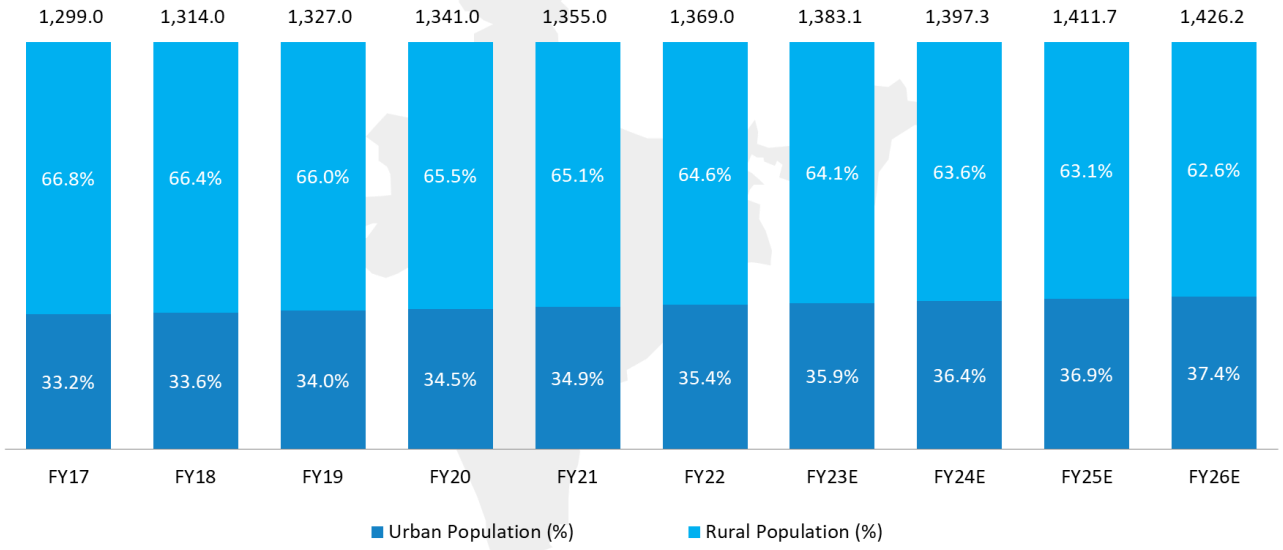
India's demand for electronic items has expanded significantly in recent years, owing mostly to the country's progress in the EMS sector. Low manufacturing costs, together with a skilled workforce and a vast geographical area, are some of the driving elements behind the development of India's electronics ecosystem. Also, the EMS companies are slowly shifting their focus on product mix from high volume low margin products to high margin low volume products.

Other Key Parameters

Population and urbanization in India

As at Fiscal 2021, 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 a CAGR of 1.0% between Fiscal 2022 and Fiscal 2026. 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 Fiscal 2026. 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, primarily driven by a better standard of living and job opportunities in the cities. India's seven largest metropolitan areas – Mumbai, Delhi, Bengaluru, Kolkata, Chennai, Hyderabad, and Ahmedabad—dominate the country's economic landscape.

Chart 3.2: Urban Vs rural population in India, in %, total population in million, 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*

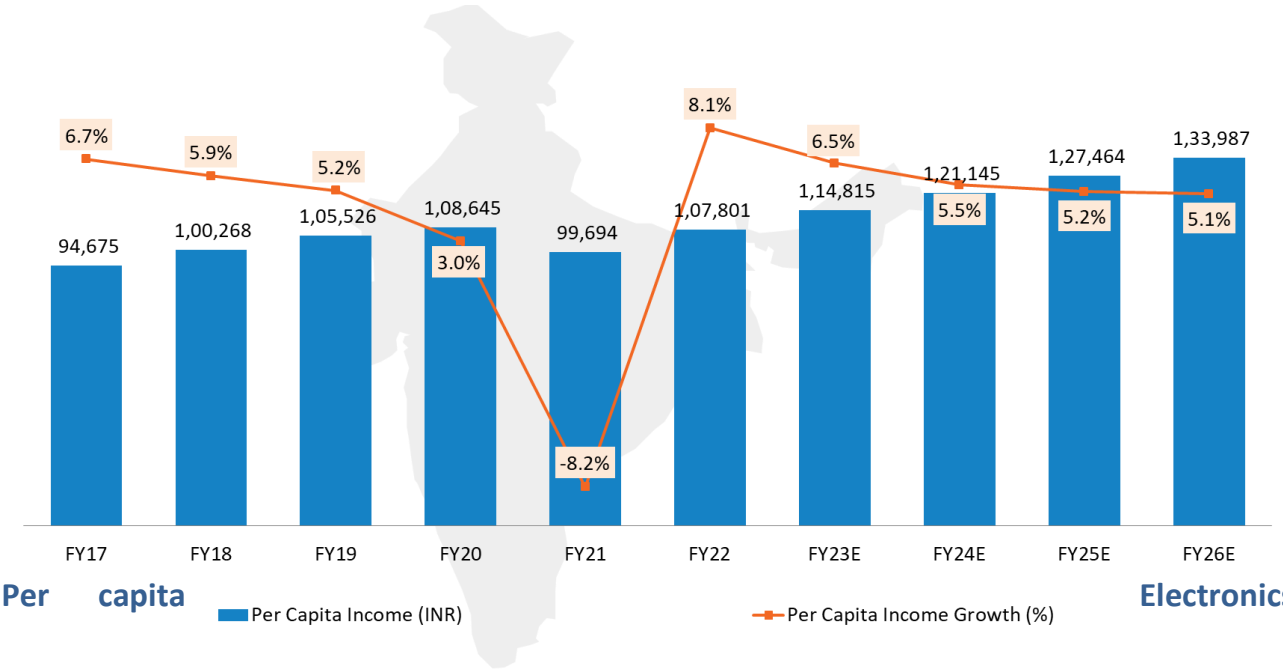
Employment opportunities and the opportunity for income generation across newly urbanised towns create a positive outlook for the consumption of electronic products. Urbanization is expected to be a major driver of the overall electronics market's growth, particularly for mobile phones, which are imperative 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. In addition, rural markets will likely see increased demand for consumer electronics as the government aims to invest heavily in rural electrification.

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 Fiscal 2021, as compared to INR 108,645 in Fiscal 2020, representing an approximate decline of 8.2%. As the economy is reviving, the per capita income increased by

8.1% during Fiscal 2022 to reach INR 107,801. Post that, the growth is likely to be stable at approximately 5.6% CAGR over the medium term.

Chart 3.3: Per capita income and growth (annual percentage change), value in INR, growth in %, India, FY17-FY26E



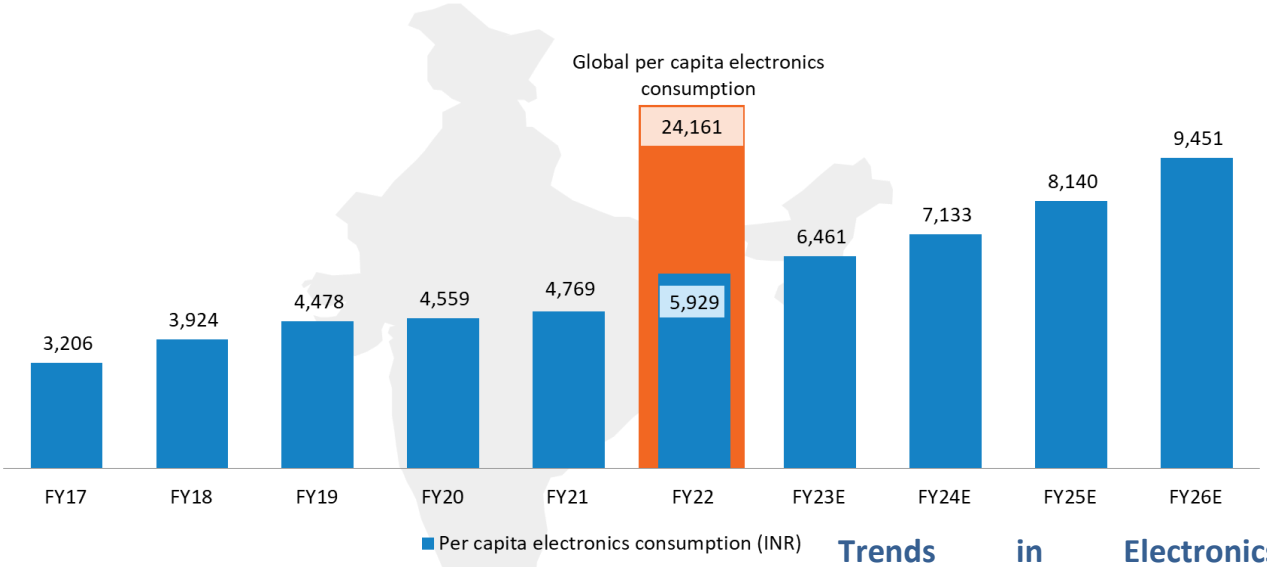
Note: E refers to Estimate *Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), IMF; Frost & Sullivan Analysis*

consumption

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 Fiscal 2017 and Fiscal 2022. Long term growth outlook for the industry is extremely positive, primarily because market penetration for many electronics products is still very low compared to global average. In addition, the growth of India's per capita electronic usage is expected to be driven by stable growth outlook for the economy, Digital India programme, rising disposable incomes (proportion of mid & high-income earners expected to increase from 64% in Fiscal 2021 to 85% in Fiscal 2030), 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. 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. At a global level, the per capita electronics consumption is increasing.

[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 3.4: Per capita Electronics consumption, value in INR, India, FY17-FY26E



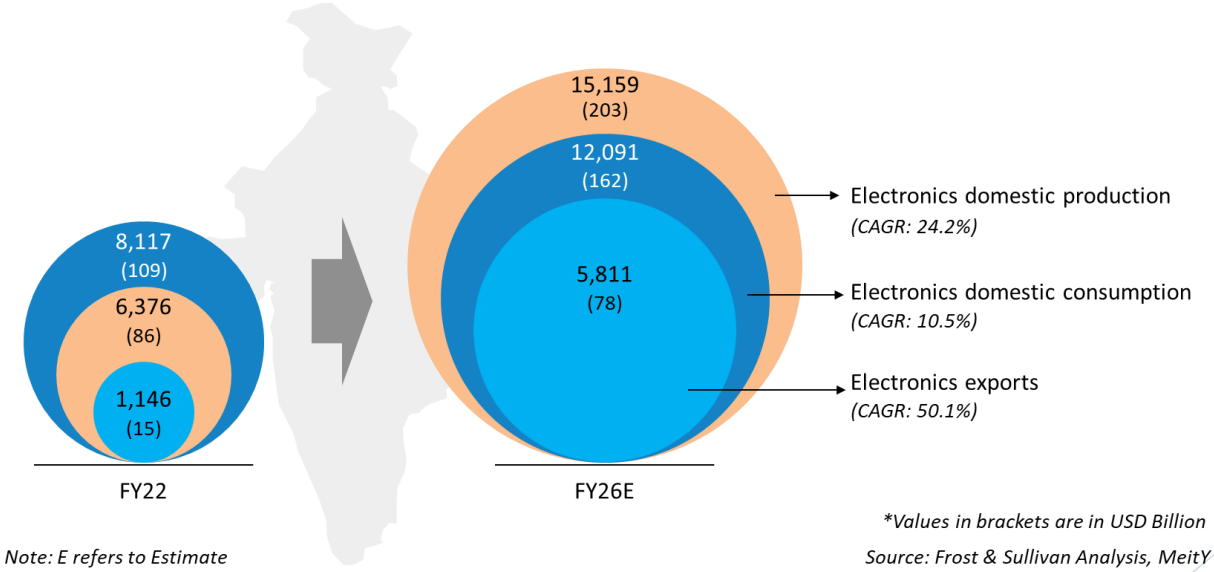
**Per capital electronics consumption = Total electronics consumption / Total population*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Trends in Electronics consumption vs. share of domestic production

Chart 3.5: Indian electronics market – Domestic production vs. consumption vs. exports, value in INR billion, USD billion, India, FY22 and FY26E



**Values in brackets are in USD Billion*

Note: E refers to Estimate

Source: Frost & Sullivan Analysis, MeitY

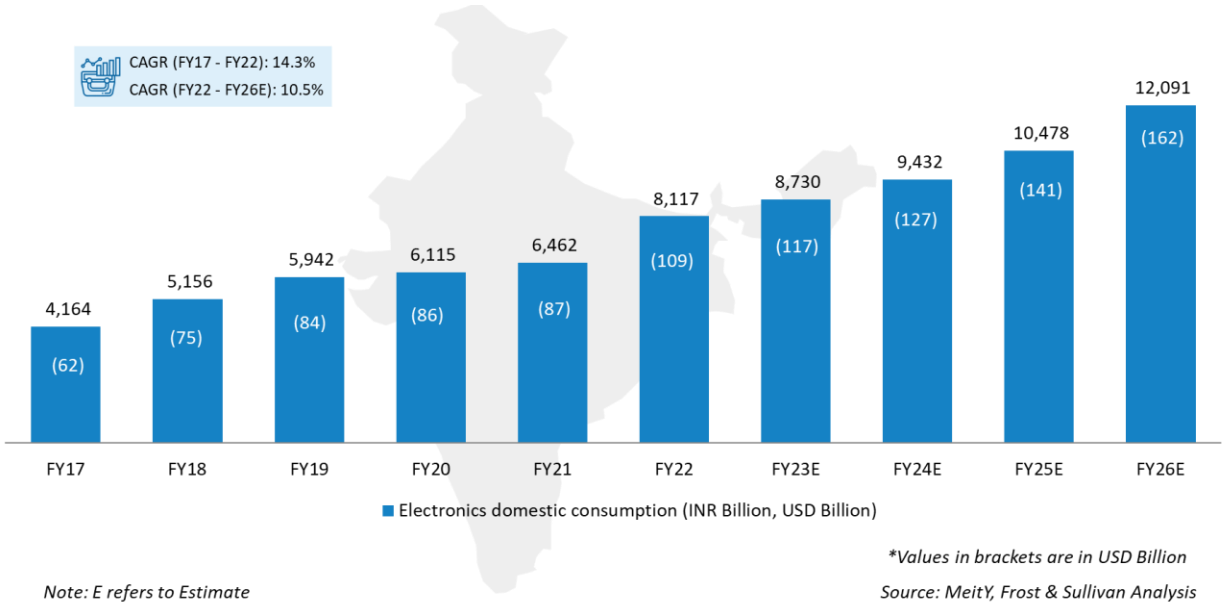
The Indian government has taken steps to enhancing manufacturing capability within India, such as imposing customs duty for certain products or removal of duties on components. The government has also taken several steps towards increasing the ease of doing business, which has resulted in increased manufacturing setups by multiple foreign manufacturers in the country. This environment has certainly encouraged the EMS/ ODM market as electronics brands/ OEMs continue to push for collaboration and partnership.

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

A. Consumption of Electronics products in India

The electronics consumption market in India is estimated at INR 8,117 billion (USD 109 billion) in Fiscal 2022 and is expected to grow at CAGR of 10.5% to reach INR 12,091 billion (USD 162 billion) by Fiscal 2026. 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.

Chart 3.6: Electronics domestic consumption market, value in INR billion, USD billion, India, FY17-FY26E



Note: E refers to Estimate

Source: MeitY, Frost & Sullivan Analysis

The major product segments of the Indian electronics consumption market include the following: -

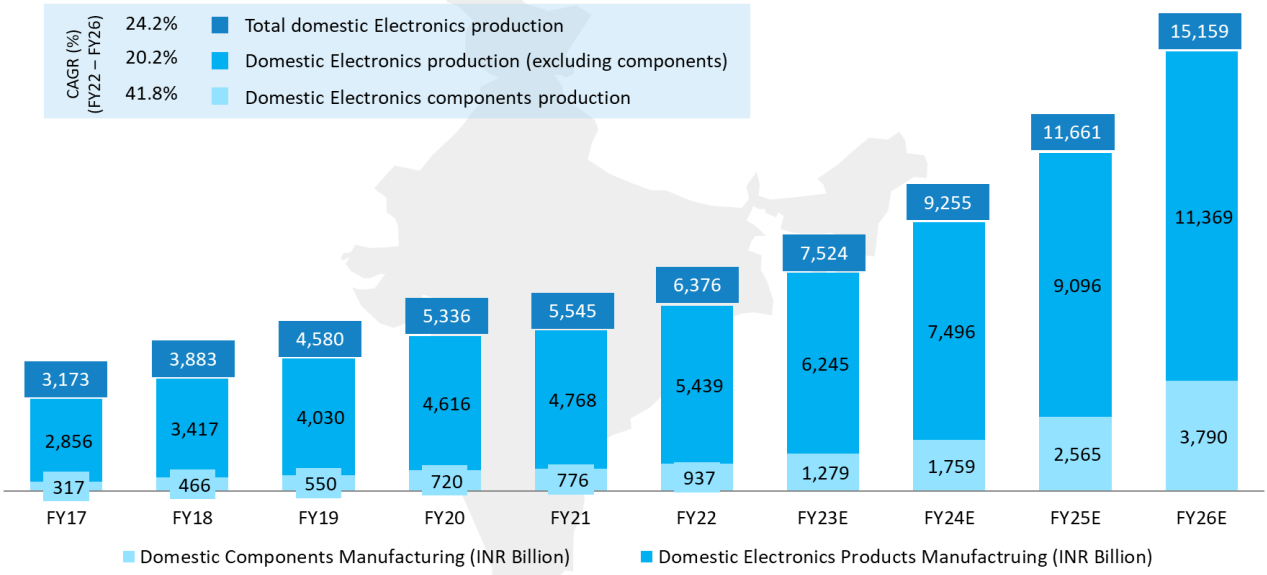
- **LED Lights:** Supported by the recent Government initiatives and changing consumer preference, LED lighting industry has grown significantly over the last decade, primarily driven by energy efficiency regulations, widespread manufacturing, and reduced prices of LED light sources. India is expected to become more cost competitive compared to China on account of its lower labour costs, greater levels of localization, automated processes in manufacturing, and a weakening Indian Rupee.
- **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 of this consumer electronics segment.
- **Mobile phones**: In this segment, with introduction of new smartphone models along with better availability, declining prices and increased customer spending 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.

- **Telecom and Networking Products**: The growth of the telecom and networking products segment is driven by the need for deep penetration of broadband networks and availability of mobile telephony. The Indian government's push for the availability of broadband in remote areas of the country is a key demand driver for the telecom segment. In addition, the increasing focus on the 5G sector is driving this segment.
- **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.

B. Indian Electronics domestic production

Chart 3.7: Total domestic Electronics production market (including and excluding components), value in INR billion, India, FY17-FY26E



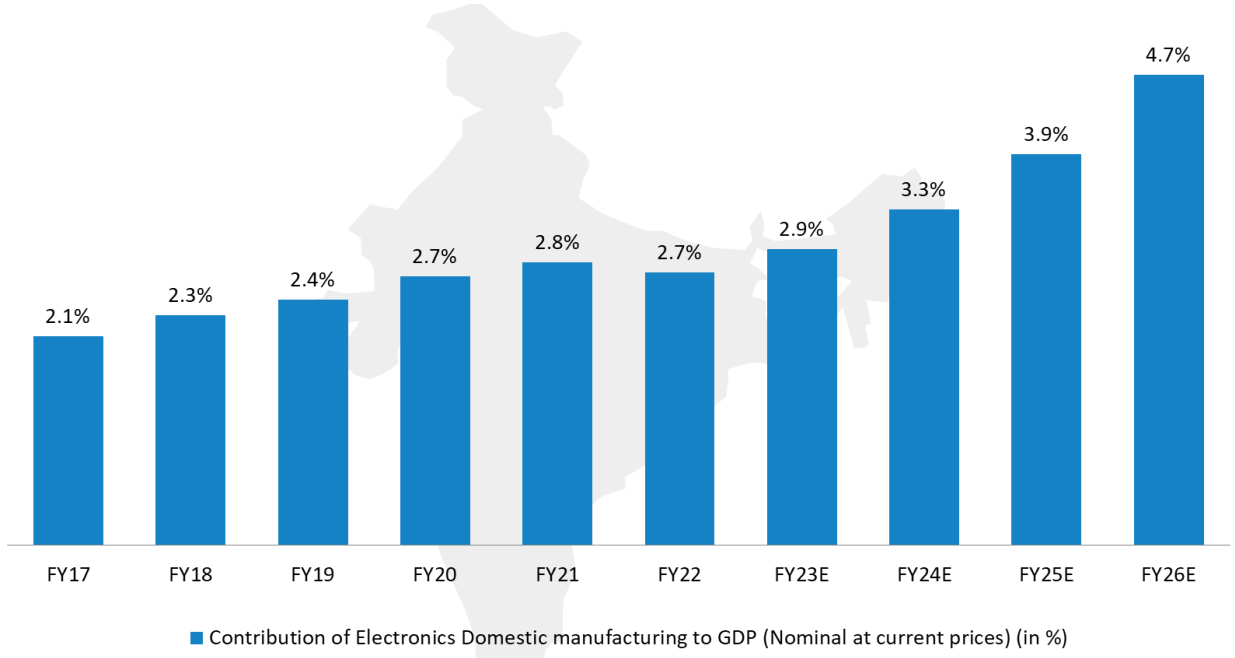
Note: E refers to Estimate

Source: MeitY, Frost & Sullivan Analysis

Electronics production in India is estimated at INR 6,376 billion (USD 86 billion) in Fiscal 2022 and is expected to grow at a CAGR of 24.2% to reach INR 15,159 billion (USD 203 billion) by Fiscal 2026. India has the potential to be one of the most attractive manufacturing destinations and support the objective of "Make in India for the World". 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 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. The growth of the consumer electronics and appliances, the automotive sector, lighting, electronic components, and the medical electronics sector is expected to drive the growth of electronics manufacturing in India.

Chart 3.8: Contribution of Electronics domestic production (including 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

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.

In Fiscal 2022, 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 Fiscal 2026. The Indian government's objective is to provide domestic manufacturers with a better operating environment to make them competitive with imports into the industry by simplifying the tariff system, simplifying the procedures involved in importing raw materials/components into the country, giving incentives, and improving operating infrastructure. Given that there is considerable high value-added manufacturing takes place in the consumer electronics and appliances

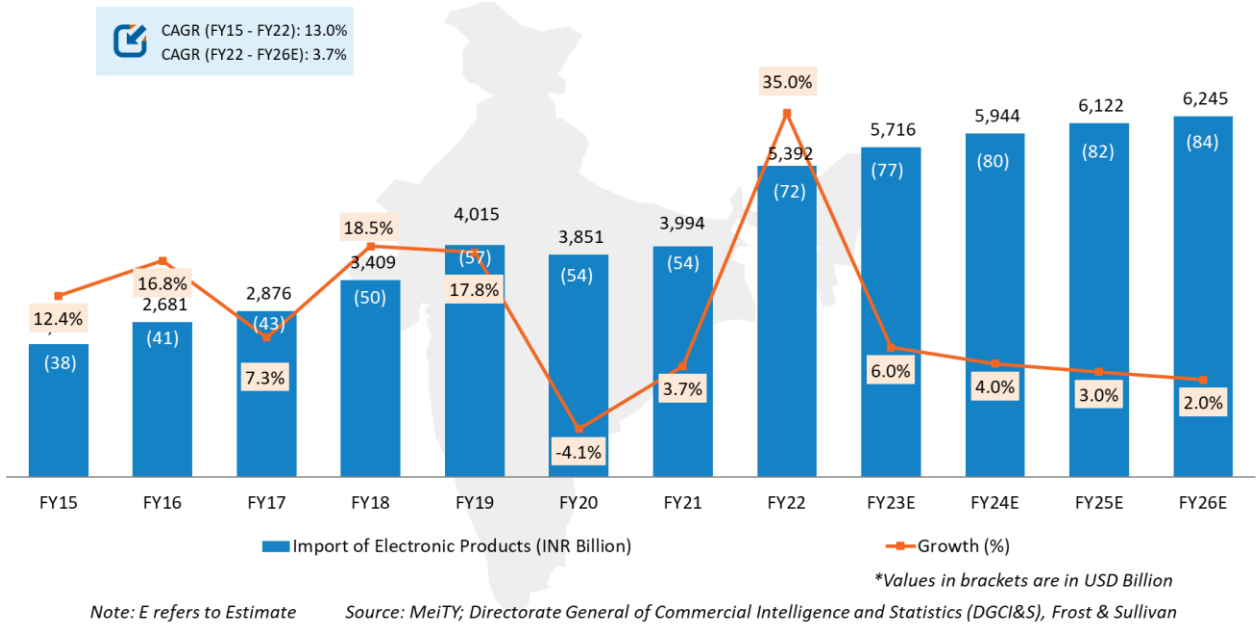
segment and most products command high brand quality, there is an excellent opportunity for Indian EMS companies to export.

D. Import of Electronic products in India

The total import value of electronics products in India was INR 2,296 billion (USD 38 billion) in Fiscal 2015 and INR 3,851 billion (USD 54 billion) in Fiscal 2020. The import value decreased by 4.1%, as compared to INR 4,015 billion (USD 57 billion) in Fiscal 2019, and eventually leapfrogged to INR 5,392 billion (USD72 billion) in Fiscal 2022. Shortage of chips have slowed down domestic manufacturing in the last quarter of Fiscal 2022, which resulted into higher imports of electronics products. China and Hong Kong accounted for approximately 62.5% of India's total electronic imports in Fiscal 2022. Most of the 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 to minimise reliance on imports.

The electronics industry relies extensively on Chinese suppliers, especially in the consumer electronics, industrial electronics, computer and IT hardware, strategic electronics, and light emitting diodes segments. Presently, a substantial share of finished LED lighting products is imported from China in the organised market, and this could be much higher in case of the unorganized market. The prices of Made in India products are going up as components imported from China are getting expensive. While the production linked incentive (PLI) scheme is likely to benefit the existing manufacturers to expand their production base, there is no financial incentive to reduce import from China.

Chart 3.9: 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*

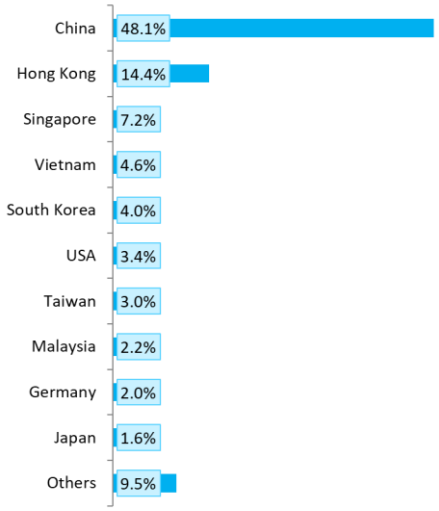
In the laptops and notebooks segment, almost all the components used are completely imported or as semi-knocked down units from China and Thailand. Mobile phones contribute to around 2.1% of the total import value. In GPON (Telecom and Networking Products) and CCTV segments, the components are imported from China and Taiwan. Despite the government's efforts to build India's electronics ecosystem, domestic manufacturers' reliance on China for components persists. This reliance is expected to decrease slowly as the localization of production for these products increased with the opening of new manufacturing facilities.

Indian electronics import is expected to grow at a CAGR of 3.7% between Fiscal 2022 and Fiscal 2026, while Indian domestic electronics manufacturing is expected to grow a CAGR of 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 3.10: List of top 10 imported Electronic products by value, India, FY22

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

Chart 3.11: Import of Electronic products by key countries, value in %, FY22



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

E. Export of Electronic products from India

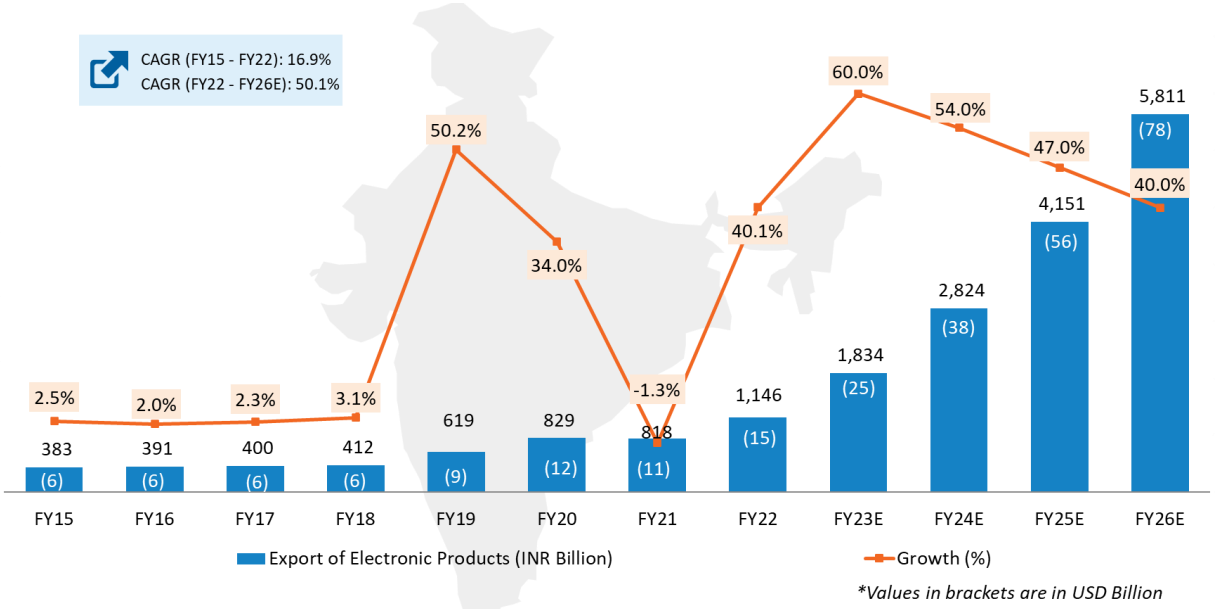
The total export value of electronic products from India in Fiscal 2015 was INR 383 billion (USD 6 billion) and INR 1146 billion (USD 15 billion) in Fiscal 2022. The value of exports increased by 40.1% in Fiscal 2022 as compared to Fiscal 2021. The export market is expected to grow substantially in next five years at a CAGR of 50.1%, owing to various government initiatives such as PLI scheme, Atmanirbhar Bharat which facilitates the domestic manufacturing. India's exported its LED lights to approximately 70 countries in 2014. This number grew to more than 100 countries in 2022. Among countries importing LED lights from India, the fastest growing markets were Nepal, the United States, and United Arab Emirates.

The top three leading products in the electronic products 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.

An increase in design and manufacturing capabilities has led to export opportunities for some product segments. 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 these manufacturers have in-house manufacturing facilities, as well as R&D and testing facilities. However, many components such as LCDs, relays, communication modules, PCBs,

passive components, and microcontrollers are imported. Components such as mechanical components, terminals, brass terminals, and screws are typically locally sourced.

Chart 3.12: Export of Electronic products, INR billion, USD billion, India, FY15-FY26E

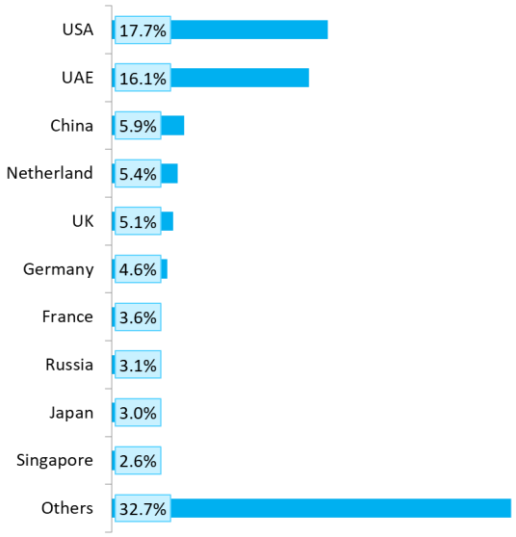


Note: E refers to Estimate *Source: MeiTY; Directorate General of Commercial Intelligence and Statistics (DGCI&S), Frost & Sullivan*

Chart 3.13: List of top 10 exported Electronic products by value, India, FY22

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

Chart 3.14: Export of Electronic products by key countries, value in %, FY22



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

Growth drivers for Electronics Industry in India

Investments by local and global players in India: The higher growth rate of the electronics industry in India vis-à-vis the global market is due to multiple factors, including consistent local demand for electronic products, the Indian government's focus on domestic manufacturing, implementation of programs like 'Make

in India' and 'Digital India'. All of these factors 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, MSIPS, have been instrumental in encouraging new investment from EMS companies.

China + 1 Strategy: There is a new urgency now to examine practical alternatives to manufacturing in China given the tariff conflicts and the aftereffects of COVID-19 pandemic along with rising manufacturing cost structures and changing geo-political landscape. However, transferring production decisions is not very straightforward as concentrated production of all major components in China improves the product cost, efficiency and time-to-market. Due to the above factors, OEMs are considering an alternative country for additional production rather than completely replacing China. OEMs are considering developing economies as potential manufacturing locations out of which India has a particular edge as a developing country that provides infrastructure as well as a platform for cost-cutting.

Localization of supply chain: High domestic volumes and consumption and higher outsourcing volumes will influence domestic electronics manufacturers to bring in the component ecosystem locally and enhance local capabilities of component sourcing, thus making the ecosystem stronger and closer. Tier-2 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. drive OEMs to leverage on services offered by EMS companies.

Emerging technologies: Rapid technology advancement and newer products having upgraded technology have led to shorter life cycles for electronic products. Also, continuously changing customer attitudes and various consumer-to-consumer websites has made it relatively easier for customers to replace their current electronic devices with newer products.

Augmented demand for high-speed data has also 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, 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.

System automation: Indian design companies work on end-to-end product development. Advanced product development focusing on miniaturisation, IoT, automation, Artificial Intelligence, 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 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. However, the fast rise of Artificial Intelligence and Machine Learning, deployment of 5G communication, edge and cloud computing have all created the need for invention in hardware, resulting in increased demand for electronic design automation software tools.

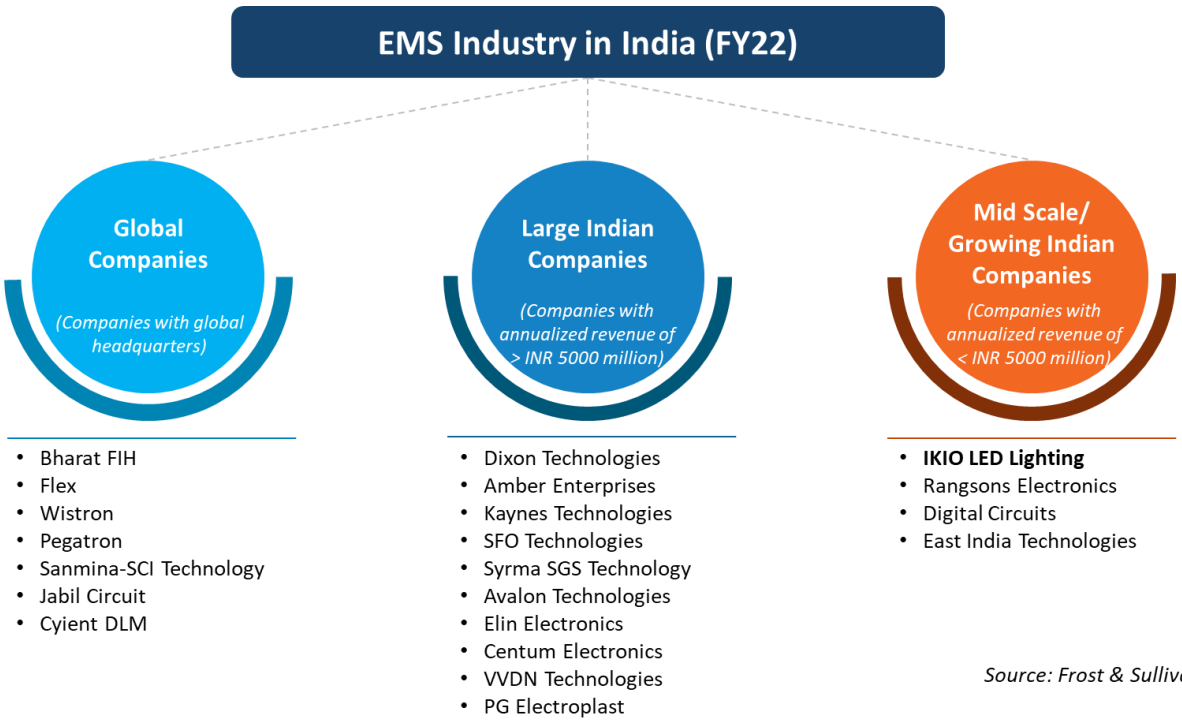
CHAPTER 4 – INDIAN ELECTRONICS MANUFACTURING SERVICES (EMS) INDUSTRY OVERVIEW

Overview of EMS industry in India

The Indian EMS industry is relatively young, with nearly three decades of experience. The Indian 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 and medium scale investments in Indian EMS sector. Despite the fact that Nokia wound up its India operation in Fiscal 2014, global EMS giants have started showing interest in India by 2015. 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 4.1: 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 include Bharat FIH, Flex, Wistron, Pegatron, Jabil; large Indian companies include Dixon, Amber, SFO, Syrma, Elin, Centum among other. In the Indian context, Ikio Lighting Private Limited is one of the fastest growing providers of ODM services for global & domestic companies in the category of less than INR 5000 million annualized revenue. 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 and 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 established itself as the design hub of the world for electronic design. 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) announced that it will invest INR 57,000 million (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 20,000 million (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 6,000 million (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 16,700 million, 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.

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

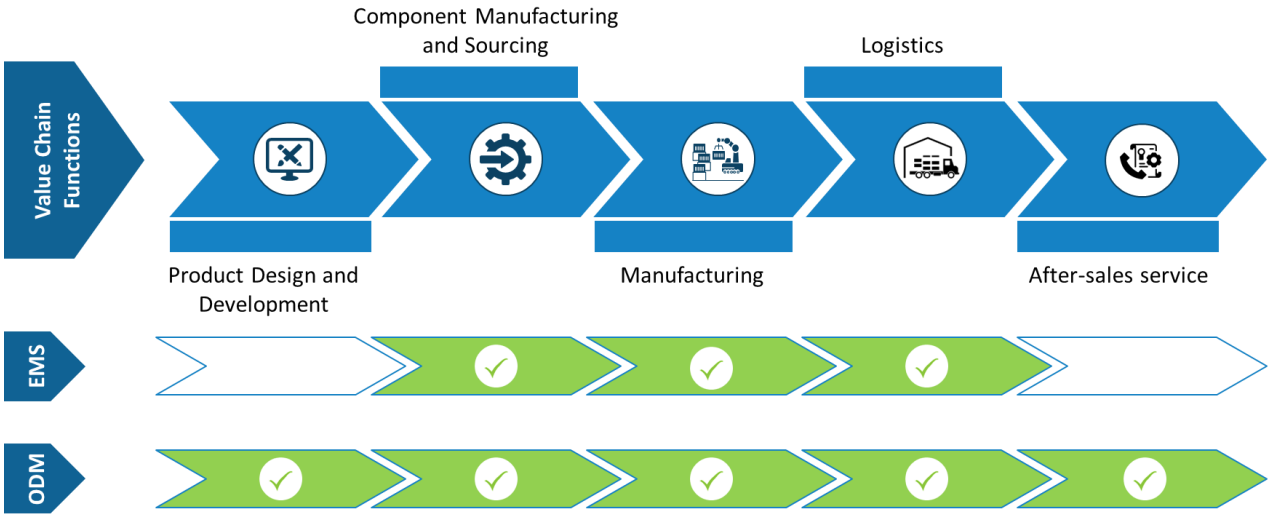
ODM (Original Design Manufacturers) model

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

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

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.

Chart 4.2: Business models of Indian EMS companies, FY22



Source: Frost & Sullivan

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

The term Job-work typically refers to the processing of goods supplied by the principal. In the concept of job work, a principal manufacturer can send inputs or semi-finished goods to a job worker for further processing, which may or may not culminate into manufacture. 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 prefer to have one point solution with their EMS companies, so 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 United States 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.

The country also has high maturity levels in packaging, distribution, repair, sales, and marketing functions to meet geographical standards and cater to local requirements 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.

Contribution of ODMs in Indian 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.

ODM business model of Ikio

- Scope of engagement – To develop new technology provider for home automation lights.
- Service offered – To design new generation high efficiency lights and new generation lights with Wi-Fi and Bluetooth.
- No. of SKUs developed – Approximately 450 new SKUs.

Benefits of ODM model in EMS business

Chart 4.3: Advantages and Disadvantages of EMS and ODM

Original Design Manufacturing (ODM)	Electronic Manufacturing Service (EMS)
✓ ODM develops designs and products that are capital and technical intensive	✓ 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 capabilities and moulds 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

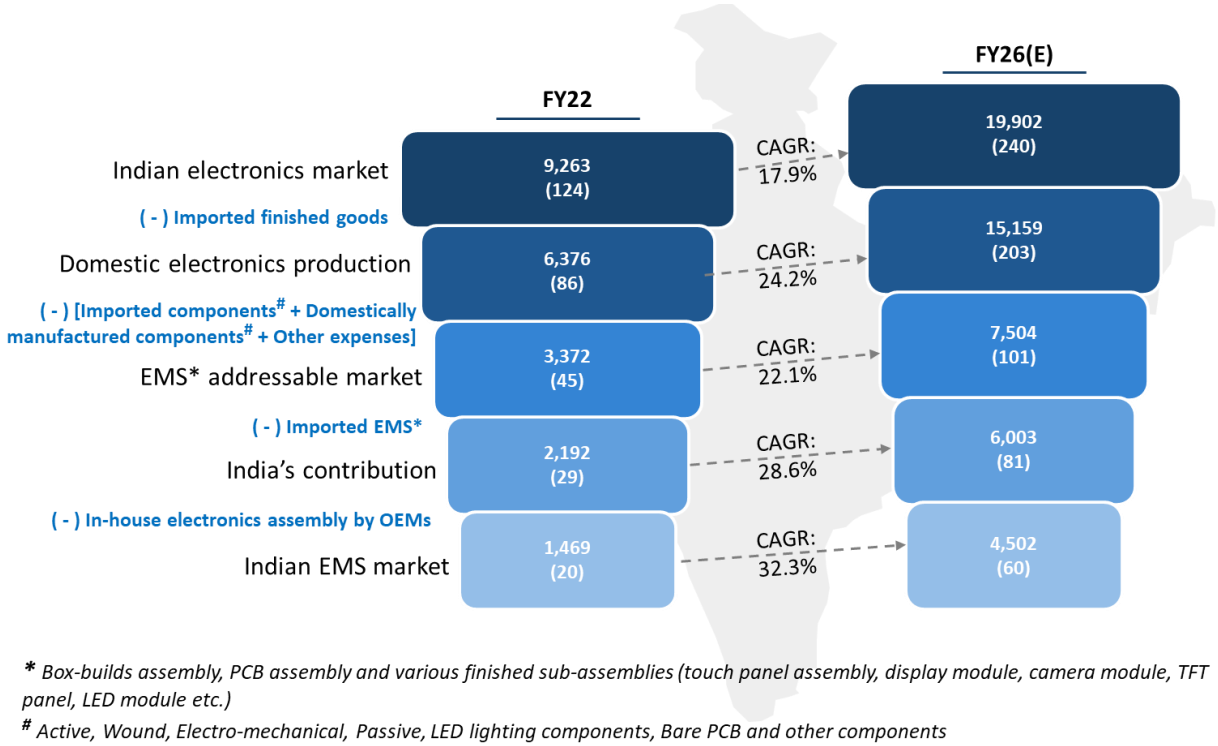
Constantly increasing logistics and raw material costs are resulting in a rise in total manufacturing costs, which is affecting the OEMs. This serves as a catalyst for the OEMs to choose the ODM model, which provides an end-to-end solution, including product design and after-sales support, owing to better 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.

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.

Chart 4.4: 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*

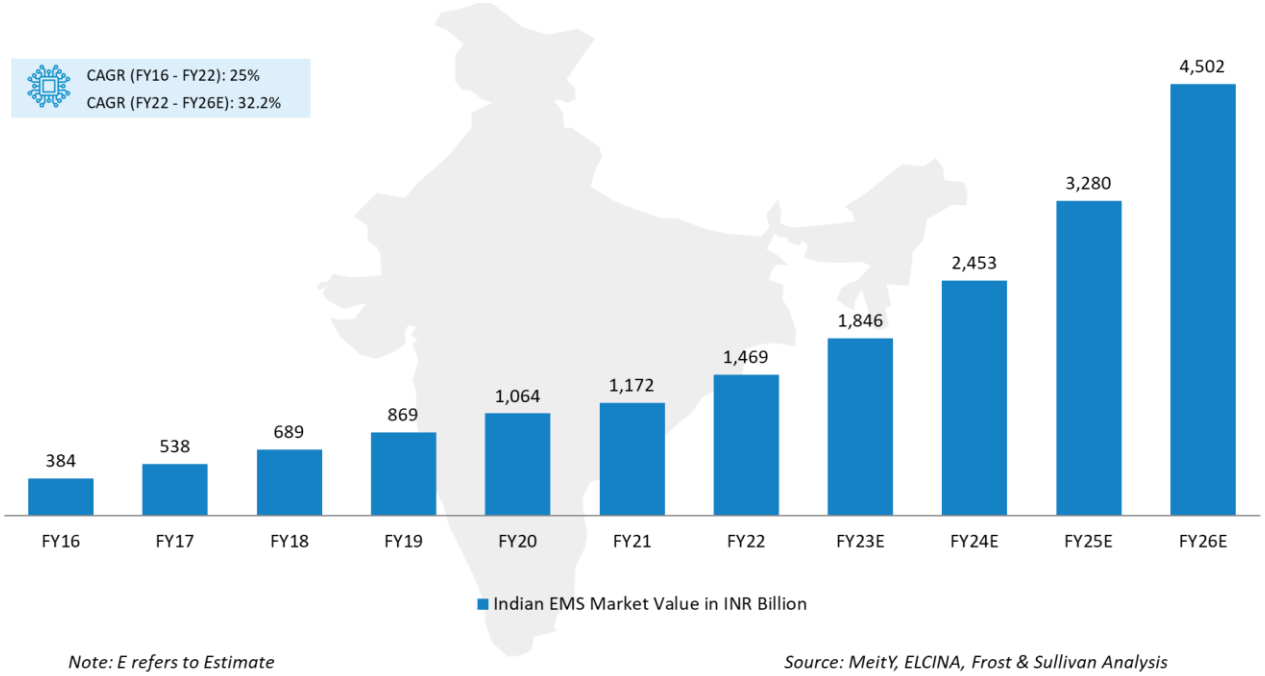
In Fiscal 2022, electronics production in India is estimated to be USD 86 billion which comprises of domestically manufactured electronics components worth of USD 12 billion and imported components worth of USD 18 billion. The remaining market, after subtracting the cost of the components and other expenses (logistics, packaging, administrative expenses, etc.), represents the addressable business opportunities for EMS companies in India. This addressable EMS market in India was valued at INR 3,372 billion (USD 45 billion) in Fiscal 2022 and is expected to grow at a CAGR of 22.1% to reach INR 7,504 billion (USD 101 billion) in Fiscal 2026.

The Indian EMS market and is comprised of three components:

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

Contribution of Indian EMS companies represents approximately 43.5% of the addressable EMS market in India in Fiscal 2022 and is expected to grow at a CAGR of 32.3% to reach INR 4,502 billion (USD 60 billion) by Fiscal 2026.

Chart 4.5: Indian EMS market, value in INR billion, growth in %, FY16-FY26E



Note: E refers to Estimate

Source: MeitY, ELCINA, Frost & Sullivan Analysis

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.

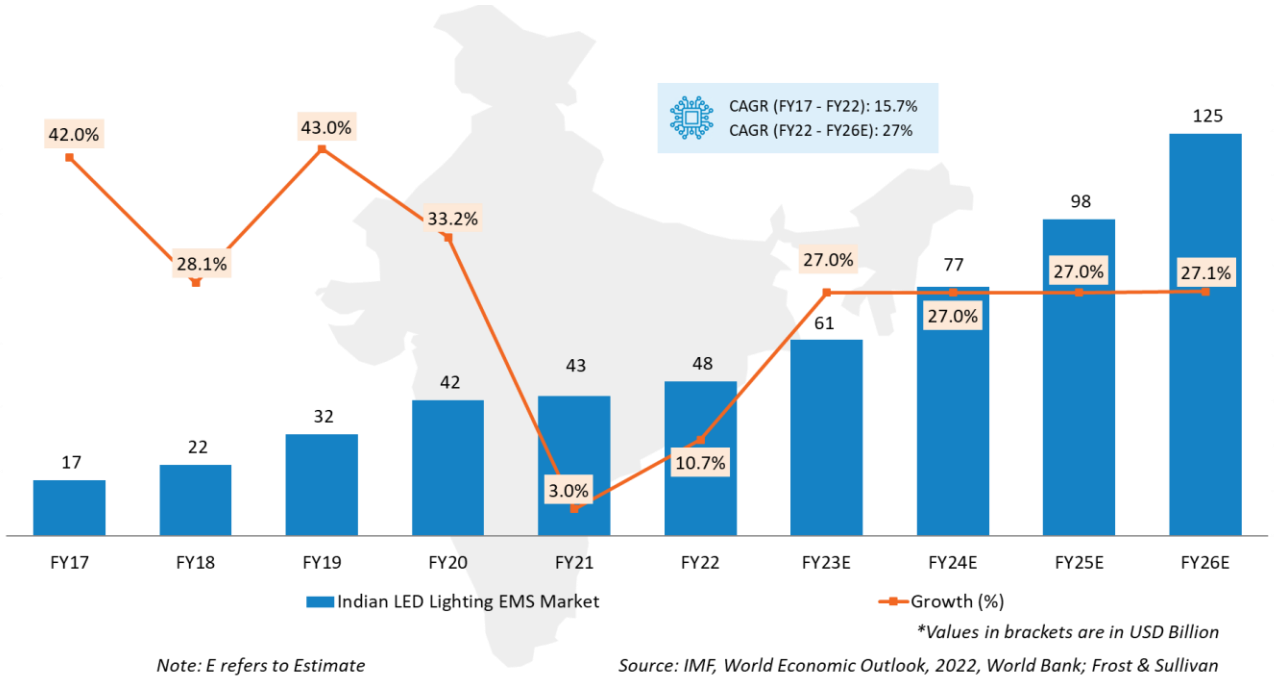
Electronics have become more prevalent in the Indian EMS industry, and domestic demand for mobile phones, consumer electronics and appliances, medical products and automotive electronics offers a huge growth potential. Because of the 5G rollout, there is an increase in demand for telecom infrastructure 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. 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. . 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.

Indian LED EMS Market Size

In India, the LED business is booming, and the government has designated LED as one of its strategic priorities. Smart lighting solutions would contribute to building management systems via wireless networking, as the Internet of Things (IoT) gains traction. The Indian government continues to drive for LED lighting and measures to replace conventional CFL and GLS lights. Up to 2022 the Indian government has installed over 12 million LED lights as part of the Street Lighting National Programme.

Chart 4.6: Total Indian LED Lighting EMS Market by value (INR Billion) and in Growth in %, FY17 and FY26E



**Values in brackets are in USD Billion*

Note: E refers to Estimate

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

Growth drivers for India EMS business

- China+1 strategy
- Development of electronics ecosystem by global and domestic players
- Government incentives and schemes
- Import substitution

- **Supply chain realignment**
- **Component manufacturing / lead time**
- **Local value addition**

China + 1 Strategy: The increase in the Chinese electronics contract manufacturing cost structure, coupled with changing geo-political landscape, has resulted in increased interest from OEM customers to shift electronics production to other countries. Such increase in electronics production in India will drive the Indian EMS industry.

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 Fiscal 2017 to INR 6.4 trillion in Fiscal 2022 depending on such favourable incentive schemes.

Development of Electronics Ecosystem by Global and Domestic Players: 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.

Import substitution: India's import of electronics products systematically declined between Fiscal 2015 and Fiscal 2020. Import was however increased sharply in Fiscal 2022 owing to slowdown in domestic production due to shortage of semiconductors globally. Long run mission of the Indian government is to reduce dependency on imported electronics products and services through Atma Nirbhar 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: 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 four weeks to one 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.

Enhancing 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, pharma, and steel, etc.

Production Linked Incentive (PLI) Scheme: The scheme was initially announced in the year 2019 by the Government of India considering the incremental investment and sales of manufactured goods 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.

Chart 4.7: 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

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 scheme. It has different thresholds of investments required for domestic and international companies. Fully

integrated manufacturers are going to be the biggest beneficiary of this scheme. This scheme will help India Inc. to be an integral part of the global supply chain.

PLI Scheme for White Goods business including LEDs

Chart 4.8: Target segments and eligible products under PLI scheme

Target Segments Eligible under PLI Scheme

- LED Core Components
  - LED Chip Packaging
  - Integrated Circuits (ICs)
  - Resistors
  - Fuses
  - Large Scale Investment in LED Components
- LED Components
  - LED Chips
  - LED Drivers
  - LED Engines
  - LED Modules
  - Printed Circuit Boards (PCB)
  - Mechanical Housing
  - Wire Wound Inductors
  - Drum Cores
  - Heat Sinks
  - Diffusers
  - Ferrite Cores
  - LED Light Management systems (LMS)

The PLI Scheme for White Goods (PLIWG) that was first notified in April 2021, to provide financial incentives to boost domestic manufacturing and attract large investments in the white goods manufacturing value chain. Its prime objectives include removing sectoral disabilities, creating economies of scale, enhancing exports, creating a robust component ecosystem and employment generation.

The scheme extends an incentive of 4-6 per cent on net incremental sales (net of taxes) over the base year (FY 2019-20) of goods manufactured in India or net incremental sales of eligible products over the base year or FY 2020-21, whichever is higher, as the case may be and covered under target segments, to eligible companies, for a period of five years subsequent to the base year and gestation period.

Chart 4.9: Eligible threshold investment and Net incremental sales for LED lights for applicants opting for initial investment period as 1st April 2021 to 31st March 2022

Segment	Proposed Incentive Rate (%)	Incremental Investment Over Base Year (INR Million)	Incremental Sales of Manufactured Goods Over Base Year	Incremental Investment Over Base Year (INR Million)	Incremental Sales of Manufactured Goods Over Base Year
		Large Investment		Normal Investment	
LED Lights (Core Components)	2021 - 22: - 2022 - 23: 6% 2023 - 24: 6% 2024 - 25: 5% 2025 - 26: 5% 2026 - 27: 4% 2027 - 28: -	1,000 1,500 2,000 2,500 3,000 - -	- 6,000 9,000 12,000 15,000 18,000 -	200 400 600 800 1,000 - -	- 1,200 2,400 3,600 4,800 6,000 -
	Total	**3,000**	**60,000**	**1,000**	**18,000**
Components of LED Lights	2021 - 22: - 2022 - 23: 6% 2023 - 24: 6% 2024 - 25: 5% 2025 - 26: 5% 2026 - 27: 4% 2027 - 28: -	50 100 150 200 250 - -	- 300 600 900 1,200 1,500 -	20 40 60 80 100 - -	- 120 240 360 480 600
	Total	**250**	**4,500**	**100**	**1800**

Source: Ministry of Commerce and Industry Department for Promotion of Industry and Internal Trade

Chart 4.10: Eligible threshold investment and Net incremental sales for LED lights for applicants opting for initial investment period as 1st April 2021 to 31st March 2023

Segment	Proposed Incentive Rate (%)	Incremental Investment Over Base Year (INR Million)	Incremental Sales of Manufactured Goods Over Base Year	Incremental Investment Over Base Year (INR Million)	Incremental Sales of Manufactured Goods Over Base Year
		Large Investment		Normal Investment	
LED Lights (Core Components)	2021 - 22: - 2022 - 23: 6% 2023 - 24: 6% 2024 - 25: 5% 2025 - 26: 5% 2026 - 27: 4% 2027 - 28: -	1,000 1,500 2,000 2,500 3,000 - -	- 6,000 9,000 12,000 15,000 18,000 -	200 400 600 800 1,000 - -	- 1,200 2,400 3,600 4,800 6,000 -
	Total	**3,000**	**60,000**	**1,000**	**18,000**
Components of LED Lights	2021 - 22: - 2022 - 23: 6% 2023 - 24: 6% 2024 - 25: 5% 2025 - 26: 5% 2026 - 27: 4% 2027 - 28: -	50 100 150 200 250 - -	- 300 600 900 1,200 1,500 -	20 40 60 80 100 - -	- 120 240 360 480 600
	Total	**250**	**4,500**	**100**	**1,800**

Source: Ministry of Commerce and Industry Department for Promotion of Industry and Internal Trade

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 760,000 million (>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 15,000 million 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.

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 and China

Economic development in India is gaining support as a result of the continuing expansion of private consumption and investments in certain 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

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 is gaining ground as the second-best destinations after China. The IMF estimates that India's GDP is improving, and projects that GDP is expected to grow at a CAGR of 6.5% by 2026. Various government initiatives and tax regimes are expected to stimulate India's domestic manufacturing sector.

Chart 4.11: Economic comparison on favourable manufacturing parameters, India & China 2021

India has the potential to become a global manufacturing powerhouse, competing with China, which now

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

Source: World Bank, IMF, Frost & Sullivan

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. 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

Chart 4.12: Labour market comparison, India & China, 2021

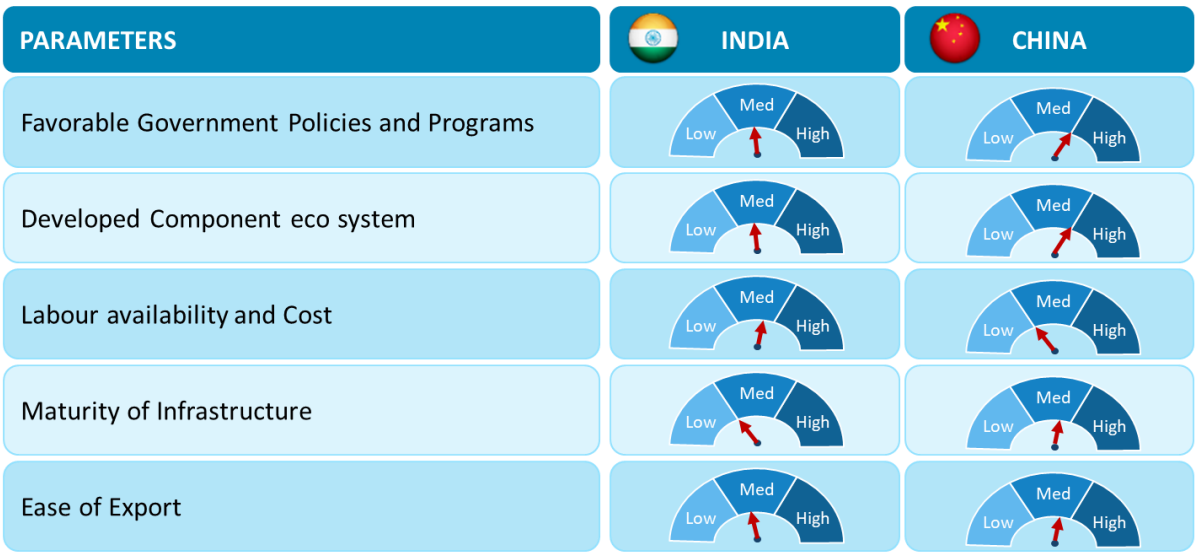
PARAMETERS	INDIA	CHINA
Total Labour Force (Million)	471.3	793.8
Total Labour Force, Female (% of Total population)	20.3	44.5
Labour force participation rate (% of total population)	67.0	70.0
Employment in Industry (% of Total Employment)	26.18	28.18
Wage and salaried workers (% of Total Employment)	23.9	53.5
Average Daily Wages - Manufacturing (USD)	~6	~35.5

Source: World Bank, IMF, Frost & Sullivan

In comparison to other Asian countries, India benefits from lower labour costs and availability of 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).

C. Manufacturing eco-system comparison

Chart 4.13: Manufacturing eco-system comparison, India & China, 2021



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 many 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.

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. 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. 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 5 – DEEP DIVE INTO IKEO'S BUSINESS SEGMENTS

A. HIGH END HOME AND DECORATIVE LIGHTING SEGMENT

Overview of the Indian LED lighting Industry

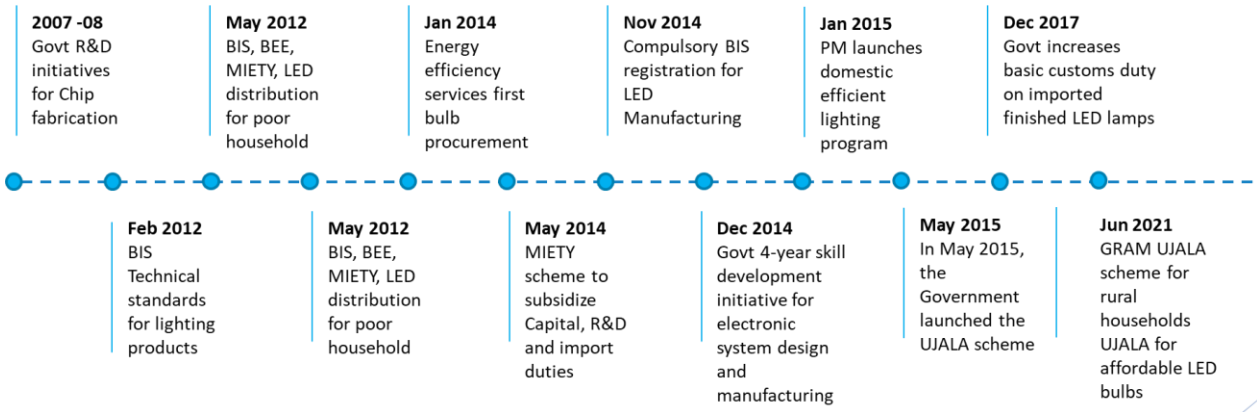
The incandescent bulbs, halogens and CFL lights have dominated the lighting market for centuries now but over the last decade LED lights have become very popular in the Indian lighting industry. These LED lights were first introduced to the Indian market in 1993. Since the LED light bulbs have been invented, there has been a drastic change in the industries of lighting technology. Many have adopted the new LED lights over the traditional incandescent and fluorescent lights. This is because LEDs give more light, have lesser environmental impact and last longer as compared to incandescent bulbs.

User-segments such as the government and commercial segments have been witnessing exponential growth. The street lighting segment is also expected to be the biggest application for the next few years. Lately, energy-efficiency initiatives are gaining momentum in India. As people become more aspirational, the demand for high end home and decorative lighting market will continue to increase. EESL (Energy efficiency services limited) efforts such as UJALA, SLNP and the PLI schemes are assisting vendors to drastically reduce product costs.

The supply chains that had seen major disruptions during the pandemic may continue to see further disruption due to the Russia Ukraine War. Similar to Taiwan, both Ukraine and Russia also play a crucial role in the global semiconductor supply chains. Ukraine is an important source and supplier of raw materials like semiconductor-grade neon used in semiconductor manufacturing. The on-going war is expected to have bearing on the production of semiconductor chips and impact industries across the board including the LED lighting industry.

Evolution of Indian LED lighting industry

Chart 5.1 Evolution of the LED lighting industry in India



Source: Desk Research; Frost & Sullivan Analysis

LED lights have emerged as a very reliable source for lighting over the past several years. Due to the many advantages over conventional lighting technology, these lightings are becoming increasingly popular in the Indian lighting market. Although Indian LED lighting market is at a nascent stage, it offers innumerable opportunities for growth over the next few decades.

India commenced its policies and initiatives for LED lighting in 2007-08 which began with an R&D funding program, followed by a policy in 2012 which aimed at aligning with international technical standards for LED lamps. Other relevant policies include domestic value – addition requirements for LED bulbs that are procured, compulsory registration for domestic and foreign manufacturers supplying to the Indian market and restructuring of the LED-related import tariff structure. In 2014, the impact of different policies saw a flurry of changes, when the government introduced the Unnat Jyoti by making LEDs more affordable. The program targeted the residential sector, which accounted for 23% of the country's total electricity consumption in 2015-16 and aimed at replacing about 770 million incandescent bulbs by LED lamps.

LED bulbs in the last decade gained momentum as the popular choice and emerged as an alternative to the commonly used incandescent and CFL bulbs. In a price sensitive market such as India, LEDs are being accepted more and more as they rank higher when it comes to energy saving and lifespan when compared to the other two alternatives mentioned above. LEDs are far more energy efficient than their CFL counterparts and at the same time are more reliable. When you factor in these advantages, the initial high price of LED bulbs is justified.

Growing popularity of LED Lights in India

- **Government Factors**
- **Longer Life**
- **Cost Effective**
- **Environmentally friendly**

Government Factors

Various Government programs like the UJALA has been readily adopted by all the states. By encouraging the use of LED bulbs, it has helped in reducing annual household electricity bills. Energy efficiency is a key selling point for LED lights. With an estimated energy efficiency of 80-90% compared to conventional light bulbs, LEDs have proved to significantly reduce energy consumption, and thus further driving the demand for LED lights in the country especially If you have outdoor lighting that is left on for a long time. LEDs in these fixtures can save a lot of energy. Consumers have been able to save money, improve their quality of life, and contribute to India's economic growth and prosperity.

Longer Life

LED lights have a long lifespan and typically last for up to 15 years or 50,000 hours. These lights usually do not dim over the course of its life which reduces the need for frequent replacement of lights.

Cost Effective

Increasingly we see there is rising consumer awareness of the cost-effectiveness and eco-friendliness of LED lighting. The cost of LED light bulbs has decreased dramatically since they entered the market and prices are expected to come down further as more products become available. While LEDs are more expensive than traditional incandescent bulbs, they are still more cost effective as they last a long time and are more energy efficient. Today, LED lights can be purchased across multiple platforms and is clearly a much better choice from a cost standpoint.

Environmentally Friendly

Traditional fluorescence lights contain mercury. Disposal of conventional bulbs lead to toxic accumulation of mercury in ground water. LED lights, unlike traditional fluorescence lights, do not contain mercury and thus are more environmentally friendly.

Important Government's Initiatives for adoption of LED lights

Several government schemes, including without limitation the Street Lighting National Program (SLNP) and Unnat Jyoti by Affordable LEDs for All (UJALA), has remained India's largest demand generator for LED lighting. The goal of these initiatives is to raise consumer awareness of the adoption of LED bulbs over traditional lighting sources such as incandescent bulbs, CFL, and halogen lights. For example, EESL has installed over 12.3 million LED street lights in ULBs and Gram Panchayats across India.

Street Lighting National Program (SLNP)

The Government of India is undertaking various initiatives to promote the usage the LED lights. For instance, under the Street Lighting National Program (SLNP), till date, over 12.3 million LED street lights in ULBs and Gram Panchayats across India. This has resulted in energy saving of more than 8,587 Million Units (Mus) of electricity per annum, peak demand reduction of over 1431 MW and 5.92 million tonnes of CO2 emission reduction annually.

UJALA Scheme

The UJALA scheme was announced as "Domestic Efficient Lighting Program (DELP)" in January 2015 and later renamed Unnat Jyoti by Affordable LEDs (UJALA). It urged the people to use LED bulbs in place of incandescent bulbs, tube lights and CFL bulbs as they are more efficient, long lasting, and economical in their life cycle duration.

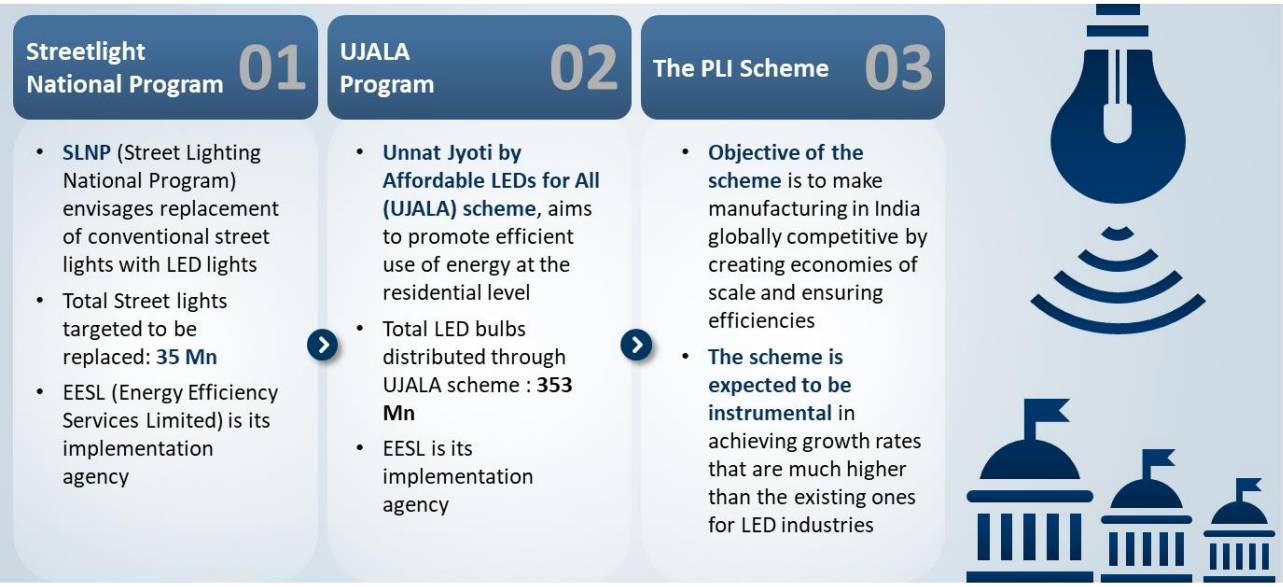
The scheme aims to light up every household with LED bulbs, tube lights and 5-star ceiling fans. More than 250 million households across the country have benefited from this scheme.

The PLI Scheme

The prime objective of the PLI scheme is to make manufacturing in India globally competitive by creating economies of scale and ensuring efficiencies. It is designed to create a complete component ecosystem in India and make India an integral part of the global supply chain. So far, the scheme for six segments has been approved – electronic/ technology products; pharmaceuticals; telecom & networking products; food products white goods; and high-efficiency solar PV modules.

Selection of companies for the scheme will be done to incentivize manufacturing of components and sub-assemblies, which are not manufactured in India presently with sufficient capacity. Incentives will also be open to companies making brownfield or greenfield investment.

Chart 5.2: Highlights of Key Government Initiatives in LED Lighting

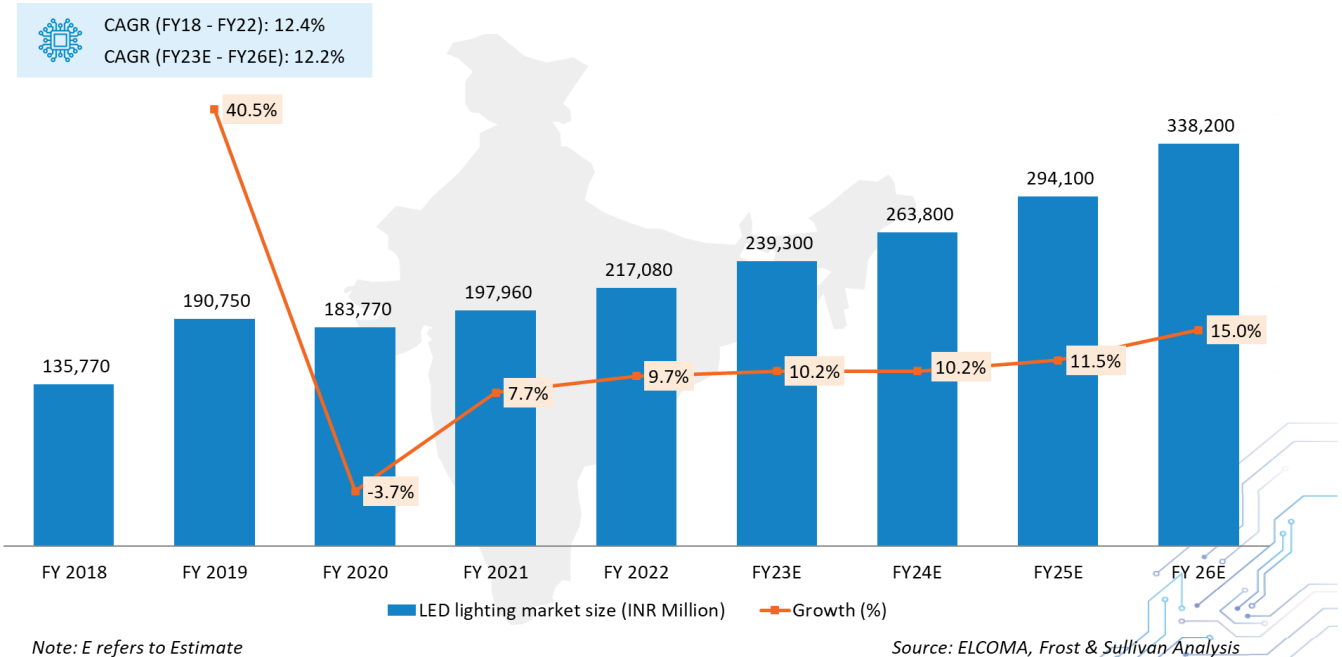


Source: Frost & Sullivan Analysis

Growth of the Indian LED lighting industry

The Indian LED lighting market has seen an increase due to population growth and subsequently rapid urbanization in the last decade. With a growing rate of electricity use, demand for an environmentally sustainable and cost-effective lighting solution is also gaining momentum. Thus, LED lighting has begun to dominate the general lighting market of India tremendously in recent years.

Chart 5.3: Total LED lighting market, value in INR million, India, FY18-FY26E



Note: E refers to Estimate

Source: ELCOMA, Frost & Sullivan Analysis

LEDs in the day and age are progressively being used in automotive headlamps, aviation, general lighting, advertising boards, various medical devices, camera flashes as well as traffic signals, and is expanding quite briskly throughout the country. In addition, the entry of Chinese LED light producers in India has enabled Indian manufacturers to offer innovative products. The Northern Region has the highest proportion of sales in India's overall market, followed by the Southern Region. Supported by various upcoming infrastructural projects throughout residential, industrial, and commercial areas across the country, the market for LED lighting is likely to see strong growth in the forecast years.

As at Fiscal 2022, the Indian LED lighting market is valued at INR 217,020 Million (USD 2.89 Billion) and is estimated to expand at a rate of CAGR of 12.2% to reach INR 338,000 million (USD 4.5 billion) from Fiscal 2023 to Fiscal 2026.

Key Growth Drivers for Indian LED Market

- **Rise in Smart City Projects and Overall Infrastructure Development**
- **Increasing Demand for Energy-efficient Lighting and Emergence of the LaaS Business Model**
- **Decreasing TCO of Advanced Lights**
- **Pronounced Increase in real estate**
- **Smart and Automation Uptake**

Rise in Smart City Projects and Overall Infrastructure Development

Rapid economic development and the Governments vision to increase number of smart cities are pushing the demand for infrastructure development across India. The demand far outstrips the supply and, there are 100 smart cities planned in India with expected investment worth USD 30.2 billion toward their completion. As these smart city vision comes to fruition, there will be stronger demand for the latest lighting solutions, such as smart and connected lighting.

Increasing Demand for Energy-efficient Lighting

While there is increasing demand for energy-efficient lighting, the relatively high investment costs (when compared to traditional lights) act as a deterrent to end users. However, the low power consumption of LEDs leads to significant energy savings, such as its usage for traffic signals. National programs to develop effective solid-state lighting industries in the India are strongly driven by the potential energy savings associated with using LED and the limited impact it has on the environment.

Decreasing total cost of ownership (TCO) of Advanced Lights

There is increasing focus on the TCO of lighting systems. For most segments, the TCO is central to making purchase decisions. As a result, user base has rapidly moved to more efficient conventional technologies and are shifting to LED. LED prices have drastically dropped over the years. As LED prices continue to fall, the TCO will become an even stronger selling point, and will help increase the adoption of advanced LED lights.

Pronounced Increase in real estate

With tourism gaining popularity and India becoming a global tourist attraction spot, luxury hotels and restaurants are giving importance to the ambiance of the place. In the domestic front, increasingly people are also becoming conscious about the need for better homes, for people have realized they are spending a lot of time working from home and kids schooling from home. Nowadays, people are focusing on the interior decoration of the entire house resulting in interior decorative budget to starkly go up.

Smart and Automation Uptake

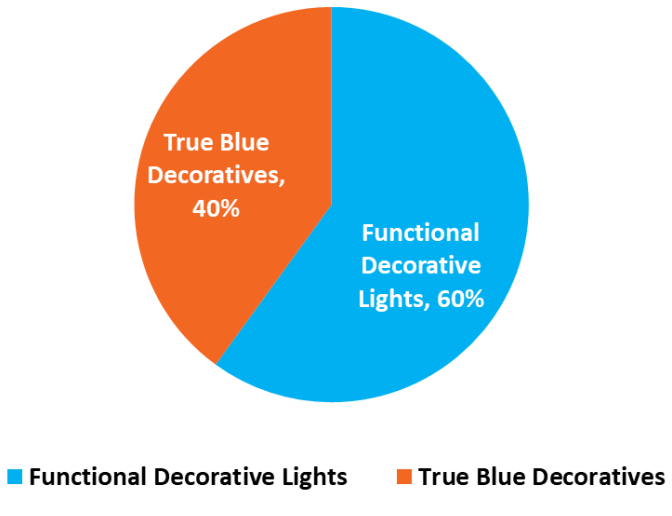
Overall uptake of smart and automation lighting is on the rise. Increasingly brands are playing around automating lights at least for the functional lights. Post covid digital savvy and information discovery that people have access to on account of the time spent on digital medium is also driving up aspirational quotient around how home should look like.

Home and Decorative Lighting Segment: Market Context

The value of the LED light and luminaire market is estimated to be approximately INR 220,000 million (USD 2.93 billion) in Fiscal 2022, with the value of the high-end home and decorative lighting market estimated at approximately INR 35,000 million (USD 0.47 billion). The high-end home and decorative lighting market generally comprises designer lamps, luminaires, lighting fixtures, etc. High-end decorative lighting is increasingly becoming an important part of many Indian households today, especially in urban areas, as living standards and aspirations of people are increasing due to higher disposable incomes among the middle class of the country as well.

Increase in the affordability of individuals and their growing desire for convenience and ease of use is spurring the demand for home and decorative lighting. Consumers are viewing modern high end decorative lighting fixtures not just for improving the visual appeal quotient but as also from a functionality standpoint. People are choosing modern décor items that also complement their homes floor, furniture, and colour of the wall which eventually creates a very inviting space.

Chart 5.4: High end home and decorative LED lighting market split, India, FY22



Source: Frost & Sullivan Analysis

Types of Decorative Lighting

Initially, penetration of LEDs was limited due to the limitation in their designs. However, with the advancement of technology in LEDs, there are now different types of LED bulbs available which can be used for a particular purpose or place.

LED bulbs can be broadly classified as:

- Functional Decorative Lights
- True Blue Decorative Lights

Functional Decorative Lights

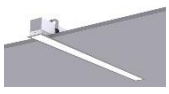
Functional decorative lights comprise approximately 60% of the home and decorative lighting market, as at FY 2022, valued at INR 35,000 million (USD 0.47 billion). In this category, almost all of the functional decorative lighting segment use LEDs and there are no conventional retrofit solutions that sell anymore. The functional decorative lighting segment is where the branded play happens and is considerably dominated by private labels.

Major types of functional decorative lightings include the following: -

Recessed Spotlights: These are lights that are installed in hollow opening created in the ceiling. They usually have three main components: housing, trim and the bulb. The housing is what is hidden behind the ceiling, and they also have the electrical fixtures inside.

Track Lights: Track lights are lights that uses a track for support on the ceiling. These rails are used to provide electricity to each of the fixtures. They can either be mounted on the ceiling or on the wall.

Cove Lights: This lighting technique is one of the basic lighting techniques where the lights sit inside a cove and are directed to the ceiling. In many cases it is also referred to as ambient lighting or luminescence.



Linear Lights: Linear lights are typically long and are easily available. They are suspended lights, surface mounted or as recessed lights.

Highbay and Outdoor Lights: These are lights that are typically used where ceilings are tall, and the intensity of the light is enough so that it can spread out over a large area or a focussed area.

Industry structure of fuctional decorative lighting market

Until sometime back, there used be a considerable unorganized sector in the functional decorative lighting market. In particular, every big store in the country would have import arrangements with Chinese suppliers

that was privately labelled by the store brand. This arrangement has shrunk considerably. The functional decorative lighting market is now dominated by branded players such as Philips, Syska, Havells, Crompton, Wipro.

As one moves towards the more premium end of the segment, brands like iGuzzini, FLOS play in what is also called the architectural lights which is a very niche segment. Majority of the functional decorative light category is with brands in the mass premium market.

True Blue Decorative Lighting

True-blue decorative lighting refers to all the traditional kinds of light fittings (floor lights, pendants, chandeliers, wall lights etc). Decorative lighting can provide general illumination for the entire room or even focus on smaller area. They usually come in attractive shapes and colours which complement the décor of the room. True blue decorative lighting comprises approximately 40% of the home and decorative lighting market, as at 2022. The true-blue decorative lighting segment is fragmented, and few brands operate in this market. There is Usha, Phillips, Havells and Jaquar lightings that are trying to make a mark here. The rest of the market is unorganized since consumers focus on design rather brands.

The fragmented segment is split 50:50 between LED and conventional lights. Conventional lights in this context refers to those where the luminaire is separate and the lamp or the light source is separate. For example, a chandelier with a E14 base cap for candles, the light source there will also be an LED, but the luminaire there which forms the bulk of the value in that end use will be conventional.

In the high-end home and decorative lighting segment, design is the most important. The supply base is largely China where people source by what is called container trade. Larger brands like Phillips (Signify) typically source their lights from locations in China where all the lighting vendors or malls display their variety. The brands select two or three patterns, import these containers, and repeat this one or twice a year. This is how typical retailers in India operate in this segment. In the value chain there are also players who do this in bulk, there are wholesalers in some of the main market who bulk break this and subsequently be purchased by decorative light stores in the neighbourhood. The retailers would go to these big importers and buy from them. This is generally how the fragmented high-end home and decorative lighting segment in India.

Types of True-Blue Decorative Lighting

Chandeliers: Chandeliers typically hang from the ceiling and have fixtures with lights that are traditionally facing upwards and occasionally downwards. Going back generations, the use of bulbs and electricity was powered by candlelight for centuries. Chandeliers are used traditionally in practically any room of the home, from dining rooms to bathrooms.

Pendant Lighting: Ceiling pendant lights provide a contemporary look and are considered a good alternative to traditional chandeliers, although the origins of pendant lights stretch even further back than chandeliers. Pendant lights may consist of a single hanging fixture or multiple hanging fixtures and are typically installed over dining room tables, kitchen islands, in entryways or over staircases, in living rooms, bedrooms or anywhere else you would find a chandelier or ceiling fixture.

Wall Scones: Wall sconces typically provide both accent and ambient lighting, illuminating dark hallways or highlighting decorative wall I. A sconce is typically a wall lighting fixture that is installed using the wall for support. While sconce lights are good option for indoor lights, they are used as outdoor lighting as well. Wall sconce lighting maximizes floor space, making them an attractive solution for smaller rooms. While floor or pendant lighting and even bedside table lamps take up a lot of space, wall-mounted lighting frees-up room for other tasks.

Table and Floor Lamps: As the name itself suggests, floor lights typically tall I items and are usually place on the ground. They can range from anywhere between four to six feet tall. The advantage of table lamps is that they are easy install and are also available in a variety of designs. Floor lamps are typically used as a stand-alone lighting solution to focus on a particular spot in a room or with other lights. Table lamps are usually placed on the bedside tables. Their major use is for providing reading lights. These lights also find application in drawing areas for setting the ambiance of the room

Trends in the high-end decorative lighting market

- **IoT Based Smart Lighting**
- **Built in Lights**
- **Daylight Integration**

IoT Based Smart Lighting

The use of smart lighting systems or connected systems is expected to drive the expansion of the home and decorative lighting industry in India. Pendants, chandeliers, cove lights and lamps with smart LEDs are examples of decorative lighting goods that utilize smart lighting systems. A smart lighting system connects via wireless technology. Wi-Fi and Bluetooth technologies are used to link these smart lights wirelessly. Smart lighting systems are operated through voice control systems like apple's Siri, Amazon Alexa, Google Assistant, and Microsoft's Cortana. The increased use of wireless technology will drive the increase in use of smart lighting systems or connected systems, which in turn will drive the use of home and decorative lighting in India.

Built in Lights

Built-in light source has emerged as a trend in the high-end home decorative lighting market. These lights are fitted inside the walls or ceiling which give them a very sophisticated look. These lights are integrated with the lighting fixtures.

Day Light Integration

The adoption of tuneable light has increased recently. For example, for a I interior to look bright to ensure that people can tell if the I is open or not, the lighting has to be optimal so that it can stand out even in broad daylight. As the day progresses, the lighting ambience is expected to be more sombre and more welcoming

as the lighting conditions outside change considerably. In order to achieve this, the lighting fitment has to have the daylight integration feature.

Market Size of High-End Home and Decorative Lighting in India

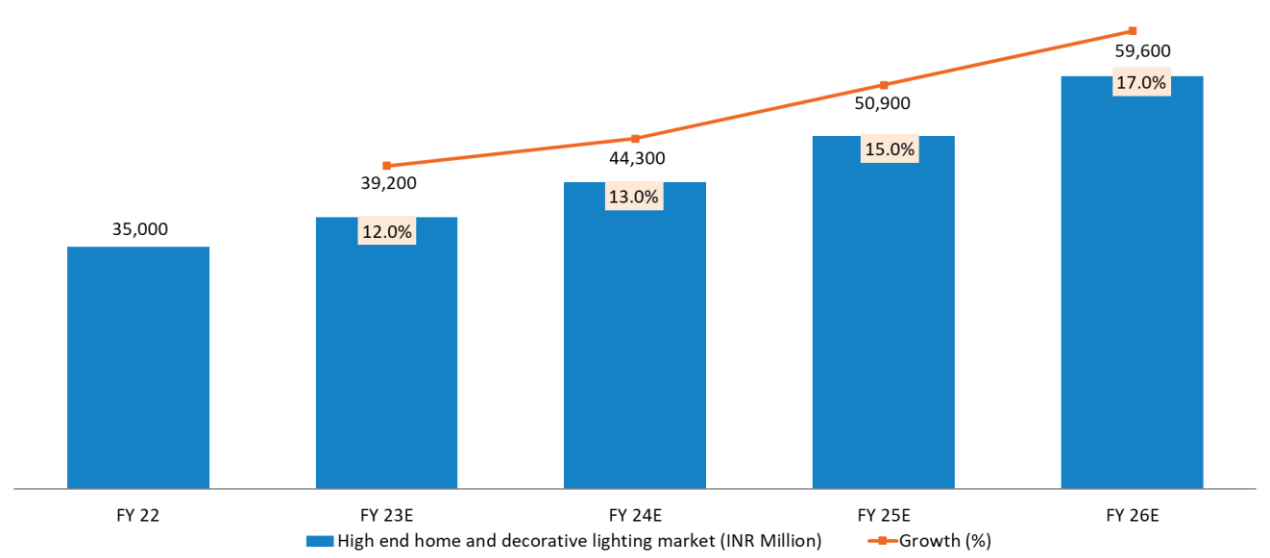
Demand from high net-worth residential users drive the demand for high-end home and decorative lighting products. LED lighting comes in a variety of colours and various other levels of customizations like brightness levels, making them ideal for usage in a variety of decorative designs thus boosting the decorative lighting industry's growth.

Other factors that drive the growth of the high-end home and decorative lighting market include:

- Higher budgets for renovating home spaces.
- India's ever improving global position as an attractive tourist spot.
- Increasing access to the online world (social media) driving demand for luxury items as aspirational quotient of people is on the rise.
- Greater availability of disposable incomes of the population in India.
- Need for better homes as substantial number of people still work from home.

The Indian high-end home and decorative lighting market size was valued at INR 35,000 million (USD 0.47 billion) in Fiscal 2022. Moving forward, this segment is expected to grow at a CAGR of 15.44% to reach approx. INR 60,000 million (USD 0.75 billion) in Fiscal 2026. This industry is set to grow given the rising importance given to the role of decorative lights in helping to create a visual appeal to the house.

Chart 5.5: Total home and decorative lighting market, value in INR million, India, FY22-FY26E

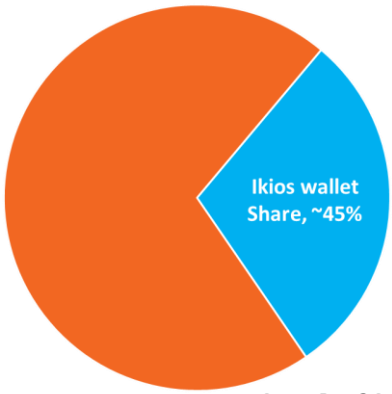


Ikio's wallet share

On the basis of stakeholder interaction conducted by F&S, as of Fiscal 2022, Signify has approximately 50% revenue share in the functional decorative lighting category. As functional decorative lighting market makes up approximately 60% of the overall high-end home and decorative lighting segment, Signify's share in the INR 35,000 million market stands at approximately INR 10,500 million. True-blue decorative market makes up for the remaining 40% i.e., INR 14,000 million. The supply base is largely China in this scattered segment where

container trade is still at large. Signify's share in this segment is approximately 10%, i.e., INR 1,400 million. Considering a 60% gross margin, Signify's LED light purchase cost is estimated to be approximately INR 4,800 million (i.e., 40% of INR 11,900 million). Since Ikio's revenue from sales to Signify is approximately INR 2,200 million, its wallet share stands at approximately 45% (which includes both functional decorative and true-blue decorative lighting) in Fiscal 2022. Wallet share refers to how much of a customer's expenses for a category of product or service goes to a particular company. In this case how much of Signify's expenses towards LED lighting goes to Ikio.

Chart 5.6: Ikio's wallet share, in percentage, India, FY22



Source: Frost & Sullivan Analysis

Sectors driving the growth of the high-end home and decorative lighting market

- The commercial application segment is a very important segment contributing heavily to the increasing use of decorative lights. Decorative lights find major applications in commercial establishments such as pubs, restaurants, hotels, malls, retail shops and museums, etc. The use of decorative lighting has become a trend to enhance the customer experience in these places. Restaurants and pubs, where millennials form an essential demography for the social gathering of friends and families prefer to visit places where the ambience is very premium. Shopping malls were once a place of just purchasing products has now become a destination for family and friends to gather and is considered more an entertainment venue.
- Decorative lighting is expected to expand at a brisk rate in the household application segment as well, as demand for well-designed houses increases. House owners are constantly looking at ways to enhance both visual appeal and functionality and this is leading to increasing household application of the products. With an increasing access to the online world, exposure to global decors is high and as aspirations of people are ever increasing, this will prove to be a big impetus to the decorative lighting business in India.

Factors that will support the growth of the high-end home and decorative lighting segment.

The decorative lighting market is driven by Government backing and rising budget allocations for home renovations and decors. The few factors that will support the growth of high-end home and decorative lighting segment include: -

- Government schemes such as Unnat Jyoti by Affordable LEDs for All (UJALA) and Street Lighting National Program (SLNP) are biggest demand drivers for the LED lighting market in India. The aim of these initiatives is to increase awareness among the consumers regarding the adoption of LED bulbs over conventional lighting sources.
- The size of the average home in the country is increasing. Until a decade ago, 70 – 75% of the money spent on home improvement was on decorating the living room only. Now, renovation attention is given to the entire house.
- Decorative lights find their applications in a variety of places, including shops, restaurants, homes, spas, malls, libraries, etc. These lights have been gaining popularity from a large number of designers, who then experiment with the style of these lights to create aesthetic ambiance.

Positive impact of these drivers on Ikio Lighting Private Limited's LED business

- As Government continues to roll out plans to phase out the incandescent bulbs, it will eventually result in higher adoption of LED lights because of their energy saving feature
- Manufacturing companies are bound to benefit from increased demand for innovative lighting coming from the home lighting space, as people have realized they are spending a lot of time schooling from home and working from home. Typical interior decorative budget has starkly gone up.
- Increasing budgets and spend on lights would also be a boosting factor for Ikio. Post Covid, digital savvy and information discovery that people have access to on account of the time spent on digital medium is also driving up aspirational quotient around how modern home should look like.
- As the pandemic settles and people are gradually moving back into offices, there is a sudden surge in real estate. The premium end of this category of LED lights is growing at a fast rate as commercial spaces open up and realizes the importance of architectural lighting given the amount of international exposure.

B. ORGANIZED RETAIL LED LIGHTING SEGMENT

Overview of Organized Retail Market

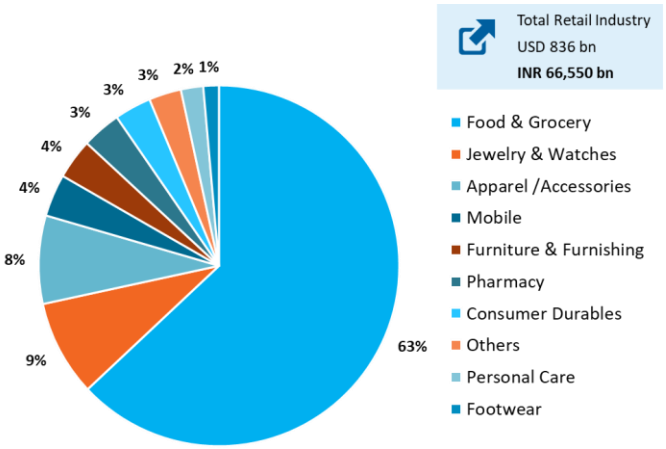
The retail industry in India has established itself as a key contributor to the Indian economy. As of 2022, it accounts for more than 10% of the country's GDP and employs around 8% of the workforce. As of 2022, India is the world's fifth-largest global destination in the retail space (Source: World Banks Doing Business). The expansion of the organised retail industry has not only aided the growth of the economy, but also improved and widen the customer choice portfolio. This has shifted the retail industry from a producer-centric to a consumer-centric one.

India's retail industry in FY 2022 was estimated to be US$ 836 bn (INR 68,550 bn). Food & groceries (F&G) segment forms the major share of India's merchandise retail expenditure. High share of F&G is an expected outcome of the emerging nature of the Indian economy. When economies progress, the share of F&G in the retail consumption basket is expected to come down and stabilize at around 55%, as is the case with mature economies, such as the UK. However, such a decline is gradual and spans decades.

The decline in the share of food & groceries segment often translates into a rising share of discretionary retail segment; in the case of India, apparel & accessories is a primary discretionary category in the Indian retailing basket. Owing to COVID-19 pandemic, the retail sector witnessed a decline of about 8.5% in FY 2021. The

share of discretionary retail categories, such as apparel & accessories, footwear, jewellery, and beauty & personal care, declined in FY 2021 while the share of essential categories, such as food & grocery and pharmacy, increased. However, the retail sector is estimated to have largely recovered in FY 2022 and is expected to witness a steady growth of a 10% CAGR between FY 2022 and FY 2025 to reach a sizeable ~US$ 1,109 billion (~INR 88,700 bn) by FY 2025.

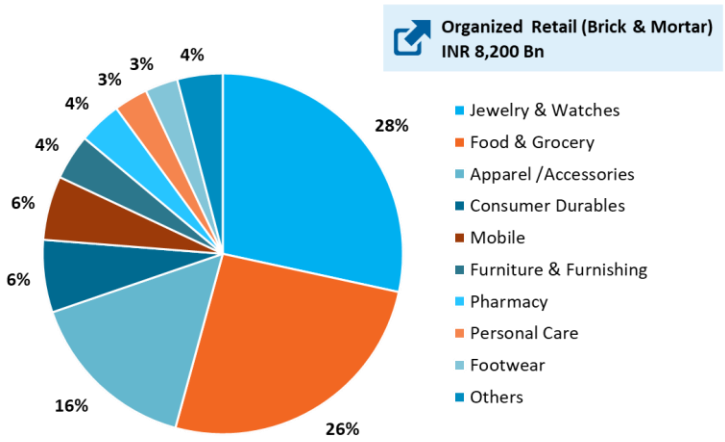
Chart 5.7: Share of various Categories in Overall Indian Retail Basket, value in INR bn , FY2022



Source: Frost & Sullivan Analysis

In India, the contribution of organized retail is low (~18.5% in FY 2022) as compared to mature markets such as the US, the UK and Germany where the penetration of organized retail is much higher. However, in relatively newer market like India and China, the online medium has seen tremendous growth. In India, the online channel and the organized brick & mortar channel is expected to grow at a CAGR of 29% and 20%, respectively, between FY 2022 and FY 2026.

Chart 5.8: Share of organized retail in Overall Indian Retail Basket INR 8,200 bn (USD 100 bn)



Source: Frost & Sullivan Analysis

The organized brick & mortar market in India was estimated at INR 8,200 bn (US$ 100 bn) in FY 2022, with categories such as jewellery (28%), food & grocery (26%) and apparel & accessories (16%) having the highest contributions. These categories will continue to play a pivotal role in future as well as the organized penetration within these categories is expected to rise the fastest. The online channel continued to be the

fastest growing channel in FY 2022, growing ~32% year on year to reach an estimated US$ 54 bn, with categories such as mobiles (32%), apparel & accessories (24%) and food & grocery (13%) having the highest contributions.

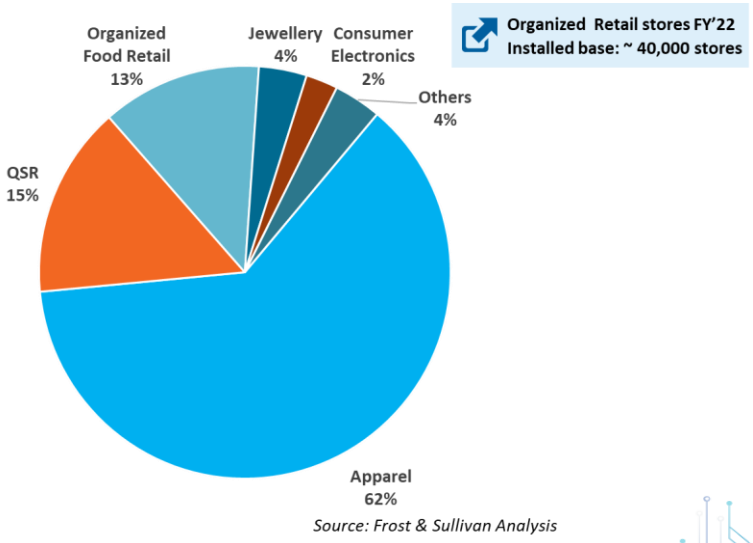
Estimates of organized retail outlets in India

Frost & Sullivan estimates that there are more than 40,000 organized retail stores/outlets in India at the end of FY2022. This does not include retail stores and outlets of local city-level brands and mom-and-pop stores. The number of organized retail stores has grown almost four times in the last seven years. The top 50 brands account for approximately 75% of these organized retail stores/outlets. For the purpose of this report, the stores / outlets have been classified under six segments:

a. Apparel, Fashion, Lifestyle, and Footwear
b. Quick Service Restaurants
c. Organized Food Retail (Hypermarket, Supermarkets, etc.) – 5,000+
d. Jewellery
e. Consumer Electronics – 1,000+
f. Others (High-end and fine dining restaurants, Furniture, etc.)

As at the end of FY2022, the first three segments account for approximately 90% of the organized retail outlets in India. The Indian apparel industry is the largest segment of the Indian organized retail industry and is currently witnessing some major shifts. Entry of international brands, changes in preferences from non-branded to branded, a fast-growing economy, large young consuming population in the country has made India a highly lucrative market. The following chart highlights the number of organized retail stores in India by various segment:

Chart 5.9: Overall number of organized retail stores in India, by category, split in %, in FY2022



Source: Frost & Sullivan Analysis

Types of Retail store in India and the importance of LED lighting

This section will discuss each organized retail segment, leading brands present in that segment, number of stores/outlets and importance of LED lighting in that segment.

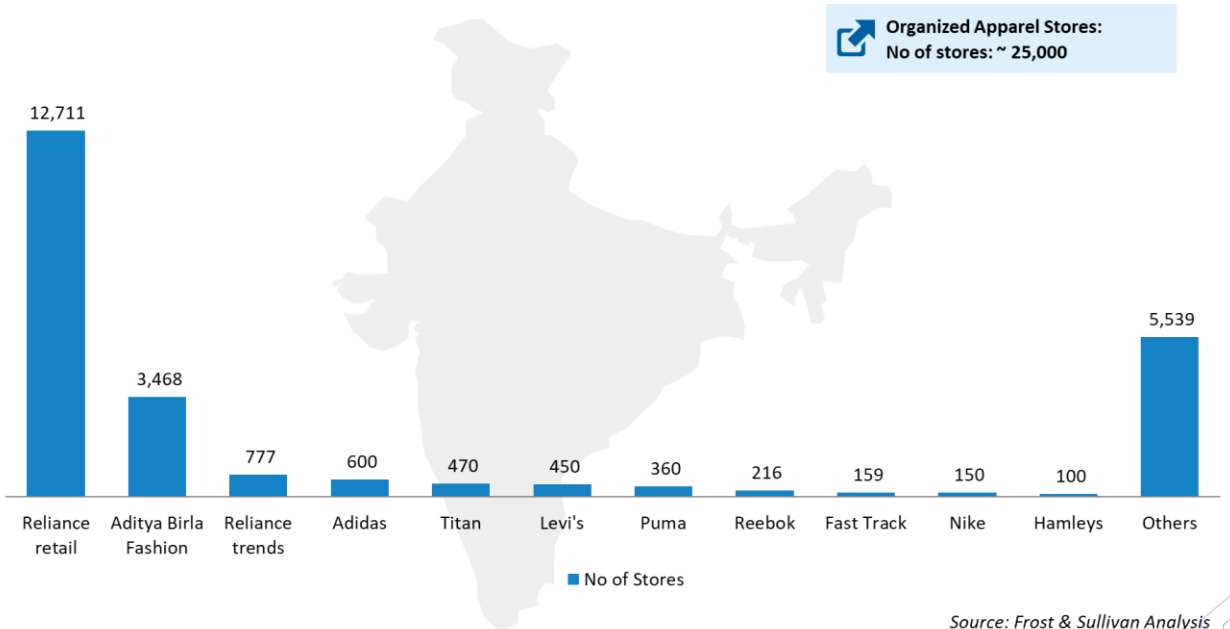
1. Apparel, Fashion, Lifestyle stores

Apparel/fashion/lifestyle industry is one of the most important sectors of the economy with regard to investment, revenue, trade, and employment generation all over the world. The significance of the apparel industry is entirely based on the contribution of the industrial productivity and employment. Apparel sector contributes to the country's GDP after agriculture and thus plays a major role in its augmentation.

The right type of lighting is crucial to create an appealing environment at an apparel store, one that can stir the interest of prospective buyers and increase sales. Smart lighting in a store can draw attention of customers to products or brands on sale. Lighting is much more than an aesthetic element and when deployed strategically, can enhance sales at a store.

The average organized Apparel store size is currently 5,000 to 8,000 square feet, with small stores ranging in size between 700 square feet and 2,500 square feet and smaller micro-stores in urban markets with a size below 700 square feet. The key companies in this market in India are Nike, Adidas, Reliance Trends, Jockey, Flipkart, Relaxo, Westside, Bata, LUX, and H&M. Estimates suggest that there are approximately 25,000 organized apparel, lifestyle, fashion, and footwear retail stores/outlets in India at the end of FY2022.

Chart 5.10: Number of organized apparel, fashion and lifestyle stores in India, volume in numbers, in FY 2022



Source: Frost & Sullivan Analysis

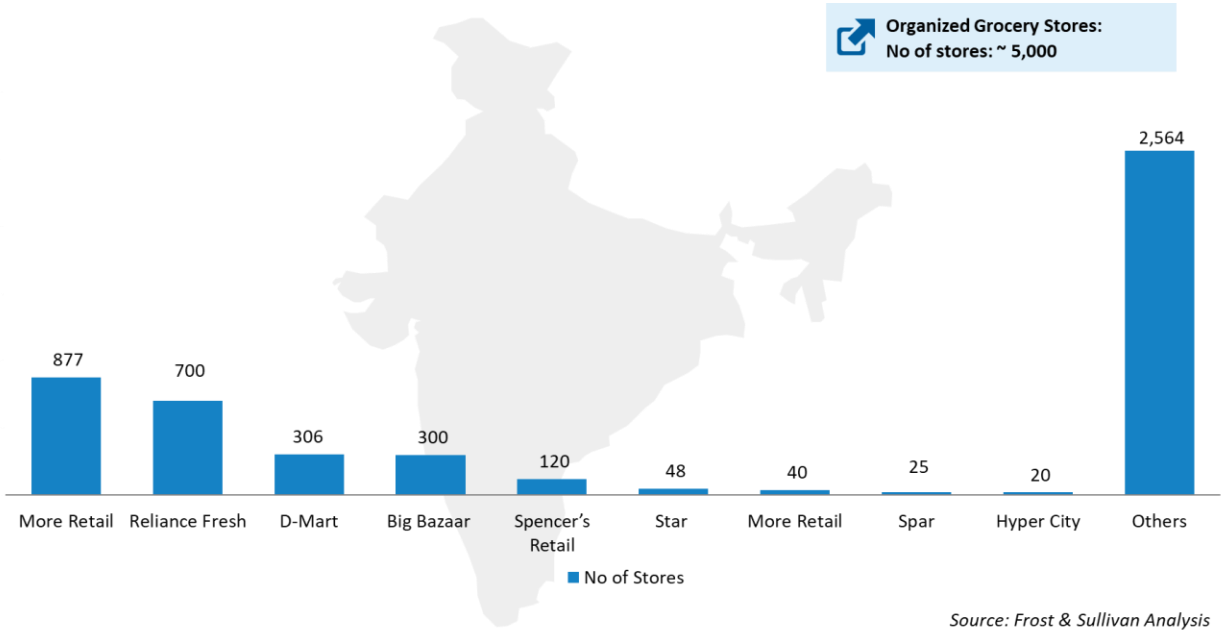
2. Organized food retail

Grocery stores and supermarkets sell a wide range of food products. Selections typically include fresh and packaged foods, pet food, and basic household products. Reliance Fresh, Star Bazaar, More, D-Mart, Big Bazaar and Spencer's retail are examples of brands in the grocery or supermarket retail category.

When it comes to grocery store lighting, it is important to highlight items in an appealing manner by way of proper illumination. In particular, with respect to lighting for the produce section, one needs to consider colour temperature, low heat emitting and colour rendering.

The average organized grocery store size is currently 20,000 to 30,000 square feet, with small stores ranging in size between 5,000 square feet and 15,000 square feet, and even smaller micro-stores below 5,000 square feet in urban markets. Estimates suggest that there are approximately 5,000 organized retail stores/outlets in India (Hypermarket, Supermarket) as at the end of FY2022. This does not include retail stores and outlets of local city-level brands and mom-and-pop stores.

Chart 5.11: Number of organized food retail stores in India, volume in numbers, in FY 2022



Source: Frost & Sullivan Analysis

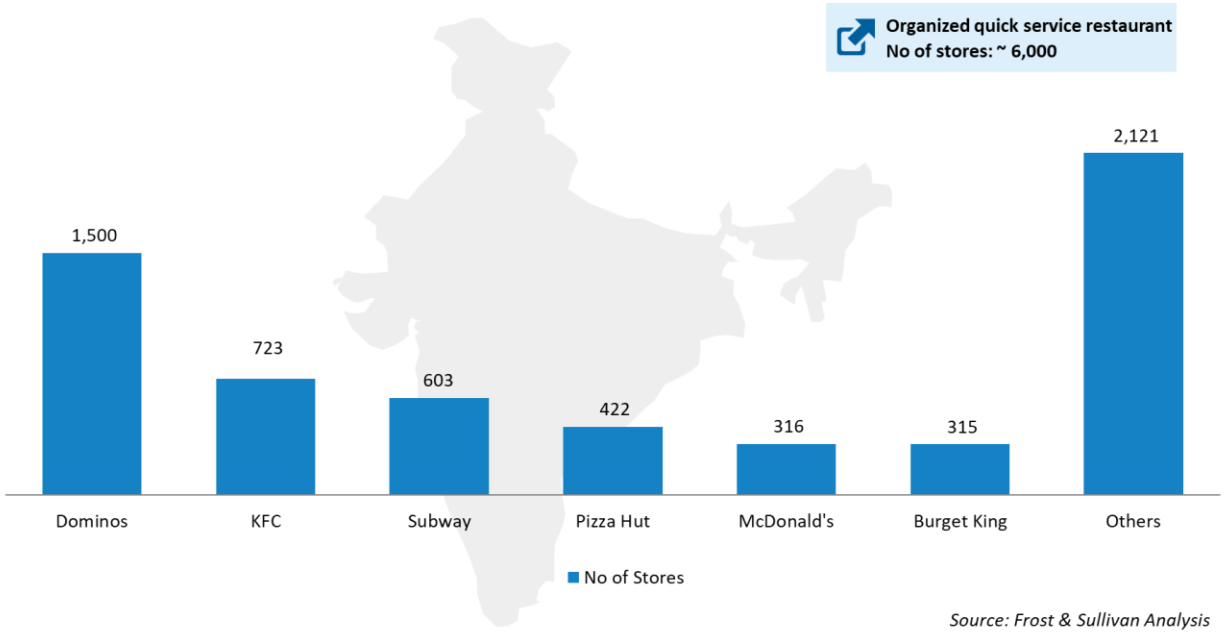
3. Quick service restaurants (QSR)

QSR, or Quick Service Restaurants, is a name of the industry for the fast-food restaurants that offer you food that does not require much time for preparation, will be served instantly and with low costs. The average size of quick service restaurant is currently 1,200 to 2,500 square feet, with smaller restaurants ranging in size between 700 square feet and 1,000 square feet, and even smaller restaurants with size below 700 square feet in urban markets.

One of the most common lighting fixtures used in quick-serve establishments is recessed troffers utilizing fluorescent lamps. This form of lighting is typically inexpensive and most commonly comes in 2×4 or 2×2 troffers utilizing either T8 or T12 fluorescent tubes.

The key companies in this market in India are Dominos, KFC, Subway, Pizza Hut, McDonalds, and Burger king. Estimates suggest that there are approximately 6,000 Quick Service Restaurants outlets in India as at the end of FY2022.

Chart 5.12: Number of quick service restaurants in India, volume in numbers, in FY 2022

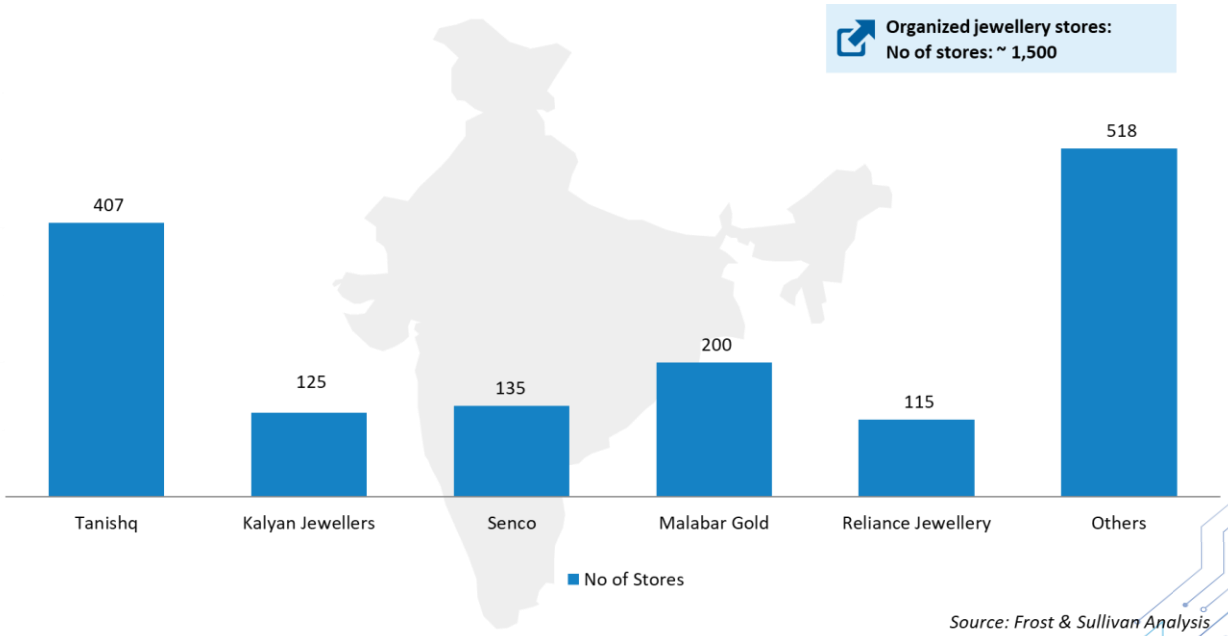


Source: Frost & Sullivan Analysis

4. Jewellery

The Penetration of Organized jewellery stores in India was approximately 8.5% (by value) of the retail market in FY2022. Typically, jewellery in India is not bought for occasions and adornment purposes only. Investment has been an important reason for jewellery purchase as well.

Chart 5.13: Number of organized jewellery stores in India, volume in numbers, in FY 2022



Source: Frost & Sullivan Analysis

Jewellery stores are one of the most challenging commercial spaces when it comes to indoor lighting solutions. Jewellery made from items like gold, silver, diamonds, etc. are shiny and tend to reflect a lot of light. Moreover, they contain fine details and designs. Thus, they require customized lighting solutions that

cater to all the requirements of a jewellery store. Typically, a lighting solution with 70+ CRI (Colour Rendering Index, which measures the ability of a light source to accurately reproduce the colours of the object it illuminates) can work perfectly for jewellery stores. However, one can go higher (80+ CRI) depending on the requirements of the store.

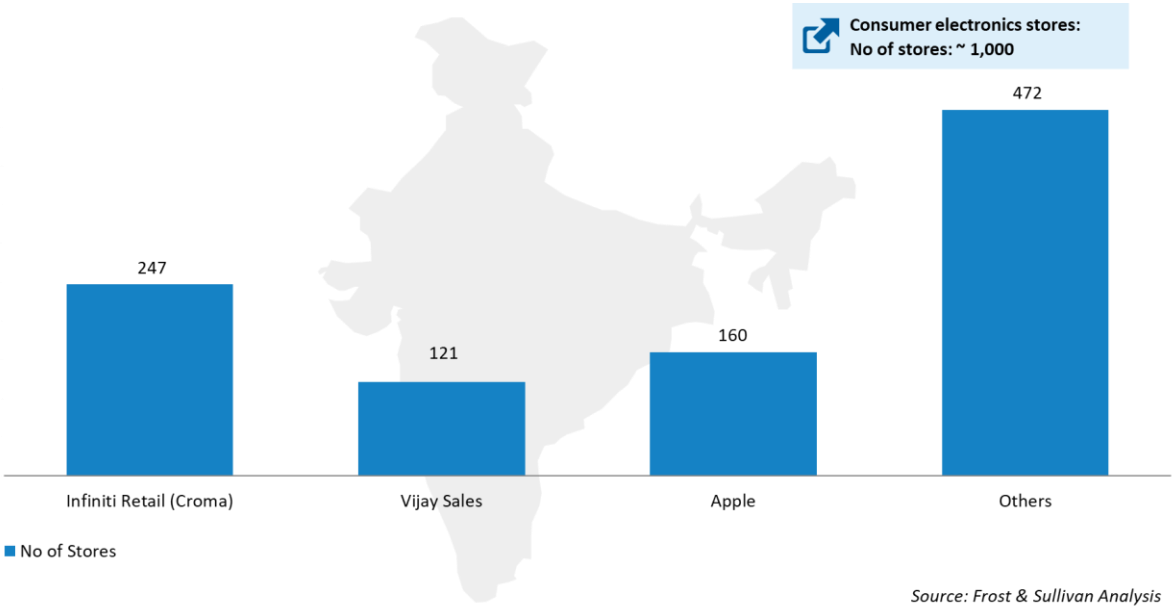
Kalyan Jewellers, Tanishq and Malabar are some of the leading retailers in the jewellery and watches segment within the organized market across the country. Estimates suggest that there are approximately 1,500 organized jewellery stores/outlets in India as at the end of FY2022.

Consumer Electronics

Consumer electronics are electronic equipment for non-commercial use. Consumer electronics include devices that provide one or more functionalities, such as computers, laptops, mobile devices, smart wearables, television sets, refrigerators, smartphones, and home appliances.

Consumer electronics & appliances companies in India include HCL Tech, OPPO, Vivo, Bosch, Samsung, Godrej & Boyce Manufacturing, Dell, LG Electronics. Estimates suggest that there are approximately 1,000 organized consumer electronics retail outlets in India at the end of FY2022.

Chart 5.14: Number of organized consumer electronics stores in India, volume in numbers, in FY2022



Source: Frost & Sullivan Analysis

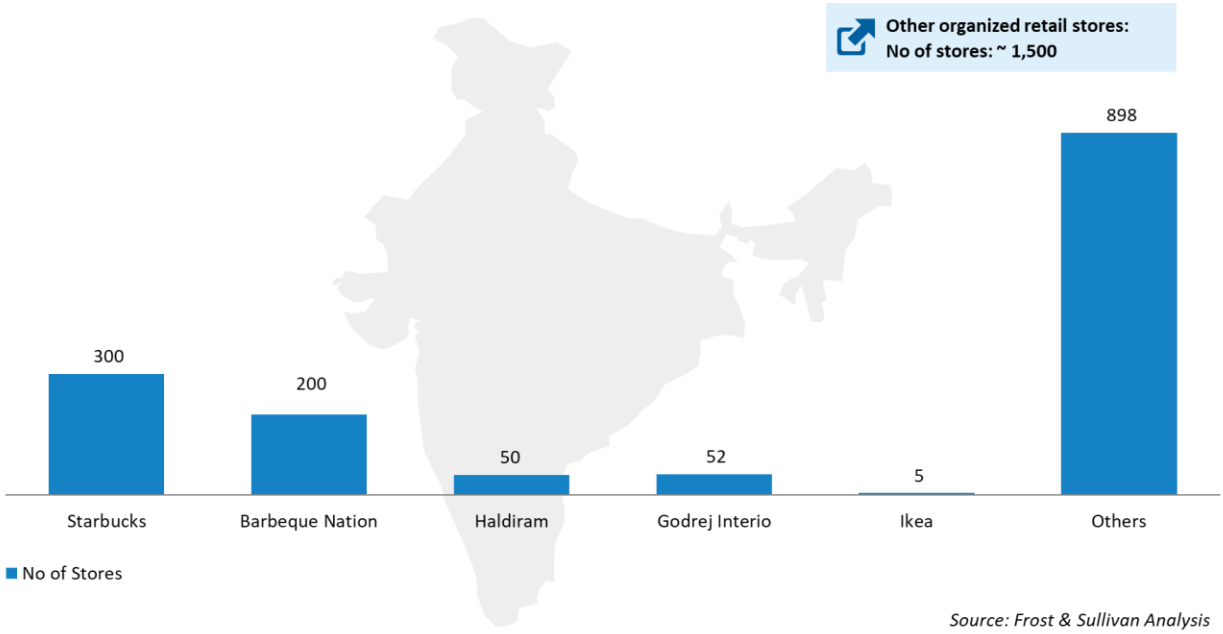
5. Others (High-end and fine dining restaurants, Furniture)

For high-end restaurants, the ambience in a restaurant plays an undeniably significant role in shaping the customers' overall dining experience. Ambience ties the cuisine, service, and environment together to define the diners' perception of a restaurant.

Good lighting has the capacity of creating a good sense of space if it is executed properly, as it will enhance the quality of a setting. LED lights instil positive mood and helps customers to relax and enjoy their meals.

High-end restaurants and furniture stores in India include Starbucks, Barbeque Nation, Haldiram, Godrej Interio, and Ikea etc. Estimates suggest that India has about 1,500 outlets which include premium high end fine dining restaurants, furniture stores etc. at the end of FY2022.

Chart 5.15: Number of other organized retail stores (High-end and fine dining restaurants, Furniture) in India, volume in numbers, in FY2022



Source: Frost & Sullivan Analysis

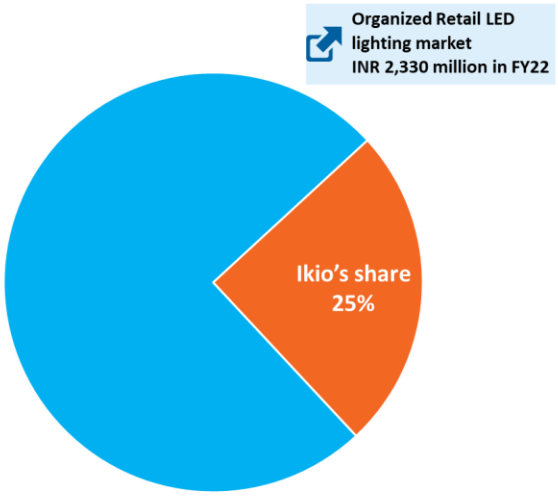
Organized Retail LED Market in India

Based on information furnished by the leading retailers in their websites and interactions by Frost & Sullivan with the industry experts, approximately 5,200 new retail stores have become operational in India in FY2022. These new retail stores offer LED lighting business opportunities. In addition, trends suggest that a new store goes for replacement / refurbishment / retrofitment / renovation after 6 – 7 years whereas and the entire lighting of the outlet is changed during this time. This renovation projects also offer LED lighting business opportunities. Estimates suggest that approximately 2,500 retrofitment projects were executed in FY2022. Hence, a total no. of 7,700 stores / lighting projects were considered for FY2022 for market size calculation.

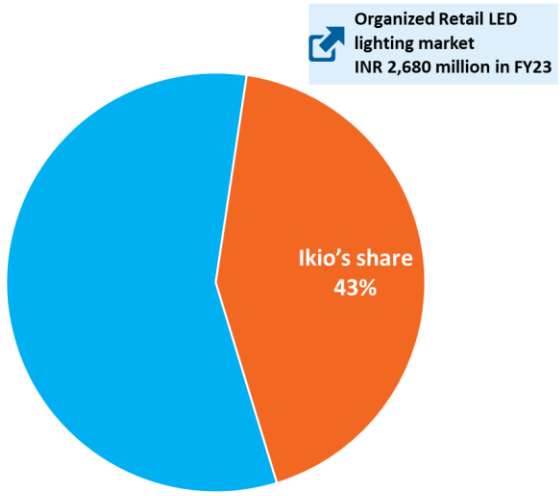
Cost of LED lighting in a store varies from INR 0.1 million to INR 3 million – segments such as QSR spends much lesser on the lighting than the segments such as Lifestyle, Fashion and Jewellery stores. For the market size calculation, an average spends of INR 0.3 million on LED lighting have been considered for a store. Based on the forementioned assumptions, Organized Retail LED lighting market has been estimated at INR 2,330 million in FY2022. The market is expected to grow at 15% to reach approximately INR 2,680 million in FY2023.

Ikio has sold approximately INR 580 million worth LED lighting in the organized Retail segment in FY2022 and is expected to clock a revenue of INR 1,150 million in FY2023. This would give a tremendous boost to Ikio's share in the organized retail segment from 25% in FY2022 to 43% in FY2023.

Chart 5.16: Ikio's market share of the LED lighting market in the overall organized retail basket (in India, value in INR million, in CY2022 and FY2023E



Source: Frost & Sullivan Analysis



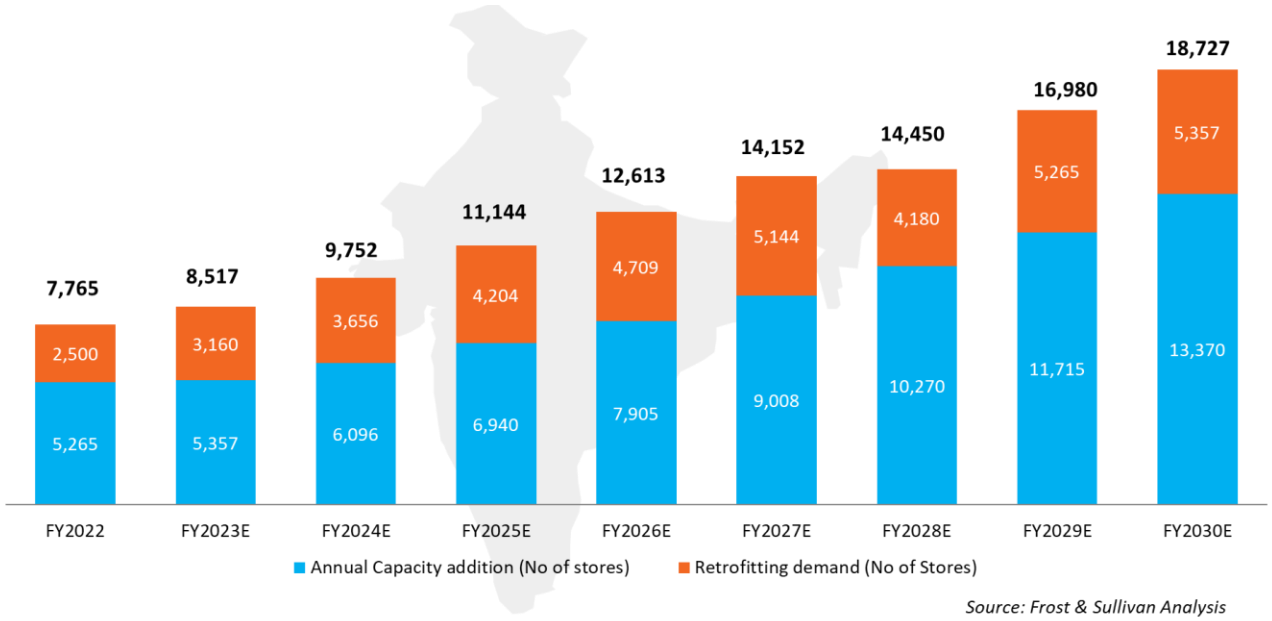
Source: Frost & Sullivan Analysis

Growth outlook for LED lighting in organized retail sector in India

Various estimates suggest that organized retail sector in India is projected to grow at a CAGR of 15 – 25% due to multiple drivers, such as rapid urbanization, changing demographic profile, increasing disposable incomes, changing consumer preferences, changing lifestyles etc. Based on growth plan of the leading retailers in the country and outlook of individual retail segments till FY2030, Frost & Sullivan estimates that, on a conservative basis, there would be approximately 110,000 organized retail stores at the end of FY2030. This translates to approximately 12.3% CAGR in the annual organized retail store addition in the country till FY2030.

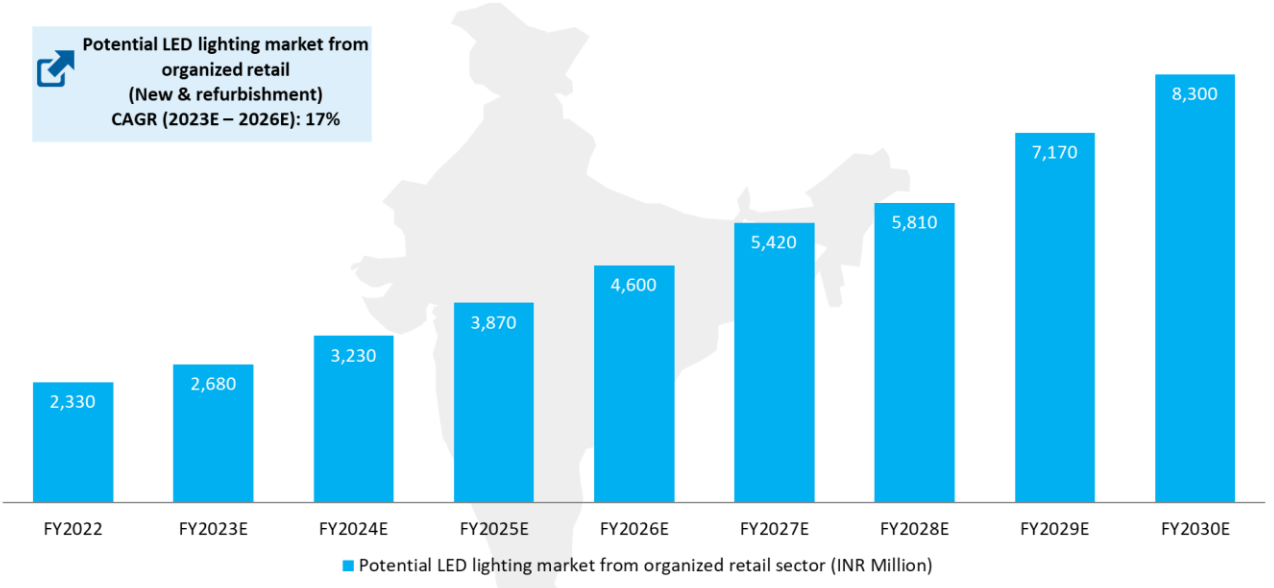
Besides, as the number of retail stores increases every year, number of retrofitment projects will also increase. It is expected that retrofitment projects will grow from 2,500 projects in FY2022 to approximately 5,350 projects in FY2030. The chart below highlights the estimated number of LED lighting projects in the organized retail sector in India between FY2022 to FY2030.

Chart 5.17: Potential Organized Retail LED Lighting projects (New stores and Refurbishments), in India, volume in numbers, CY2022 to CY2030E



Source: Frost & Sullivan Analysis

Chart 5.18: Potential demand for LED lighting from organized retail market (New stores and Refurbishments), in India, value in INR million, CY2022 to CY2030E



Source: Frost & Sullivan Analysis

C. COMMERCIAL REFRIGERATION SEGMENT (LED LIGHTING AND OTHER PRODUCTS)

Overview of the Indian Commercial Refrigeration Market

Commercial Refrigeration market in India is highly fragmented with presence of many regional and local suppliers. Large players in the past have taken initiative to organize the market for certain product categories. The leading eight to ten national players enjoy 65 – 70% market share due to very good presence in the high-

volume categories, such as Visi Cooler and deep freezer. However, remaining 35 – 40% market is highly fragmented with presence of more than one hundred players across regions and cities. Per F&S analysis, Voltas is the market leader in the Indian commercial refrigeration market. Blue Star, Western, Rockwell, Celfrost, Elanpro, Haier etc. are the other leading players in this market.

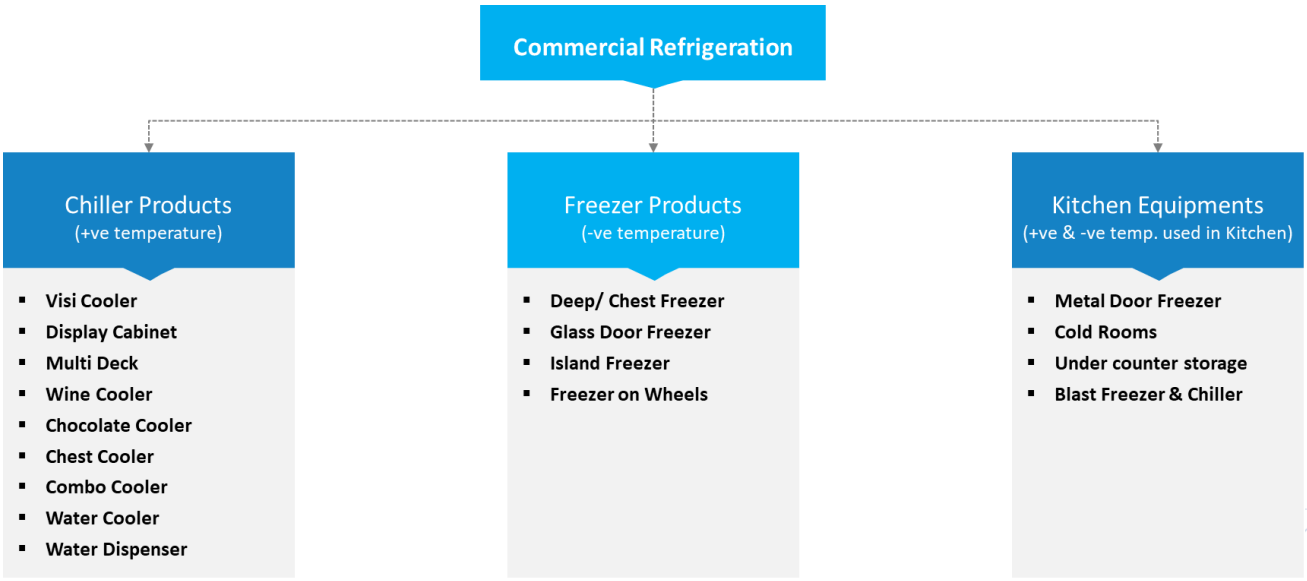
Majority of the suppliers (national, regional, and local) across Indian commercial refrigeration market product categories are Indian companies, although some foreign manufacturers such as Frigoglass, Haier, Arneg etc. are also catering to the Indian market. Almost all the major players have their own manufacturing facility in India except Haier, Elanpro and Celfrost. However, a significant volume is also imported from countries like China, Taiwan etc. Recent sharp depreciation in the Rupee value has impacted the margins of the importers and hence some large importers are contemplating setting up local manufacturing facilities in India.

Supply chain of the Com-ref products is highly complex in nature as there are multi-layer distributions. Other that suppliers and channels, a third party, also known as institutional buyers (companies like Coke, Pepsi, Amul, Nestle etc.), is an important stakeholder in Indian commercial refrigeration market value chain. These companies also buy products in large volumes from suppliers or channels and re-distribute the products to the end users.

Emergence of service industry, higher disposable income and changing lifestyles have led to a clear and gradual shift in the consumption pattern in favour of ready-to-eat food besides the emergence of leading quick service restaurants. Organized retail of frozen meats and fresh vegetables in malls and other retail stores has also increased, thereby propelling the growth of commercial refrigeration market.

Types of Commercial Refrigeration Products

Chart 5.19: Types of products under Commercial Refrigeration Category



Source: Frost & Sullivan Analysis

Usage of Commercial refrigeration products across different applications

Chart 5.20: Commercial refrigeration products used under different categories

Segments of Interest	Sub segments	Commercial Refrigeration - Products of Interest																	
		Chiller Products							Freezer Products				Kitchen Equipments						
		Visi Cooler	Display Cabinet	Multi Deck	Wine Cooler	Chocolate Cooler	Combo cooler	Chest Cooler	Deep Freezer	Glass Door Freezer	Island Freezer	Freezer on Wheels	Metal Door Freezer	Cold Room	Under Counter	Blast Freezer	Water cooler	Water Dispenser
Bakery	Bakery chain	●	●			●		●	●									●
	Unorganized bakery	●	●			●			●									●
Hotels	Premium/ Luxury	●			●				●	●				●	●	●	●	
	Budget	●							●						●			
Restaurants	Food chain	●	●		●				●				●	●	●	●	●	
	Medium and small	●							●				●		●			●
Quick service restaurants	Café chain	●	●						●									
	QSR/ Fast food	●	●						●	●			●	●	●			●
Organized retail	Cash & Carry	●	●	●	●	●	●	●	●	●	●			●			●	
	Hypermarket	●	●	●	●	●	●	●	●	●	●			●			●	●
	Supermarket	●		●		●	●	●	●	●								●
	Convenience store	●		●		●			●	●								●
Unorganized retail	Ice cream parlour		●						●									
	Processed food chain		●						●									
	Meat shop		●						●									
	Grocery shop	●				●	●	●	●									●
Offices		●																●
Railways														●			●	
Industries														●		●	●	●
Institutional buyers		●				●		●	●	●		●						

F&S has segmented the commercial refrigeration market based on product and end-user category. Based on product type, the market is divided into chiller product, freezer products and kitchen equipment's.

The chiller product segment collectively accounted for approximately 54% of the total Commercial refrigeration market share in India in Fiscal 2022, while the Freezer products segment accounted for approximately make 43% of the total Commercial refrigeration market in that year.

At present, commercial refrigeration finds major applications in:

- Grocery stores
- Quick service restaurants
- Restaurants,
- Organized retail
- Dairy
- Bakery
- Ice cream parlors and many such segments

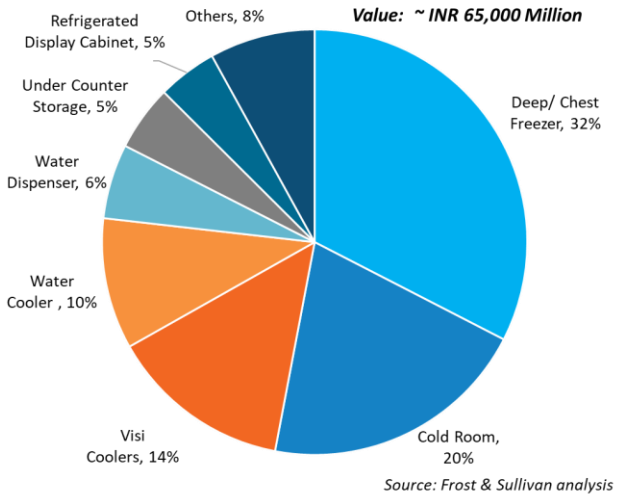
The commercial refrigerators found in many of these applications have been installed to provide for practical designs that in a way are placed to capture the attention of customers at typically point of sale. Also, change in food consumption habits in the country trends and rising international food trade are additional factors contributing to the growth of the commercial refrigeration market in India.

Market Size (value and volume) of Commercial refrigeration market in India FY 2022

To estimate the market volume of the commercial refrigeration, F&S has considered 17 products under Com-Ref Category; these products are further classified into three categories: Cooler Products (+ve temperature), Freezer Products (-ve temperature) and Kitchen Equipment

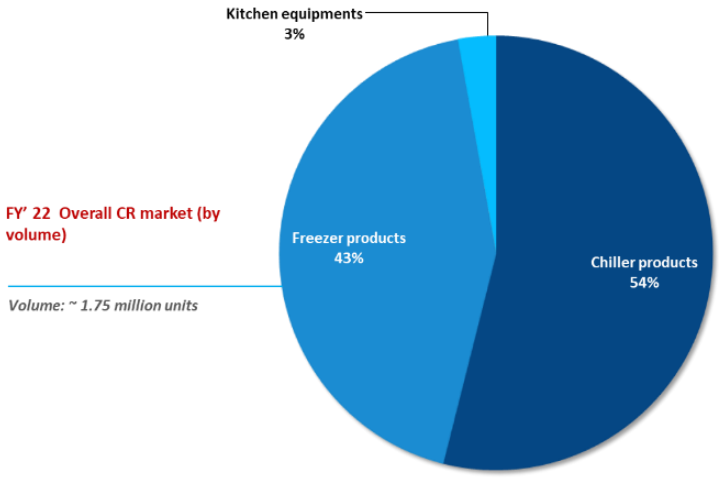
Chest freezer is the most dominant category and is expected to maintain its dominance moving forward. However, water dispenser and Visi coolers are also market leaders, owing to increase in demand for commercial refrigeration in hospitality sectors and office spaces.

Chart 5.21: Total commercial refrigeration market, value in INR million, India, FY22



Source: Frost & Sullivan analysis

Chart 5.22: Total commercial refrigeration market, volume in units, India, FY22

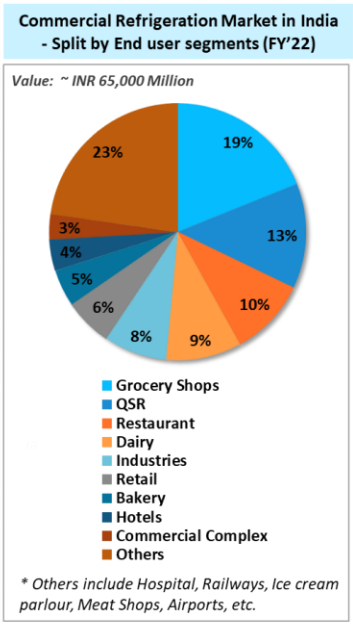


Source: Frost & Sullivan analysis

In Fiscal 2022, the chiller products segment was the most dominant segment accounting for approximately 54% of the Indian commercial refrigeration by volume and is expected to maintain its dominance moving forward. Water dispenser and Visi coolers are market leaders, owing to increase in demand for commercial refrigeration in hospitality sectors and office spaces. Commercial refrigeration is also gaining traction due to use of need for commercial refrigeration in hospitals and other medical facilities.

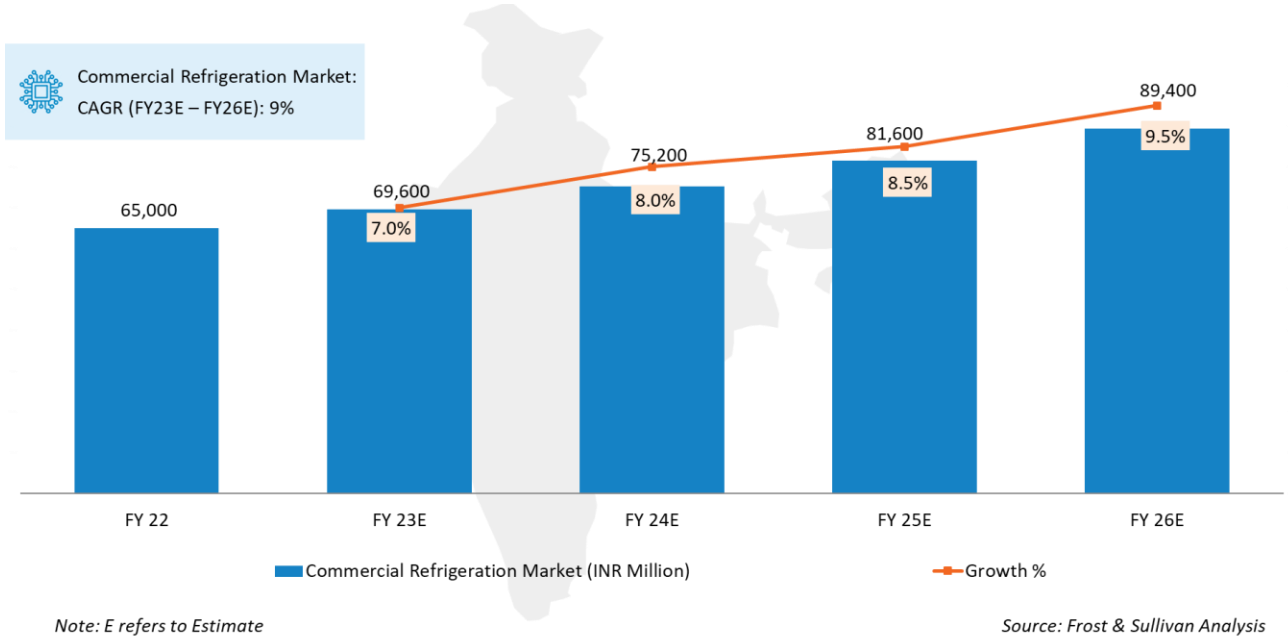
Chart 5.23: Commercial refrigeration market size by segment, in value INR million, India, FY22

Product Category	Grocery Shop	Restaurant	QSR	Bakery	Retail	Industry	Dairy	Hotels
Deep Freezer	■	■	■	■	■			
Water Dispenser		■		■				■
Visi Cooler	■	■	■	■	■			
Water Cooler		■		■		■		
Chest Cooler	■	■			■			
Chocolate Cooler	■				■			
Ref. Display Cabinet		■	■		■			
Freezer on Wheels						■	■	
Cold Room		■	■		■	■	■	■
Under Counter Storage		■	■	■				■
Blast Freezers								■
Combo Cooler			■	■				
Reach-ins		■	■	■	■		■	■
Vertical Glass Door Freezer					■			
Wine Cooler					■			■
Multi Deck					■			
Island Freezer					■			



Source: Frost & Sullivan Analysis

Chart 5.24: Commercial refrigeration market growth projections, in value INR million,India, FY22-FY26E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

The freezers segment accounted for a volume share of an estimated 43% in Fiscal 2022 across the commercial refrigeration equipment market. This is due to expansion of the travel industry and opening of various food joints and restaurants. The segment also covers blast chillers that are mainly used for freezing or cooling of items at lower temperatures and stopping bacteria growth in the stored item. It also finds major applications

by healthcare professionals, to store tissue samples of vaccines and some critical medicines that need to be kept under stringent temperature conditions, is also contributing to the segment growth.

The Indian commercial refrigeration market is expected to witness an incremental growth till 2026, riding on the wave of increased in demand for frozen & chilled products among the consumers due to drastic changes in lifestyle and rapid urbanization being witnessed in the last decade. In addition, rapid growth in the organized retail sector, such as increase in number of hypermarkets and supermarkets, further boosts the overall sales of commercial refrigerators; thereby leading to the growth of the market.

Technological advancements and a growing number of quick service restaurants especially in a growing economy like India is providing numerous opportunities for the market to grow at a rapid rate.

There are certainly some concerns about the Russia Ukraine war and its impact on India. Certain high demand low supply trends seen along with supply chain disruptions may see some temporary shortage in supplies and this may indirectly have a negative effect on the prices in the short term.

Key drivers for Indian commercial refrigeration industry

- **Changing food habits**
- **Growth in Food Processing infrastructure**
- **Booming organized food retail and QSR segment**
- **Increase in usage of CR products in unorganized retail**

Chaging food habits

In India, people's lifestyles are changing as disposable income continues to increase. Consumers are increasingly valuing food safety and hygiene. With increasing exposure to the west, consumption of frozen items and ready to eat food items are increasing. Some obvious items that are seen to be stocked in refrigerators include, juices, cold drinks, ice cream etc. There is an increased demand for packaged food in the market. A lot of families instead of adventuring outside are now being experimental at home. Items like Paneer, baby corn, mushrooms, frozen peas, coconut milk and chocolate syrup were things that went into restaurant food earlier. Now they are part of a well-stocked home kitchen.

Growth in Food Processing infrastructure

Increasingly India is seeing availability of suitable food processing infrastructure being developed in the country in the face of cold chain, pack houses, etc. In order to address the growth of food infrastructure in the country Government is also implementing various schemes for infrastructure development including integrated cold chain facility.

Booming organized food retail and QSR segment

More and more people are preferring to shop at organized retail outlets. The presence of organized retail stores in the market has shifted the preferences of customers to various organized retail formats. Due to the changing demographics, urbanization, and awareness through electronic media especially internet the customers have multiple options to choose retail outlets. Majority of the customers are visiting organized

retail for product variety, easy availability, cleanliness with various additional facility like entertainment for children and convenient parking facility etc. A typically large retail outlet store is anywhere between 50,000 and 100,000 square feet and sells a wide range of fresh, frozen, and chilled foods, fruits and vegetables, dry groceries, personal and home care. Despite the spike in prices, the demand outlook for quick service restaurant (QSR) chains is quite positive. Many of the restaurants like Subway, McDonalds, and KFC are seeing an increase in demand for commercial refrigeration. It becomes easier for a QSR brands to enter the frozen food segment as they use standard process and recipes for quick turnaround of orders.

Increasing usage of CR products in the unorganized food retail segment

Cold chain infrastructure is growing across the unorganized retail sector as well. Traditional retail stores are increasingly using number of modern technological facilities including equipment's used to store cold drinks, ice creams and chocolates that need temperature-controlled equipment's. The local meat shops have started storing branded packaged products like salamis, sausages etc that require refrigeration to keep these items fresh.

1. LED Lighting, Controls and Drivers

Application of LED Lighting in Commercial Refrigeration products

LED lighting technology is quickly becoming the new standard and continues to replace the traditional incandescent and CFL lights previously used.

Chart 5.25: Lighting applications in Commercial refrigeration product

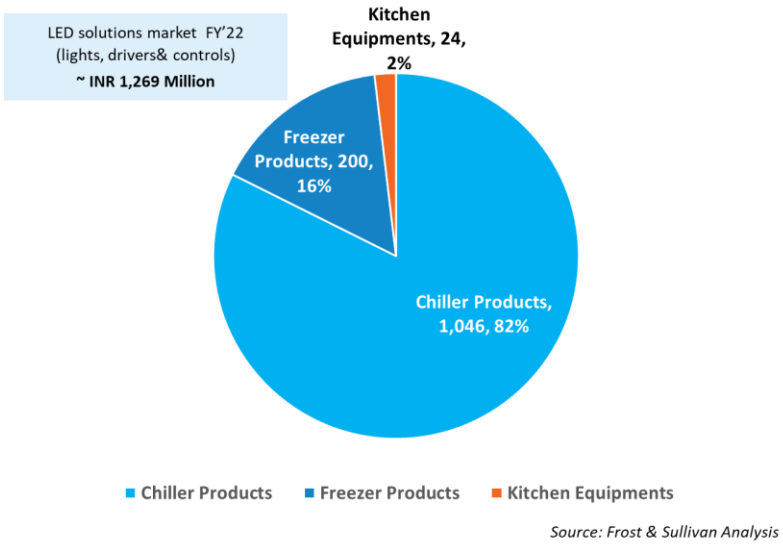
Commercial Refrigeration Category	LED Lighting Usage
Deep Freezer 	• LED Bulb & Strip lights used down inside the freezer when you open the freezer.
Water Dispenser 	• Small red/yellow led bulbs accompanied outside the freezer when plugged in. UV-LED light is installed in the cold-water tank to kill the bacteria
Visi Cooler 	• Visi cooler comes with a back lit canopy with LED tube
Water Cooler 	• LED Bulb lighting is used on the cooler to indicate whether the machine is running. When the water has been chilled, usually a small led bulb used.
Chest Cooler 	• LED Bulb & Strip lights are used either on the ceiling door of the cooler or down inside when you open the cooler, along with tiny led bulbs outside cooler
Chocolate Cooler 	• LED compact strip lighting used all around the
Freezer on Wheels 	• LED Bulb & Strip lights inside the freezer. • LED bulb accompanied on top of the walking freezer with small red/yellow led bulbs
Display Cabinet Coolers 	• Fitted with LED Strip lights all around the cabinet to show the product offering in an appealing way.
Under Counter Storage 	• LED Puck Lighting, Under Cabinet Lighting - used on the ceiling of the cabinets
Multi Decks 	• Below lower shelf, on the sides

Cold Rooms		▪ Flood lights, cold storage lighting - used on the ceiling of the room
Blast Freezer		• LED backlights to be used at the back lid of the freezer
Combo Cooler		• LED Bulb & Strip lights are used on the ceiling door of the cooler or down inside when you open the door, along with tiny led bulbs outside cooler
Glass Door Freezer		• LED tube or tube lights – used on the sides of the freezer on the inside
Wine Cooler		• LED backlights to be used at the back lid of the cooler and on ceiling of the door
Reach- Ins		• LED panels and strip lights inside the reach-ins while digital LED display boards on front in some models
Island Freezer		• Large LED tube panel lights attached in every row of the freezer, small LED power bulbs attached at the sides and bulbs at the bottom of the freezer

Current Lighting solutions market in Indian Commercial refrigeration Industry

LED lighting has quickly become the industry standard for lighting systems in both commercial and residential applications. The potential for LED lighting in commercial spaces is mostly due to the high level of energy requirement of many businesses. Restaurant and retail spaces that operate coolers and refrigerators tend to use lots of energy for lighting up products and keeping inventory organized. Increasingly, commercial refrigeration products are also indigenously made, and such trend is expected to significantly reduce India's dependence on imports of commercial refrigeration products.

Chart 5.26: Lighting solutions market by types of CR products, value in INR million, India, FY22



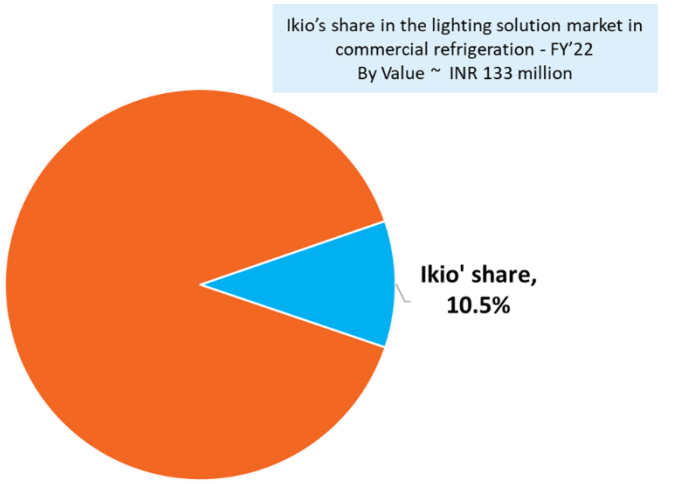
Source: Frost & Sullivan Analysis

As per Frost and Sullivan analysis, the total market potential for lighting solutions (lights, drivers, and controls) in commercial refrigeration segment is valued at approximately INR 1,270 million (USD 16.7 million) in FY2022. The Covid-19 pandemic has given a much-needed boost to the sector and demand for commercial refrigeration is growing especially in healthcare, pharmaceuticals, and food processing industries.

Ikio's current market share

In Fiscal 2022, Ikio's contribution to the lighting solutions market was valued at INR 133 million (includes Lights, drivers, and controls) with a market share of approximately 10.5%.

Chart 5.27: Ikio's share in Commercial Refrigeration lighting solutions market, in %, India, FY22



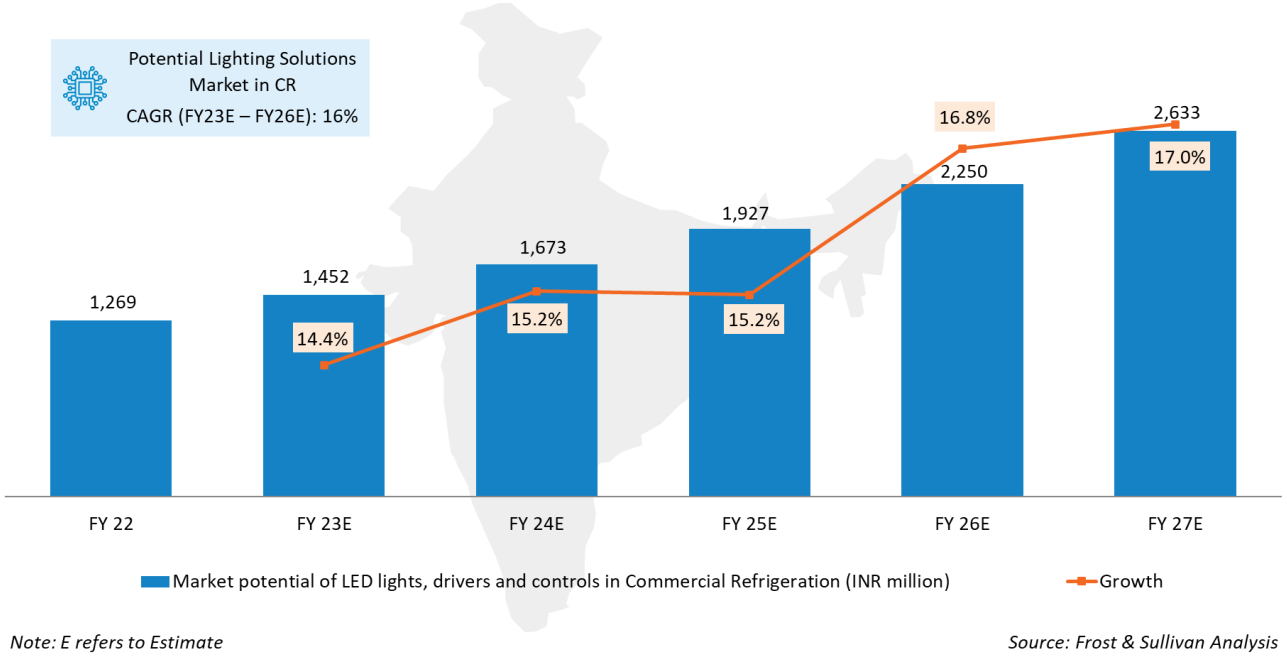
Source: Frost & Sullivan Analysis

Potential for Lighting solutions business in Indian Commercial refrigeration Industry

Lighting solutions business in the Commercial refrigeration segment is poised to grow at a CAGR of 16% from INR 1,269 million in FY2022 to INR 2,633 million in FY2027. This growth can be contributed to the following factors:

1. Share of domestic manufacturing in the commercial refrigeration segment is steadily increasing – This is primarily due to Indian Government's 'Make in India' focus and implementation of various favorable policies. Schemes such as PLI is driving investment in manufacturing in the country. Besides, Indian Government is providing various SOPs (Standard Operating Procedures) for establishment of export-oriented units. Many global suppliers, such as Frigoglass, Arneg, Hoshizaki, have already set up plants in India to cater to the global markets and others are likely to follow suit. There is a shift among the Indian customers towards 'Made in India' products. Recent events in China have forced many global suppliers to look at India as an alternative manufacturing destination.
2. Higher usage of lighting products in the commercial refrigeration products – While lights are already used in products that retail customers directly interact with, such as Visi Coolers, Multi Decks, Display Cabinets, Chocolate Coolers, Wine Coolers etc., lighting usage is comparatively much lesser in products such as Chest Freezers, Chest Coolers, Water Coolers, Water Dispensers etc. Lighting suppliers are working with commercial refrigeration manufacturers to include lights in these products to improve aesthetics and retail appeals.

Chart 5.28: Projected growth in Lighting solutions business in Commercial Refrigeration segments, in INR million, India, FY23E-FY26E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

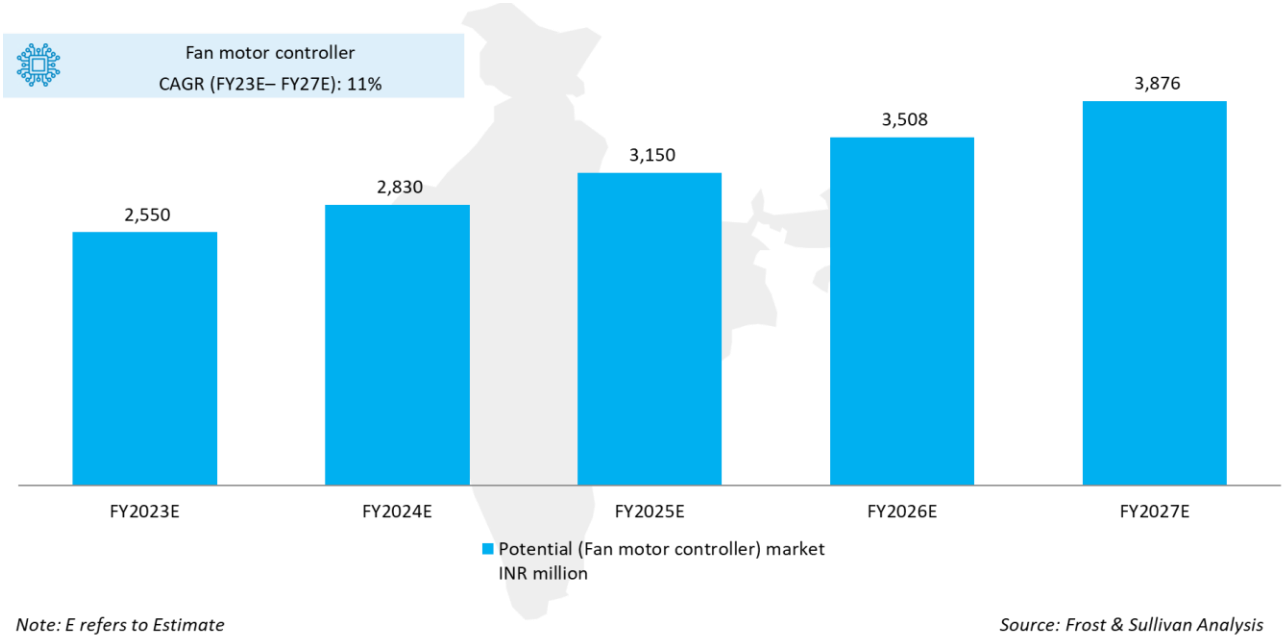
2. Fan motor controller

Nowadays, energy efficiency is not a choice but an absolute necessity to tackle the burgeoning issue of climate change. Governments across the world have developed their low carbon growth strategies and defined timelines to become carbon neutral. These targets have then become mandates for corporates and institutions to adopt various types of efficient and sustainable measures to curb greenhouse gas emissions. Bureau of Energy Efficiency or BEE, the designated authority to drive energy efficiency efforts in India, is in the process of introducing star labelling for commercial refrigeration products.

Commercial refrigeration products are energy intensive and account for a significant share of a retailer's operating cost. This led to various technological developments and innovations in the commercial refrigeration Industry. Fan motor controller is one of such innovative products which helps to achieve significant savings in electricity through controlling the fan speed.

Accordingly, use of fan motor controller can help the commercial refrigeration products suppliers to achieve higher star labelling for their products. Assuming that Fan motor controller would be an absolute necessity in all the commercial refrigeration products manufactured in India (100% adoption), the estimated market potential for fan motor controller in the commercial refrigeration segment is approximately INR 2,550 million in FY2023 and is expected grow at a CAGR of 11% to reach INR 3,876 million in FY2027.

Chart 5.29: Market potential for Fan Motor Controller in Commercial Refrigeration segment at 100% adoption, in India, value in INR million, FY2023E to FY2027E



Note: E refers to Estimate

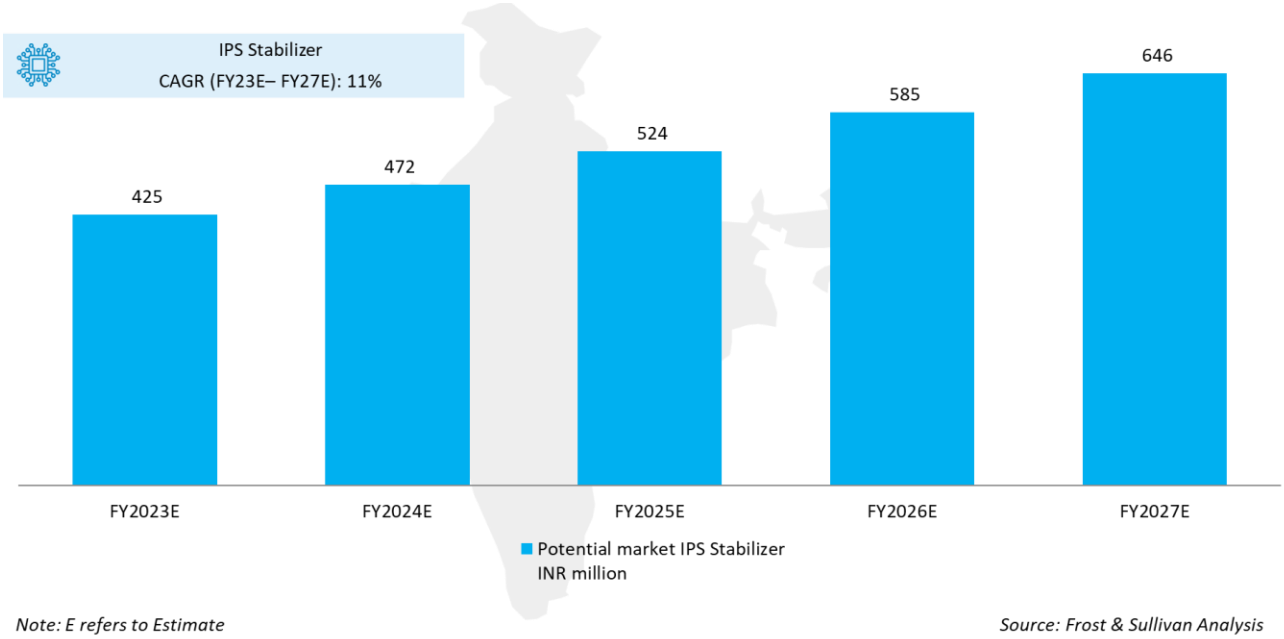
Source: Frost & Sullivan Analysis

3. IPS Stabilizers

An IPS stabilizer is a device used to sense inappropriate voltage levels and correct them to produce a reasonably stable output where the load is connected. Various consumer electronic products, such as televisions, washing machines, usually come pre-installed with an internal stabilizer. Given its benefits, Ikio is planning to introduce an IPS stabilizer for the commercial refrigeration segment. Even though the input voltage is quite stable in metro and tier 1 cities, this product will save the internal circuits of the commercial refrigeration products in case of any eventuality. Considering price of this stabilizer, it is expected that the introduction would be well accepted in the market and the product will enable commercial refrigeration products suppliers to position their products from their counterparts.

Assuming that IPS stabilizer would be an integral part of all the commercial refrigeration products in the manufactured in India in the coming years, the estimated market potential for IPS stabilizer in the commercial refrigeration segment is approximately INR 425 million in FY2023 and is expected grow at a CAGR of 11% to reach INR 646 million in FY2027.

Chart 5.30: Market potential for IPS Stabilizers in Commercial Refrigeration segment at 100% adoption, in India, value in INR million, FY2023E to FY2027E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

D. USA RECREATIONAL VEHICLE SEGMENT

Overview of US Recreational Vehicle market

A recreation vehicle (RV) is designed as a temporary living space for travel, camping, and seasonal use. Recreational Vehicles may have their own motor power (motorhomes), be mounted (truck campers) or towed by another vehicle (travel trailers, fifth wheel trailers, folding camping trailers). These Recreational Vehicles typically retail in the range from about USD $5,000 for towable models (folding camping trailers) to USD $500,000 or more for motorhomes (Type A motorhomes). The variety of options available in the Recreational Vehicle space allows them to appeal to a wide range of consumer preferences and income levels.

In addition to their recreational use, Recreational Vehicles may also be used for many commercial and other purposes such as use as mobile offices, medical clinics, bathrooms, laundries, food trucks etc. They can also be used for temporary shelter for aid workers and contractors or for families that have lost their homes.

Types of Recreational Vehicle – Market Segmentation

Based on Vehicle, the market is bifurcated into Motorhomes and Towable Recreational Vehicles. There is a rapidly growing market for towable Recreational Vehicles due to their affordability and low cost over motorized Recreational Vehicles.

It is observed that the gasoline segment growth rate is propelled by its higher RPM advantages in passenger vehicles. It is also observed that there is a preference towards Gasoline as it is more combustible than diesel, therefore enhancing the engine power significantly.

Chart 5.31: Various types of recreational vehicles






RV TYPE	Conventional Travel Trailer	Fifth Wheeler	Truck Camper	Class B Motorhome	Class C Motorhome	Class A Motorhome
Approximate Percentage of Annual Sales	55%	19%	3%	4%	9%	7%
Approximate Percentage of Installed based	38%	20%	5%	7%	12%	10%
Type	Towable RV			Motorhomes		

Travel Trailer: A travel trailer is the least expensive way to enjoy a recreational vehicle or Recreational Vehicle. Travel trailers sell more than any other form of recreational vehicles in the market. Travel trailers are very popular as they are easy to park at a campsite and then also explore the area while the Recreational Vehicle stays where you parked it. Some of the popular brands here include Forest River, Keystone, Jayco, Coachman, Heartland etc.

5th Wheel: One popular choice for travelers of all kinds is 5th wheel campers. A 5th wheel camper is a camping trailer that is pulled behind a truck and attached to the truck via a hitch mounted in the center of the truck bed. Fifth wheels are a common option for full-time RVers with families because they are spacious, often have more storage space, and are easier to tow – which is helpful when driving often. Some of the key players in this segment include Key stone, Forest river, Grand Design, Jayco, Heartland etc.

Truck Camper: Truck campers are usually considered the most versatile form of recreational vehicle. They can go virtually anywhere a pickup truck can go. Technically speaking, any Recreational Vehicle that can be easily dismounted from the carrying vehicle qualifies as a truck camper. Major players here include Forest River, Coachman, Columbia Northwest, Jumping jack etc.

Class A: A-Class Motorhomes or Class A Motorhomes are the most popular in the motorhome category, as they offer several advantages over other classes. A-class motorhomes are luxury vehicles and are very spacious on the inside for families. Thor motor coach, Tiffin, Newmar, Winnebago, Forest River etc. are key names in the Class A category of recreational vehicles.

Class B: Class B motorhomes are the smallest motorhome type. They are also known as van campers and look like an oversized family van on the road. Class B motorhomes range from 18 to 24 feet long, sleeping up to four at a time and often start around USD $50,000. Class B motorhomes offer a smaller cabin for owners than Class A or Class C motorhomes. Prominent players include Winnebago, Erwin Hymer, Coachman, Pleasure-way, Airstream etc

Class C: Class C motorhomes are the middle ground between Class A motorhomes and Class B motorhomes. They look like a larger version of the van camper with an overhead cabin above the driver and passenger seats for extra sleeping or storage accommodations. Class C motorhomes range from 30 to 33 feet long, sleep up to eight and start around USD $65,000. Class C motorhomes give you more space than Class B motorhomes and come with all the luxuries you'd expect in a Class A motorhome. Dominant players include Thor, Jayco, Forest River, Coachmen, Winnebago.

Key participants in the US Recreational Vehicle market – Sales Trend

This statistic shows the number of shipments of recreational vehicles in the United States from 2020 to 2021. The number of Recreational Vehicle shipments rose from 430,000 in 2020 to 600,000 in 2021.

Forest River, a unit of multinational conglomerate Berkshire Hathaway Inc., accounted for 27% of travel trailer sales in 2021. Forest River (excluding its Coachmen, Palomino, Prime Time, and Shasta subsidiaries) accounted for 25.4% in 2020. Keystone was second in travel trailers, with a 12.6% market share last year, compared with 13.8% in 2020.

Following this was Thor's Jayco Inc. subsidiary, which also lost market share, dipping to 9.6% in 2021 from 10.3% in 2020. (Jayco's market share figure does not include its Highland Ridge or StarCraft subsidiaries.).

In fourth place in travel trailers was Forest River's Coachmen subsidiary with 6.0% market share in 2021, versus 5.7% in 2020. Rounding out the Top 5 in travel trailers last year was Thor's Heartland subsidiary, which achieved a 5.7% market share, compared with 6.5 % a year earlier.

In fifth wheels, Keystone maintained its top spot even though its retail market share slipped a little lower to 24.4% in 2021, from 24.9% in 2020. Forest River was second, compiling a 19.6% market share in 2021, up from 19.0% in 2020.

The other Top 5 fifth wheel builders were Winnebago Industries Inc.'s Grand Design subsidiary, which gained over two percentage points in market share to reach 16.0% last year, from 13.7% in 2020. Meanwhile, Jayco's fifth wheel market share was flat at 8.8% the last two years while Heartland finished fifth at 6.7% in 2021, versus 7.8% in 2020.

Chart 5.32: Sales trends of recreational vehicle by segments, in %, USA, CY20 and CY21

Source: Frost & Sullivan knowledge repository

In motorhomes, Thor Motor Coach (TMC) was the market share leader once again in Class A's and Class C's, despite losing significant amounts of retail market share in both product categories.

TMC held 21.9% of the Class A market when gasoline and diesel engine units are combined. It had 28.8% of the gas-only market. Tiffin Motor Homes Inc. was second in the combined gas and diesel Class A market, increasing to 15.5%. Winnebago's recently acquired Newmar subsidiary was third in the combined gas and diesel Class A segment at 11.6% while Winnebago-brand placed fourth at 9.7%. Forest River, excluding its Coachmen and Dynamax subsidiaries, placed fifth at 9.2%.

Target segment for Ikio – Commercial Trailer

The focus for Ikio remains on the commercial trailer segment which makes up approximately 55% of the total recreational vehicle market sales in CY 2021. The total sales of commercial trailers in USA stands at approx. 330,000 units in CY 2021 growing at approx. 40% between CY 2020 and CY 2021

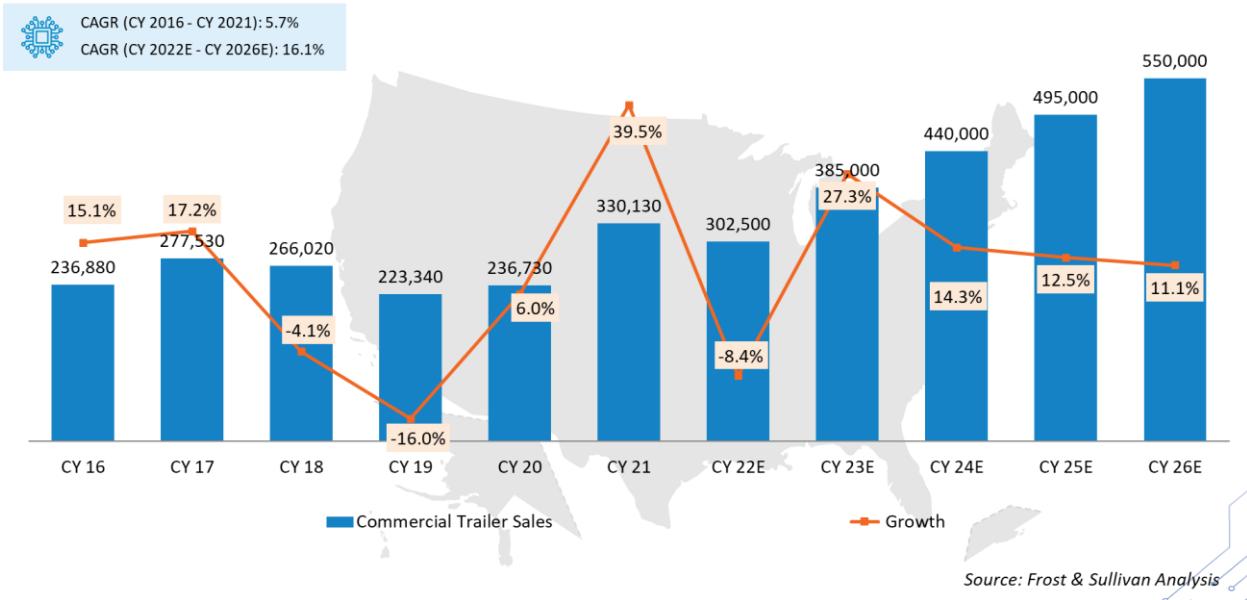
Trailers are the entry levels Recreational Vehicles and are by far the least expensive way to get a recreational vehicle (RV). Typically, owners of these commercial trailers often have an SUV or truck to haul them around. They're much cheaper and simpler to own than any other Recreational Vehicle out in the market and they are quite versatile and come in a wide range of designs, sizes, and prices.

People are also preferring Commercial trailers as they can continue to use their primary vehicle that hauls these trailers around and not use them solely as a coach. They are also easier to maneuver especially when one is navigating around downtown roads that are usually narrow or even going through a drive-through.

Commercial Trailer market size and growth forecast CY15-CY26E

The sales of commercial trailers were not affected as much as the other categories in CY20 which was the pandemic year. The commercial trailers witnessed a significant growth in the demand in CY21 as well, due to relaxation in travel restrictions.

Chart 5.33: Projected growth in Commercial Trailer sales, volume in units, USA, CY15-CY26E



Source: Frost & Sullivan Analysis

The rise in entry level RVers and Campers wanting to maintain social distancing was also a contributing factor towards the growth of this market.

Key growth drivers for Commercial Trailer market in the USA

- **Rapid expansion of tourism industry**
- **Advances in technology**
- **Increasing number of recreational parks**
- **Surge in commercial trailer rental services**
- **America the beautiful initiative from US Government**
- **Developing trail network**

Rapid expansion of tourism industry: There is increasing emphasis on travel and tourism globally which is providing an opportunity for the recreational vehicle market to expand in USA. There is a rising demand coming especially from Gen Z which is preferring to camp outdoors more frequently.

Advances in technology: Rampant changes in technology are expected to continue to be a major driver of commercial trailer market growth. The US commercial trailer and camper industry have experienced many technological advances in the last decade and this trend is expected to intensify. Features such as biometric vehicle access, comprehensive vehicle tracking etc. are expected to drive the commercial trailer market during the forecast period.

Increasing number of recreational parks: The North American Recreational vehicle market is likely to dominate and may expand due to the rapidly growing number of recreational parks, national parks, and camping ground in the country. Indicatively, there are approximately 13,000 privately owned and 1,600 public campgrounds within the United States which enables individuals to go for outdoor activities by camping within their recreational vehicles.

Surge in recreational vehicle rental services: The trend of outing on weekends with family is increasing by the day because of the hectic and busy schedule in corporate industry. This also raises the demand for recreational vehicles. Therefore, surge in recreational vehicle rental services helps to drive the growth of the market. Surge in recreational vehicle rental services, increase in the use of recreational vehicles in film industry. The demand for the recreational vehicle is majorly increased by the film industry owing to the remote locations of film shooting.

America the beautiful initiative: As part of the Presidents America the beautiful initiative, the Government has launched an agency called the Federal Interagency Council on Outdoor Recreation (FICOR) that works towards creating more safe, affordable, and equitable opportunities for Americans to come outdoors. Investing in creating recreation infrastructure, such as electric vehicle charging stations, trails, campgrounds, and boating access are initiatives that are likely to boost market for Recreational vehicles.

Developing trail network: The US Government has recognized the importance of outdoor recreation is working towards developing and expanding trail networks in the country that is sure to attract overnight visitors and new businesses.

LED Lighting and associated products business in Commercial Trailer segment

Chart 5.34: Ikio's offerings in the Commercial trailer segment

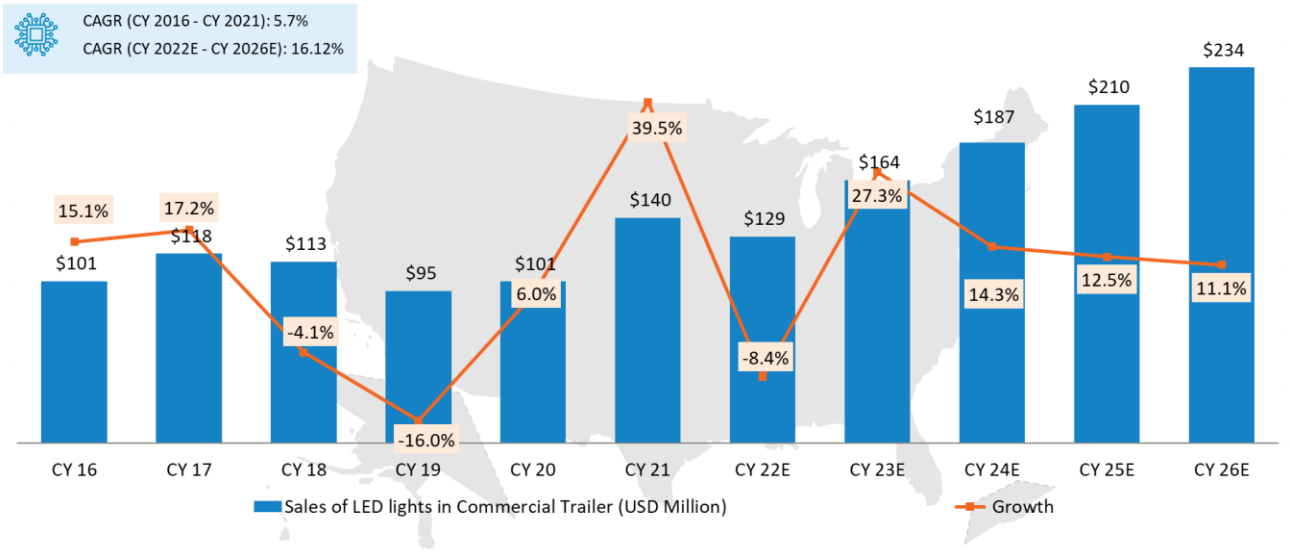
PRODUCTS SUPPLIED BY IKIO IN THE RV SEGMENT		
ABS Pipes		• ABS, or acrylonitrile butadiene styrene, is a plastic pipe that is generally used for indoor or outdoor plumbing, generally as a drain, waste, or vent pipe as well as sewer pipe and electrical wire insulation • ABS is more flexible and impact resistance then PVC it also performs better at colder and hotter temperatures then PVC which becomes brittle
Solar Panels		• A solar panel setup can be a cost-effective, environmentally friendly, and convenient way to use electricity on the go. • Solar panel systems generally require little to no maintenance and provide a dependable source of electricity when the sun is shining
Charge Controllers		• The solar charge controller is a critical component in your RV solar system. The controller maintains the life of the battery by preventing overcharging. • When your batteries are low, the controller provides a full flow of current from your solar panels to replenish your battery
Switches		• RV Lighting Switches, RV Dimmer Switches, Slide-Out Switches, RV Water Heaters Control, RV Multi Purpose Switches, RV Switch Faceplates, RV Switch Indicator Lights, RV Battery Switches.
Interior Lights		• RVs internal light mainly include ceiling dome, bulb dinette light, simple pin up light, recessed lights, map lights, Puck lights
Exterior Lights		• Exterior LED lights are a great way to brighten up the night wherever you may have decided to park. They also help give clarity to unfamiliar surroundings.

Potential for Ikio's LED lighting and associated business in the Commercial Trailer segment

The recreational vehicle market is a growing industry in the USA. At present, Ikio's revenue in recreational vehicle market is miniscule. Their primary target is to focus on commercial trailers which are estimated to make up approximately 55% of the total recreational vehicle market sales in CY 2022. The total sales of commercial trailers in the USA stands at approx. 330,000 units in CY 2021 and is projected to sell approx. 302,000 units in CY 2022. The average cost of a commercial trailer is estimated to be approximately USD $60,000, which grew at a CAGR of 8.2% to reach INR 1,505 billion (USD 20 billion) in CY 2021 and is expected to grow at a CAGR of 16.1% to touch INR 2,500 billion (USD 33 billion). Owing to the growing popularity of the need for a comfortable vehicle coupled with the need for accommodation for short distance travels, steady increase of campgrounds with multiple facilities, including hiking, fishing, along with scenic landscapes, does provide this market good opportunity to grow.

Ikio sells products worth approximately USD $425 in the commercial segment – These products include interior & exterior lights and associated products such as ABS pipes, solar panels, charge controllers, switches. In CY 2022, the total addressable market for LED lighting and associated products in the Commercial trailer segment has been estimated at approx. INR 9,770 million (USD 129 Million). With the current pricing and growth potential of commercial trailer till 2026, this represents a business potential of INR 17,765 million (USD 234 Million) by CY 2026 – with an anticipated CAGR of 16.1%

Chart 5.35: Potential for Ikio's LED lighting and associated products business in Commercial Trailer segment, value in USD million, USA, CY15-CY26E



Source: Frost & Sullivan Analysis

E. LITHIUM-ION BATTERY SEGMENT

The beginning of the Li-ion battery

For many years, the only suitable battery for portable equipment, such as mobile computing and wireless communications was nickel-cadmium. Pioneer work on the lithium battery began in 1912, however it wasn't until the 1970s when the first non-rechargeable lithium batteries became commercially accessible.

By 1991, Japanese companies Asahi Kasei and Sony started mass-producing the lithium-ion battery and applying it to many of their electronic products, with more scientists and engineers perfecting the technology throughout the 90s and up to today. Despite being slightly lower in energy density than lithium metal, lithium ion is extremely safe when charged and discharged following specified safety precautions.

Global market for Li-ion batteries

The global lithium-ion battery market is projected to grow from USD 46 billion in CY 2021 to USD 93.13 billion by CY 2028, exhibiting a CAGR of 15%. The lithium-ion battery market was moderately impacted by the COVID-19 pandemic in the first quarter of CY2020, primarily due to the lockdowns that were imposed which restricted the supply of batteries and other components due to severe disruptions in businesses and the global economy. In the future, factors such as lithium-ion's declining prices, increasing demand for fuel-cell electric vehicles, government subsidies, and financial incentives for lithium-ion battery manufacturers are expected to drive the growth of the market. In particular:

- The automotive batteries segment is expected to be one of the major applications for lithium-ion batteries, owing to the increased adoption of electric vehicles during the forecast period.
- The shift toward lithium-ion batteries in the material handling industry is expected to create a significant number of opportunities for the market studied. Demand for a more efficient supply chain in warehouse operations, is a trend that's sparking interest in alternative power solutions for industrial trucks. One of the alternatives to the traditional lead-acid battery is the lithium-ion battery

that has captured the market's attention. Businesses are working towards improving efficiency and creating more productive warehouse operations and are gradually making the switch to lithium-ion batteries for their lift trucks etc.

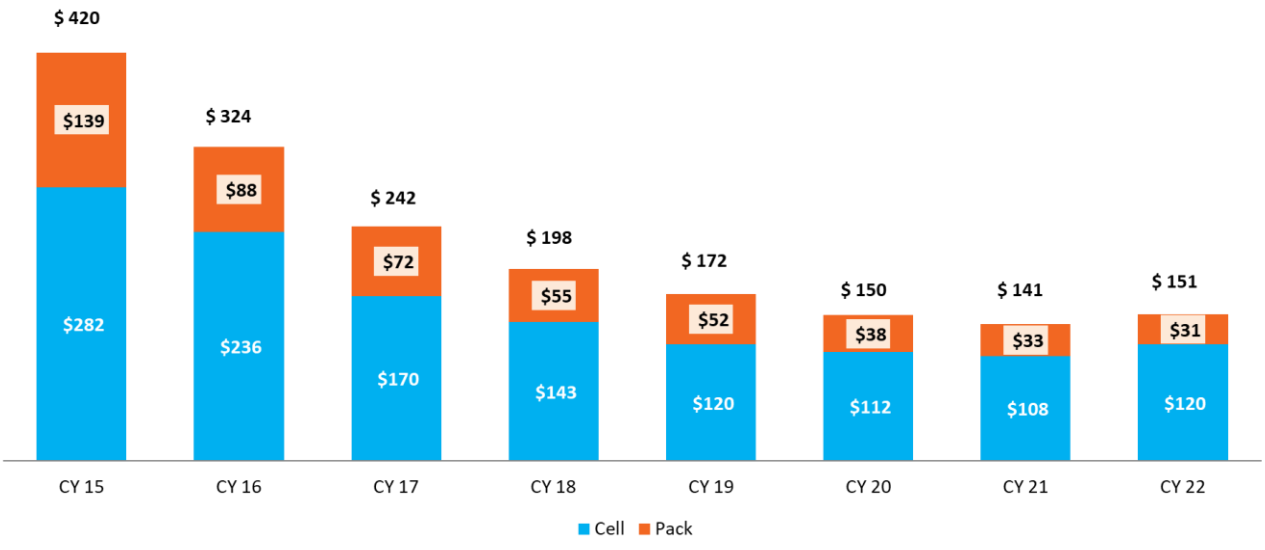
- The US government has been encouraging investments in both the EV and renewable industries, resulting in increased demand for battery-based energy storage systems, primarily led by lithium-ion batteries.

Price trends of Lithium Ion-Batteries

After declining steadily since 2010, the average price of battery packs across sectors has risen to $151/kWh in CY2022 which is a 7% rise from the year before. The current price increase can be attributed to the surging raw material prices and battery component cost along with inflation. Region-wise battery pack prices were cheapest in China at $127/kWh, while packs in the United States and Europe were approximately 24% and 33% higher than China, respectively.

Prices could have risen further if not for the higher adoption of the low-cost cathode chemistry of lithium-ion phosphate and continued reduction of expensive cobalt in nickel-based cathodes. Battery prices are expected to drop again in CY2023 - 2024 as more extraction and refining capacities are expected to come online. Average prices are expected to fall below $100/kWh by CY 2026. Continued investment in R&D, making improvements in manufacturing processes, and capacity expansion across the supply chain will help to improve battery technology and reduce costs over the next decade.

Chart 5.36: Average price of lithium-ion battery pack and cell price split, value in USD/kWh, USA, CY15-CY22



Source: Frost & Sullivan Analysis

North America Lithium-ion battery market - Key trends

Automotive Batteries Expected to be the fastest growing Segment

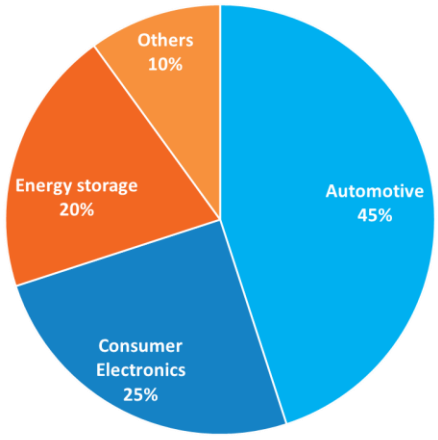
The automotive sector is expected to be one of the major end-user segments for lithium-ion batteries over the coming years. The penetration of electric vehicles is anticipated to provide a massive impetus for the industry's growth in North America. A range of different vehicle types is available, featuring an increasing

degree of hybridization and electrification. The adoption of electric vehicles is increasing at a high rate. The United States is already among the leading countries in global EV sales, along with other economies like Canada, which has already begun transforming its public transportation infrastructure to electric.

Programs such as the “National Blueprint for Lithium Batteries," developed by the Federal Consortium for Advanced Batteries, aims to guide investors to develop a domestic lithium-battery manufacturing value chain in the United States. Therefore, falling lithium-ion battery prices and improving technology are expected to bring price-competitive electric vehicles to the market, creating demand for lithium-ion battery technologies in the near future.

Recreational vehicle lithium rechargeable batteries have become a popular alternative to lead-acid batteries, particularly for recreational vehicle users who spend a lot of time off the grid and/or who use solar power. Recreational Vehicle lithium batteries are based on a newer, more efficient lithium-ion technology known as lithium iron phosphate (or LiFePO4 for short). Not only do these lithium Recreational Vehicle batteries have a significantly longer lifespan than lead-acid batteries do, they’re also lighter. As these batteries are lighter, they’re more efficient and can be recharged faster.

Chart 5.37: Market share of lithium-ion batteries by application, in %, North America CY2022



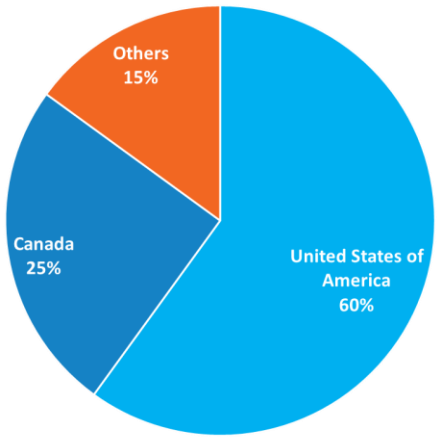
Source: Frost & Sullivan Analysis

The United States of America is Expected to Dominate the Li-ion battery Market in North America

The United States is one of the pioneers in research and innovation in the global battery market. The region also remains one of the largest consumers of batteries, i.e., both primary and secondary battery types, owing to increased electric vehicle deployment, increased spending on consumer electronics, and increased consumer and manufacturing activities.

Recreational vehicle OEMs rely on electrical components, owing to their output efficiency and lightweight; thus, making recreational vehicle electrification a fuel economic solution. Furthermore, electrification is the future step as the majority of the manufacturers are integrating several components and features that operate through the battery input to cope with green mobility requirements. In addition, batteries are a significant part of the recreational vehicle that supplies the electricity input to various electrical components required for effective functioning.

Chart 5.38: Market share of lithium-ion batteries by Country, in %, North America, CY2022



Source: Frost & Sullivan Analysis

In 2021, the United States Department of Energy (DOE) announced a new set of policies aimed at manufacturing the key components of advanced lithium-ion batteries. The new policies mandate projects receiving federal support (USD 200 million) to support battery technology and require the manufacturing of [battery] products within the United States.

Therefore, the country is likely to be the dominant player in the North American lithium-ion battery market, supported by increasing urbanization and consumer spending, which are expected to ramp up the demand for technically advanced devices and vehicles due to the benefits provided by the same. Consecutively, this is expected to boost the usage of batteries. The key players in the market include Tesla Inc., LG Chem Ltd, Panasonic Corporation, Duracell Inc., and Samsung SDI Co. Ltd, among others.

1. Li-ion Battery business in Recreational Vehicle Commercial Trailer segment in North America

Ikio's focus remains on the commercial trailer segment, which made up approximately 55% of the total recreational vehicle market sales in CY2021 in the USA. The total sales of commercial trailers in the USA stands at approx. 330,000 units in CY2021, growing at approximately 40% between CY2020 and CY2021. However, sales took a hit in CY2022. The industry has significantly reduced production compared to last year. This is because of the recent economic slowdown that is adversely impacting several industries and the Recreational Vehicle space being no exception. This has led to a significant piling up of inventories. Apart from this, recession fears triggered by high inflation and rising interest rates have started to weigh on the industry. The increasing cost of financing recreational vehicles has also added to this decline is sales especially at a time when economic scenario is uncertain.

Drivers for usage of Li-ion Batteries in Recreational Vehicles in US

Lithium-Ion batteries for recreational vehicles need to be exceptionally durable, reliable, and powerful. Growing electrification and increasing recreational activities across the globe are the key factors expected to influence the demand for recreational vehicles (RVs) batteries in the near future. Lithium-based recreational vehicles (RVs) batteries have high density and improved capacity as compared to lead acid and other types of

batteries. In addition, the demand for recreational vehicles (RVs) batteries is directly influenced by the changing momentum of the recreational vehicle industry.

More Energy Efficient

Lithium-ion batteries are more energy-efficient, meaning that a user can use more of the battery's energy. Because they have such low internal resistance, charging is highly efficient. In essence, energy equals energy out with lithium-ion batteries.

Longer life span

Any battery degrades as it gets used over time. Lead-acid batteries, however, degrade much more quickly than lithium-ion batteries. Recreational Vehicles of the past have had to replace batteries every few years or sooner due to poor maintenance or use. With lithium-ion batteries, thinking of a battery as a lifetime asset of the Recreational Vehicle is not unreasonable.

A lithium-ion battery can last 10-40 times longer than a lead-acid battery. Many will see 5,000 usable complete discharges and thousands of cycles more with lighter use. In a Recreational Vehicle, this would equate to 20 years or more of service.

Enhanced Safety

The technology behind batteries has improved to the point that lithium batteries are a very safe option for Recreational Vehicles. Batteries based on the LiFePO4 technology are inherently safe and have additional protection within battery management system (BMS).

If a lead-acid battery shorts out, it can cause an explosion, burns, and fire. However, the BMS of our lithium-ion batteries will shut down and prevent this.

There is no maintenance on these batteries, and they will not produce any gases or spill any liquids. The materials that LiFePo4 batteries are made from are also non-toxic. Overall, an Recreational Vehicle with an adequately designed Li-Ion battery will be much less prone to the dangers lead-acid batteries pose.

More cost effective

Lead-acid batteries come with a much lower up-front cost, but a lithium-ion battery is much more cost-efficient over the life of the batteries. The lithium-ion batteries' capacity is much denser than their lead-acid counterparts, meaning they can store more energy in the same physical space. The depth of discharge of a lithium-ion battery can safely reach 85% or more. Lead-acid batteries have a shorter lifespan if discharged below 50%. Not only can you get more energy storage into a given space with lithium, but more of that stored energy is available for actual use.

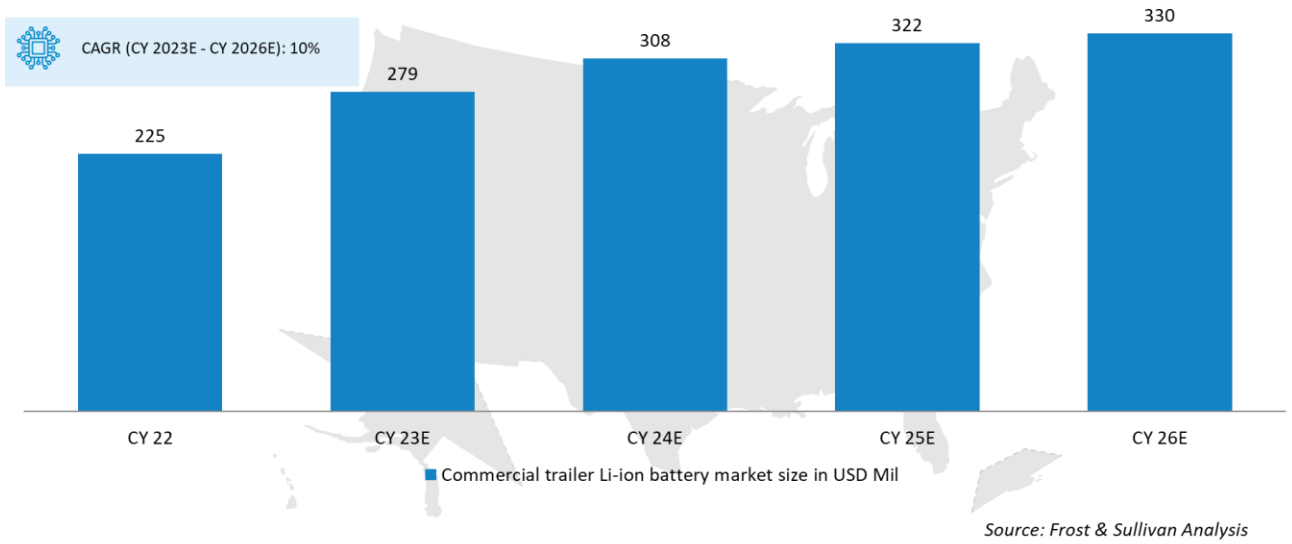
Lithium batteries have a longer lifespan, which also helps level the playing field when it comes to price. A quality lithium-ion battery can last a minimum of 10 times longer than a lead-acid. Thus, the lifecycle cost of lithium batteries is much lower than alternative batteries of the past.

Addressable market

Based on loading capacity, 50 Ah to 200 Ah (Ampere hours) rating Li-ion batteries are used in commercial trailers. The current price of a 50 Ah battery is approximately US$500, and price of a 200 Ah battery is approximately US$1000. For business potential calculation, the average price of lithium-ion battery has been considered as US$750 in CY2022. The average price is expected to drop to US$600 by CY2026 as the

technology is achieving mass adoption and economies of scale. The addressable market for Ikio in this segment is US$225 million in CY2022 and is expected to grow at 10% CAGR to US$330 million by CY2026.

Chart 5.39: Li-ion Battery addressable market, US Recreational Vehicle, Commercial Trailer segment, value in USD Million, CY2022 – CY2026

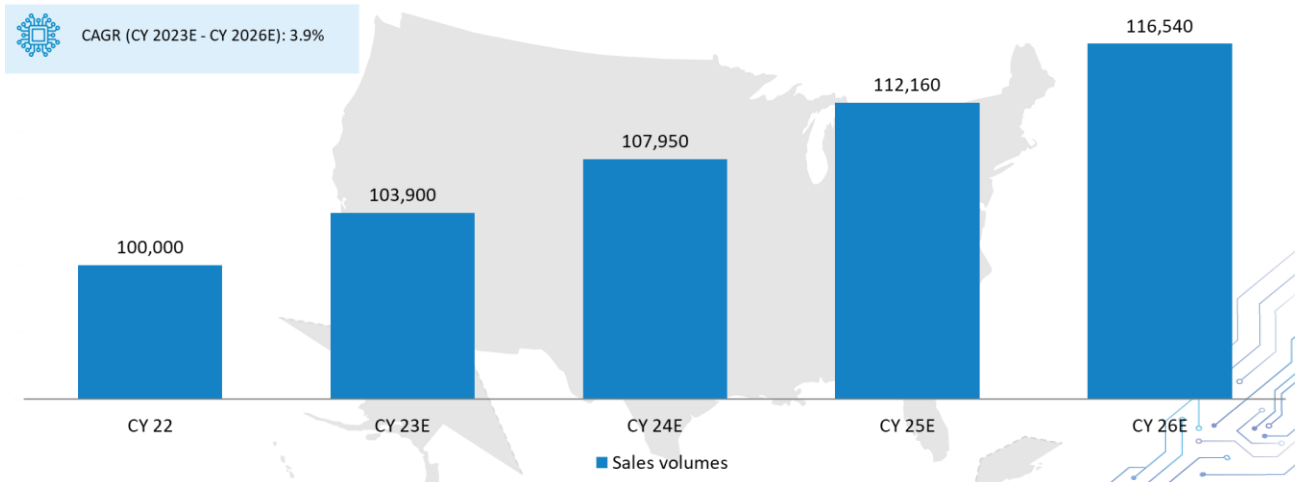


Source: Frost & Sullivan Analysis

2. Lithium-Ion Battery business in US Golf Cart segment

The price of golf carts in the United States can range anywhere between US$9,000 to US$18,000. Considering an average price of approximately US$13,000 and an estimated 100,000 golf carts sold in the United States in 2022, the size of the United States golf cart market is estimated at approximately US$ 1.3 billion in CY2022. It is expected that the golf cart market in the United States, in terms of volume sold, will grow at a CAGR of approximately 4% until CY2026.

Chart 5.40: US Golf Cart sales, volume in numbers, CY2022- CY2026E



Source: Frost & Sullivan Analysis

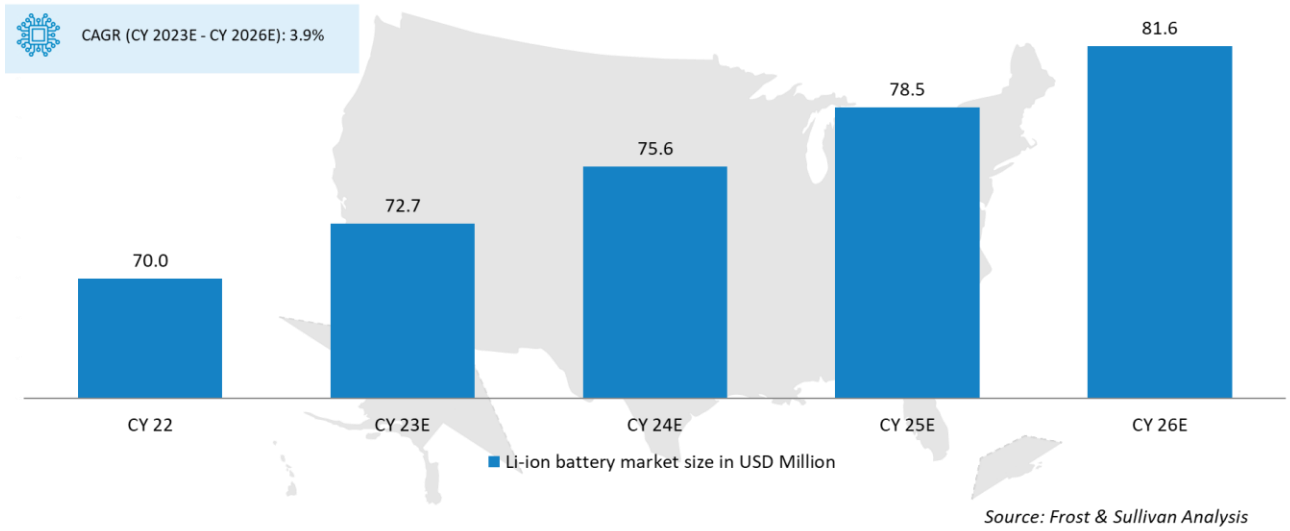
Addressable market

The demand for golf cart batteries is rising across the USA due to the widespread use of golf carts. Numerous 6V, 8V, or 12V batteries are used in golf carts as opposed to a single 6V, 8V, or 12V battery. By type, the lithium-ion segment dominates the market.

Adopting lithium-ion battery enables a golf cart to significantly increase its weight-to-performance ratio. Lithium golf cart batteries are half the size of a traditional lead-acid battery, which shaves off two-thirds of the battery weight. Lithium-ion batteries would typically offer lower depth of discharge, have the longest range, higher capacity, provides more charge cycles than the other voltage batteries and longer lifespan.

The golf cart market is expected to expand due to rising demand for low-speed vehicles for various uses, including short distance commuting in parks, business districts, colleges, malls, airports, and other places. Considering an average price of US$700 for a 100Ah 6V battery, the market for golf cart li-ion batteries is estimated to be approximately US$70 million in CY2022 and this market is estimated to reach approximately US$82 million by CY2026.

Chart 5.41: US Golf cart Li-ion battery market, value in USD Million, CY2022



Source: Frost & Sullivan Analysis

F. INDIAN SOLAR MARKET

Overview of the Indian Solar Market

Indian renewable energy sector is the third most attractive renewable energy market in the world, which is a key part of the energy transition[5]. Markets are ranked on attractiveness on the basis of their renewable energy investment and deployment opportunity. With the Indian government's increased support and improved economics, the Indian solar power sector has become attractive from an investor's perspective.

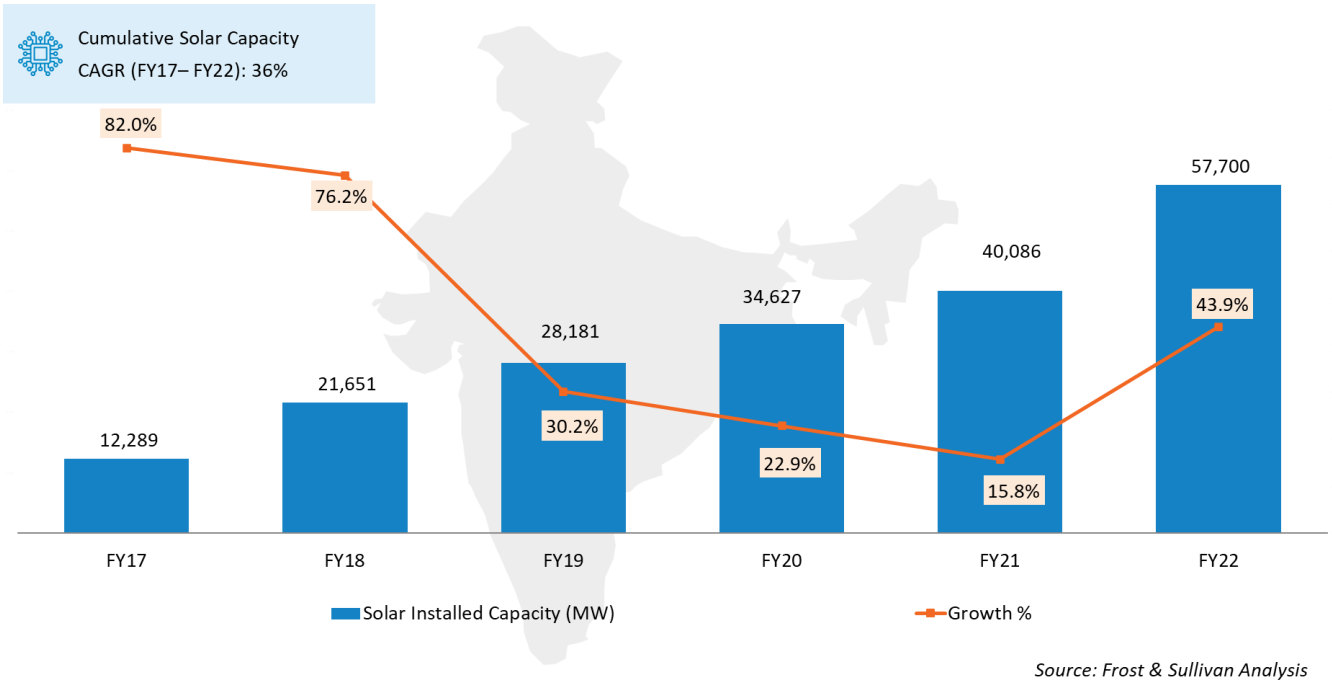
The use of solar power in India is growing at a rapid rate. The country's solar installed capacity has gained pace over the past few years. As of June 2022, India's installed cumulative solar energy capacity stood at 57.7 GW, representing nearly 50% of the overall installed renewable energy capacity of 114 GW. Solar power

[5] *Source: https://www.ey.com/en_in/recai*

installed capacity has increased by more than 22 times, from 2.63 GW in March 2014 to 57.7 GW at the end of July 2022. India has added 7.2 GW of solar power capacity, during the first half of 2022.

India is targeting an ambitious 450 GW of installed renewable energy capacity by 2030 of which about 280 GW (over 60%) is expected from solar. As announced in the COP26 conference held in November 2011, India has committed to generating 500 GW of power from non-fossil (e.g., solar, wind, hybrid power sources, hydrogen, biofuels, etc.) fuel sources by 2030, and reducing carbon emissions by one billion tons by the end of the decade.

Chart 5.42: Installed cumulative national capacity, in MW, India, FY17-FY22



Source: Frost & Sullivan Analysis

Measures were taken by Government to promote solar energy

As India is moving swiftly towards achieving its target of emerging global leader on the solar front, positive steps are to be taken to resolve the imports of important components like solar cells, modules, and solar inverters, that the Indian solar industry is considerably dependent upon.

Certain measures taken by the Indian government include the following: -

Import Duty: The Indian government has been taking several measures to promote local manufacturing under its 'Make in India' mission. As part of its moves to reduce imports, India imposed a 40% duty on the import of solar modules and a 25% duty on the import of solar cells in April 2022. This is expected to boost and promote domestic manufacturing substantially.

PLI Schemes: The Production Linked Incentive (PLI) Scheme was introduced by the Indian government, as an attempt to boost India's manufacturing capabilities and exports. Under the provisions of this scheme, manufacturers receive support from the government for establishing integrated manufacturing units of high-efficiency solar photo voltaic modules.

Bureau of Indian Standards Certification: The Indian government mandated the requirement of BIS certifications on all solar products, which will help set higher quality parameters for domestic manufacturers,

ultimately benefiting end customers.

Approved List of Models and Manufacturers: To protect the interest of customers and to also ensure the manufacturing of reliable PV modules, the Ministry of New and Renewable Energy had also introduced an Approved List of Models and Manufacturers (ALMM) of solar PV cells and modules. The above actions are expected to help India emerge as a leading global supplier of solar products, along with meeting its domestic requirements.

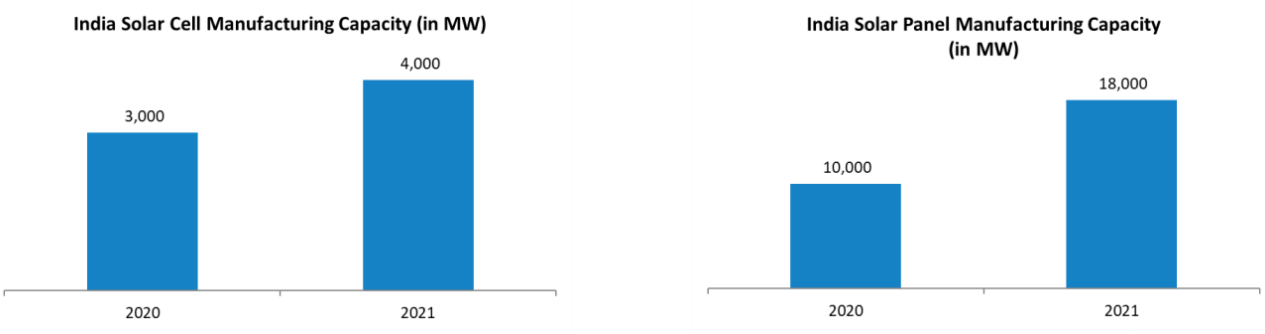
Solar panel manufacturing scenario in India

Along with leveraging its growing green energy market to boost manufacturing, India is also looking to play a bigger role in global supply chains. PLI schemes seek to create global manufacturing hubs in India by creating economies of scale to develop complete component ecosystems in the country.

With the introduction of 'Make in India' endeavors, India is looking to play a bigger role in global supply chains. Polysilicon is the building block for solar PV manufacturing from which ingots are cast. Wafers cut from ingots are then used to make solar cells, after which modules are assembled. Globally, the manufacturing of polysilicon, ingot, and wafers is dominated by China. A global price increase of fuels such as crude oil, gas, and coal has extended to solar space, with module prices reaching a high of 28 cents per kilowatt-hour (kWh) in 2021. With modules making up nearly 60% of a solar power project's total cost, any price increase will negatively impact the internal rate of return (IRR) of such solar power projects.

India is witnessing high growth in solar capacity additions, mainly driven by the recent economic recovery from the COVID-19 pandemic as well as various policies and incentive schemes imposed by the Indian government. India's cumulative manufacturing capacity for solar cells had increased at a CAGR of 33.3% from 3 GW in CY2020 to 4 GW in CY2021. These solar cells are supplied to the domestic panel manufacturing industry. India's cumulative manufacturing capacity for modules (or solar panels) had increased at a CAGR of 80.0% from 10 GW in CY2020 to 18 GW in CY2021.

Chart 5.43: Solar panel manufacturing capacity, in MW, India, CY2020-CY2021



Source: Frost & Sullivan Analysis

The manufacturing capacity for modules (or solar panels) in CY2021 is approximately four times the capacity available in the country in CY2016. The plan to increase the existing local manufacturing is aided by an additional allocation of INR 195,000 million for the production-linked incentive (PLI) scheme for high-efficiency solar modules in the Indian government's Fiscal 2023 Union budget. This is in addition to the INR 45,000 million already allocated to the scheme for manufacturing solar photovoltaic modules.

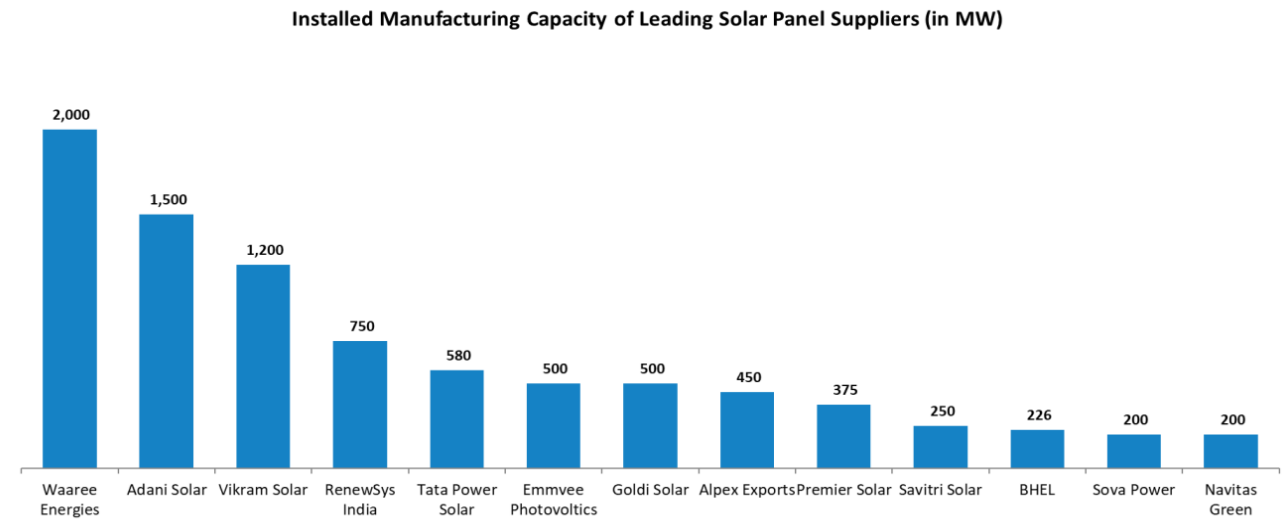
In addition, the implementation of custom duty of 40% on solar modules and 25% on solar cells by the Indian

government is also expected to boast domestic manufacturing of these solar products. Also, a large manufacturing zone each in a coastal state, a mountain state, and a landlocked state is being set up to produce power and renewable energy equipment. The government has recently invited bids for pilot projects to set up two brownfields and one greenfield manufacturing zone to meet growing domestic demand and power needs. The zones will play a critical role in meeting India's commitment at the COP26 summit last year. Vikram Solar is presently expanding its capacity in the coastal state of Tamil Nadu. Other major companies like ReNew Power, Acme Solar, and Adani Solar are currently in the advanced stages of negotiations with a few shortlisted states to set up the facility.

Going forward, India's manufacturing production capacity for solar cells is expected to increase from 4 GW in CY2021 to 18 GW by the end of 2023, and the manufacturing production capacity for solar panels to increase from 18 GW in CY2021 to 36 GW by the end of 2023.

Key Players in India and their capacities

Chart 5.44: Installed manufacturing capacity of solar panel suppliers, in MW, India



Source: Frost & Sullivan Analysis

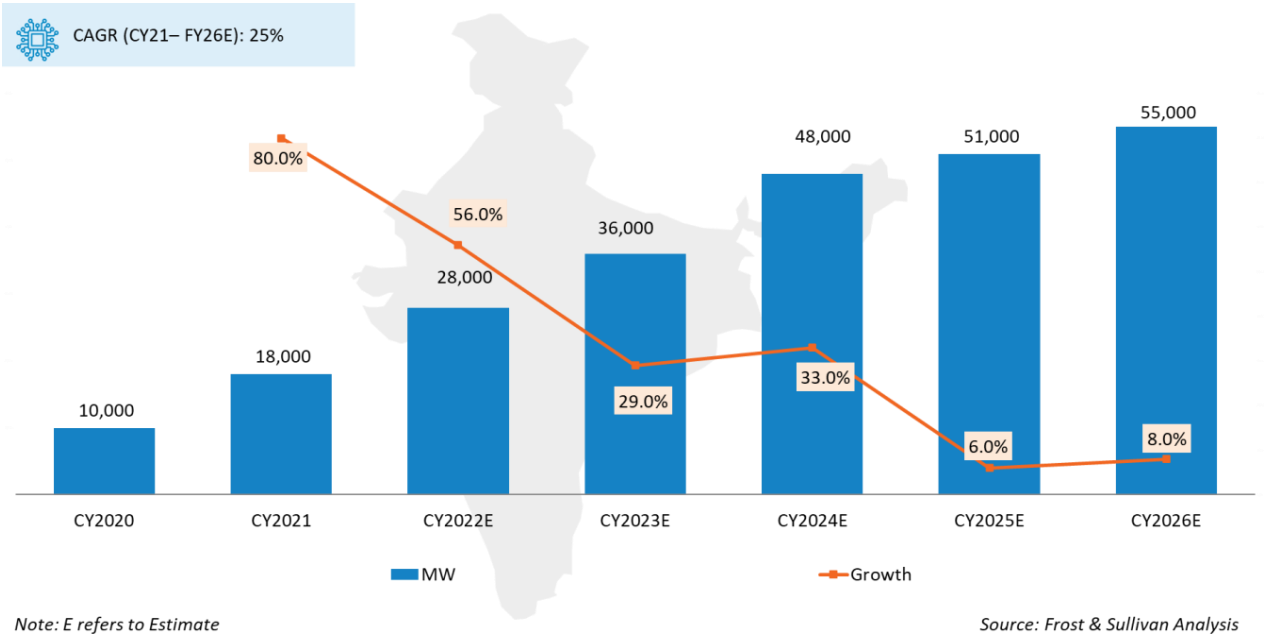
Growth opportunity for New Entrants in the Indian solar market

The imposition of customs duties on imports of solar cells and solar panels in April 2022 and the implementation of various policies promoting domestic manufacturing of solar products are expected to show a positive impact on the domestic manufacturing capacities in the Indian solar market. However, it has currently created a demand-supply gap. To meet the current demands of the solar industry and to achieve the target of 280 GW of solar power by 2030, India needs to focus on the expansion of its solar cell and module manufacturing capacities along with the introduction of the latest technology-based high-efficiency solar PV modules. These present new entrants with various opportunities to enter the Indian solar market. Based on various government policies and current market scenarios, new entrants find solar manufacturing to be a key area of growth domestically.

Despite various short-term challenges, the benefits are expected to be seen in the long term as policies become even more favorable for the sustainable growth of the Indian solar sector. Several domestic solar PV module manufacturers have announced their expansion plans so that they can fill the widening demand-

supply gap. Project developers, such as ReNew Power and Avaada, are planning to enter solar PV module manufacturing to exploit the benefits of vertical integration. Having their own manufacturing capacities will assist project developers to save on the cost of solar panels, which accounts for 50% to 60% of the total cost of a solar project. Public sector units, such as Coal India and BHEL, which have long been associated with the conventional source of energy are now entering the renewable energy sector. Coal India plans to develop integrated manufacturing of solar cells, wafers, and solar panels. It is expected that many other PSUs may also enter the solar manufacturing space.

Chart 5.45: Projected manufacturing capacity of solar panel suppliers, in MW, India, CY 2020-2026E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Large conglomerates, such as Jindal, Reliance, and SSE, are entering into integrated solar PV manufacturing. The Indian government policies are also favorable for the exports of PV modules. The sentiments towards Chinese products also give tremendous opportunity for Indian Solar PV manufacturers to develop strong relations with international buyers. In addition to module manufacturing, there is also a need for the manufacturing of cells, wafers, and other ancillaries like ethylene vinyl acetate, glass, back sheet, etc. The current scenario has made domestic solar PV manufacturing an attractive opportunity for many companies, including both existing players and new entrants.

G. FANS

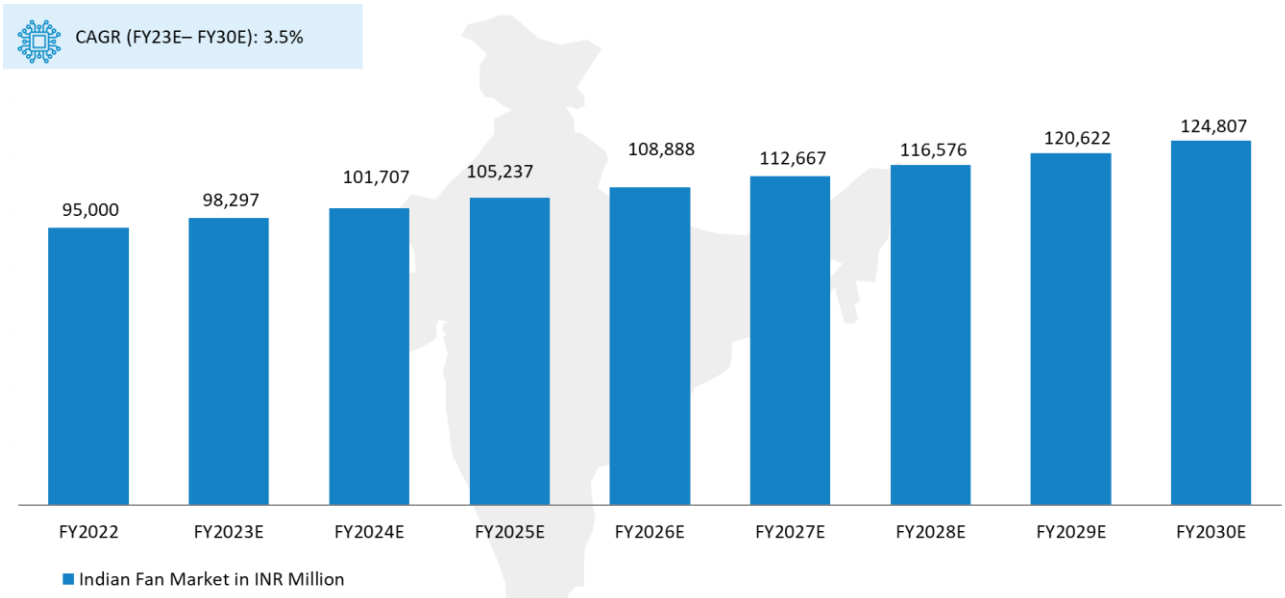
Overview of Indian Fan market

The Indian fan market, estimated to be around INR. 95,000 million in FY2022 (more than 60 million units), is growing at a healthy pace on account of rising temperatures, rapid urbanization, and aspirational and environmentally conscious consumerism. Given that fans consume between 20-25% of total electricity in Indian households, it is rational for consumers to opt for energy-saving fans. Also, fans are a healthier cooling solution compared to other options as they circulate fresh and clean air when users keep doors and windows open, which ensures proper ventilation.

The Indian fan market is expected to be driven by increased electrification of rural India, growing preference for premiumization and aesthetic appeal, housing sector boom, Internet of Things (IoT), and energy-saving technologies. Rapid urbanization and the rising number of new residential construction projects are also important factors driving the electric fans market in India. With more people looking for new homes and developers starting new projects, the top six metropolitan areas' real estate markets saw several new projects announced. Further premiumization, rural penetration, and boom in the construction sector will result in over 100 million units of fans shipped in FY2026 the increase in the number of new residential project launches in these cities have a significant growth in the electric fan market over the projected period. India is also set to become the world's third largest construction market by 2025. The construction industry in India expects a growth rate of 7.5% per annum over the next five to six years.

The Indian fans market is expected to grow at a CAGR of approximately 3.5% from INR 95,000 million in Fiscal 2022 to approx. INR 112,700 million by Fiscal 2027.

Chart 5.46: Indian Fan market, value in INR Million, FY2022 to FY2027E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

1. BLDC Fans

BLDC technology and its benefits

BLDC (Brushless Direct Current) technology or BLDC motor, in general, has been on the market for decades and is used widely in many electrical appliances. However, until recently, the technology has not been used in ceiling fans. Conventional fans with induction motors usually consume 65-75 watts of power. However, BLDC fans consume half as much power. Thus, a household with four conventional fans can save approximately Rs. 7000 annually on its electricity bill by switching to BLDC fans. With millions of ceiling fans sold annually in India, potential energy and cost savings are huge along with a significant reduction in carbon footprint. Unlike normal induction motor-based fans, BLDC fans come with a brushless electronic direct current motor that uses permanent magnets. The use of a BLDC motor eliminates friction, motor noise, and sparks that usually occur in the case of normal fans due to continuous contact of brushes with commutators.

Since the wear and tear are eliminated, BLDC motors have a longer service life compared to typical induction motors.

BEE's recent introduction of 'Star' labelling could be a game-changer

BEE has included Ceiling Fans under the ambit of mandatory star labelling from January 1, 2023, as per the revised Bureau of Energy Efficiency (BEE) norms. Star labelling denotes energy savings of a minimum of 30 per cent for 1-star rated fans to over 50 per cent for 5-star rated fans.

Though leading manufacturers, such as Havells, Orient Electric and Usha International, have welcomed the move, they also believe it would lead to an increase in the cost by 5 to 20 per cent as high energy efficient fans will require new imported motors and electronic components. Cost implications will be higher at almost 20 per cent for 5-star-rated fans as these fans will have the newer BLDC motors with imported electronic components and magnets.

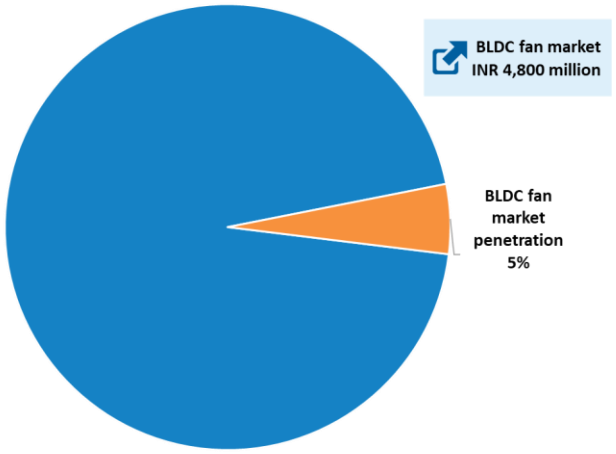
Current penetration of BLDC fans in India

Ceiling fans are, by far, the most common space cooling appliance used by Indian households – sales exceed 60 million annually. This demand is expected to increase rapidly in the coming years as purchasing power and temperatures rise.

Despite the energy savings that BLDC fans offer, the market penetration of BLDC fans remains low (of the 90% of Indian households that use ceiling fans, it is estimated that less than 3% use BLDC ones). The low market penetration is primarily due to the higher price of BLDC fans – the average price of a BLDC fan is approximately twice that of a conventional fan.

Considering the current volume share of 3% in the annual sales of ceiling fans and an average price of approximately INR. 2,700, the current market size for the BLDC fans is estimated to be approximately INR. 4,800 million.

Chart 5.47: Penetration of BLDC Fans in India, value in INR million, FY2022



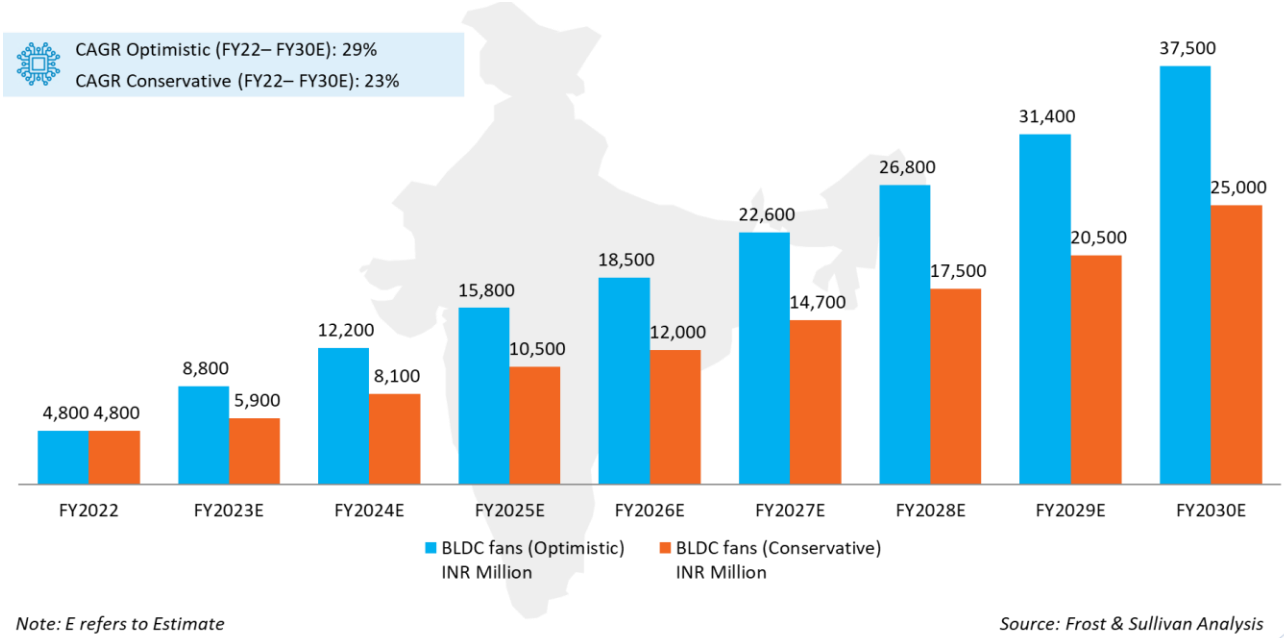
Source: Frost & Sullivan Analysis

Indian BLDC Fan market outlook and Addressable Potential for Ikio

Parameters	FY22	FY25	FY30
Size of the Indian fan market (INR Million)	95,000		
Expected CAGR of the Indian fan market (based on available reports)	~3.5%		
Projected size of the Indian fan market (INR Million)		105,237	124,807
Value-wise Penetration of BLDC fan (Optimistic)	**5%**	**15%**	**30%**
Size of the BLDC fan market (Optimistic) (INR Million)	**4,800**	**15,800**	**37,500**
CAGR (Optimistic)		**48%**	**29%**
Value-wise Penetration of BLDC fan (Conservative)	**5%**	**10%**	**20%**
Size of the BLDC fan market (Conservative) (INR Million)	**4,800**	**10,500**	**25,000**
CAGR (Conservative)		**29%**	**23%**

Source: Frost & Sullivan Analysis

Chart 5.48: Projected size of the Indian BLDC fan market in India, value in, INR million FY23E – FY30E



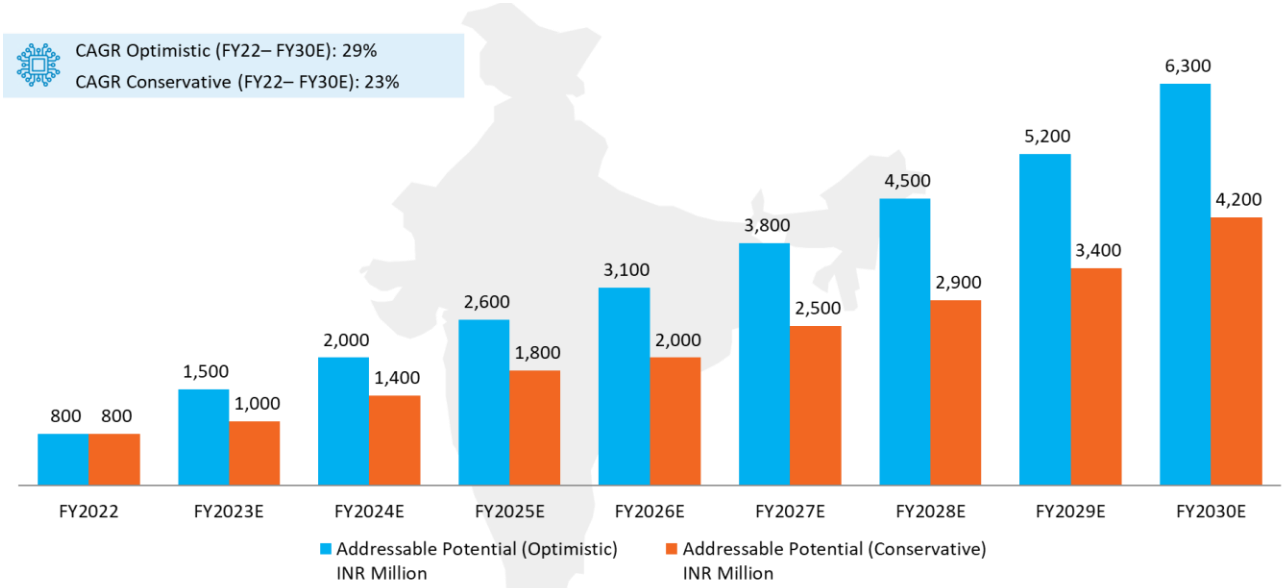
Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Ikio's portfolio would include supply of PCB assembly/controls for these BLDC fans. This is estimated to cost approximately 1/6th of the overall cost of the fan. The addressable market for Ikio would be 1/6th of the market size of BLDC fans.

In an optimistic scenario, Ikio's addressable market stands at approximately INR 800 million in Fiscal 2022 and is projected to exceed INR 6,000 million by Fiscal 2030. Conservatively, the addressable market for Ikio is pegged at approximately INR 4,200 million by Fiscal 2030.

Chart 5.49: Ikio's addressable market, value in INR million, FY23E – FY30E



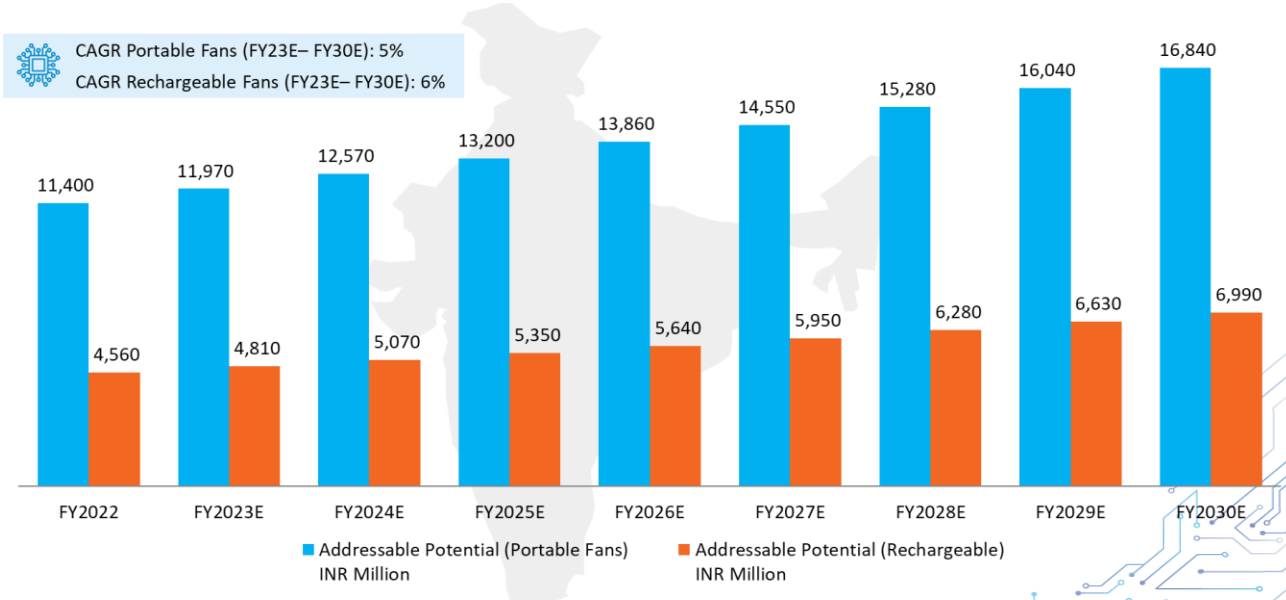
Note: E refers to Estimate

Source: Frost & Sullivan Analysis

2. Portable Rechargeable Fans

The elevated trend for outdoor activity is driving the demand for portable fans. The portable table fan segment dominated the overall portable fan market. A table fan is one of the most used appliances in houses, offices, businesses, and shops. Table fans offer many advantages, such as portability and ease of use (do not need to be installed). Moreover, table fans offer features such as oscillation that allows the fan to rotate at 180 degrees of direction.

Chart 5.50: Ikio's addressable market for portable fans in India, value in INR million, FY2023E to FY2030E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

The growth in the portable fan market is expected to be driven by launches of new products with innovative features (such as 3D auto-oscillation, touch screen control, and an in-built timer), increasing per capita income and improved standards of living.

In addition, portable fans are also gaining traction due to the development of solar-powered fans by the manufacturers in the Indian market, as consumers nowadays want devices that can be powered by renewable resources. Customers are increasingly showing interest in novel, cutting-edge products that use environmentally friendly, energy-efficient renewable energy sources.

The value of the portable fan market in India is currently estimated to be approx. INR 11,400 million (accounted for approximately12% of the overall fan market in India) and is expected to grow at a CAGR of 5% from Fiscal 2023 to Fiscal 2030. The market share of rechargeable batteries in portable fans in FY2022 was approximately INR 4,560 million and is expected to grow at a CAGR of 6% to INR 6,990 million in 2030.