

VIKSIT: An approach for India to achieve USD 1 trillion exports

August 2024





Foreword



Sanjeev Krishan
Chairperson
PwC in India

Today's economic and trade landscape is characterised by rapid transformations, driven by technological advancements, shifts in consumer behaviour and evolving geopolitics. International trade plays a key role in positioning nations as economic powerhouses, influencing international relations and geopolitics. Over the past two decades, global merchandise trade has increased from USD 9.4 trillion in 2004 to USD 23.5 trillion in 2023.*

Following the liberalisation, privatisation and globalisation (LPG) reforms of the 1990s, India's participation in global trade increased from 0.5% in 1990 to 1.85% in 2023.* Flagship programmes such as Make in India, Atmanirbhar Bharat and Production Linked Incentive (PLI) scheme, India's revamped strategy towards free trade agreements (FTAs) and the strategic move towards increased capital spend, especially towards frontloading industrial and logistics infrastructure, have enabled India to corner a larger share of global trade.

Realising the ambition of USD 1 trillion merchandise exports by 2030 is a complex undertaking, one that will require the nation to navigate both internal and external challenges. We propose a strategic pathway: VIKSIT – an approach for India to achieve USD 1 trillion merchandise exports that is designed to overcome the constraints within the current ecosystem and unlock the nation's export growth potential.

The VIKSIT acronym has six vectors: Value addition and volume-led growth (V), Inclusive industrial development (I), Knowledge and capacity building (K), Sustainable supply chains (S), Infrastructure investments (I), and Technology enablement (T). These vectors are divided into sector-specific pillars and enablers, providing a comprehensive approach to enhance India's sectoral competitiveness and export performance. This report discusses three cases in particular – automobile, electronics and food processing – to demonstrate the application of the VIKSIT approach, and chalks out a roadmap of strategic interventions that may be undertaken for enabling exports. In addition, sector-agnostic interventions that will be critical for overcoming the current ecosystem constraints have also been discussed.

We hope this report will contribute towards the conceptualisation and implementation of strategic actions required for enabling India to achieve USD 1 trillion exports by 2030.

* <https://www.trademap.org/>



Executive summary

India has powered through to emerge as the fifth largest economy in the world. International trade has played a key role in fuelling India's economic growth – the share of merchandise and services trade in India's GDP increased from 15% in 1980 to 46% in 2023.¹ The growing emphasis on export-led growth is reflected in the improved share of India's exports in global trade – from 0.4% in 1980 to 1.85% to 2023.²

India aspires to achieve a target of USD 1 trillion merchandise exports by FY30. We evaluated three scenarios: An optimistic perspective that entails the ironing out of geopolitical conflicts and India taking actions along a strategic pathway, **this target could perhaps be achieved one year in advance**, i.e. FY29.³ This scenario considers an annual export growth rate of 18%, benchmarked against export performance from 1986–1995 and India's average export growth rate in the COVID-19 period.⁴ The other two scenarios, business as usual and conservative, consider an annual export growth rate of 14.5% and 10% respectively, to achieve the USD 1 trillion exports mark by FY31 and FY33 respectively.

There are five considerations that need to be weighed while charting India's export growth journey. While adding scale, India's manufacturing sector also needs to improve its value addition ratio considerably to prevent **commoditisation (R1)**⁵ of the exports basket and ensure that exports move towards high value-adding and emerging segments. In addition to product diversification, it is critical to expand India's market access to mitigate market **concentration (R2)**.⁵ With recent additions, India now has 20 active trade agreements with several markets. It is crucial to push forward on the revamped trade agreement strategy to position Indian products competitively and reduce the burden of compliance and conformity with non-tariff barriers (NTBs).

A key factor for unlocking growth in India's journey towards USD 1 trillion exports rests with dormant micro, small and medium enterprises (MSME) exports. At present, only ~1.36% of India's MSMEs are exporting, highlighting the **disconnection (R3)**⁵ between India's exports growth and MSME's propensity to internationalise.⁶ Challenges along four key areas, namely business environment, export procedures, access to finance, and access to markets and information impact MSMEs' ability to export.

Further, to realise the projected growth in export volume, it will be crucial to enhance and expand the impact of technology. Technology **fossilisation (R4)**⁵ has impacted export efficiency, product quality and unit production. Advanced technology adoption in the Indian manufacturing and export sectors has been relatively slow, impacting the ability to cater to international market trends and demand. Similarly, technology **fossilisation** has impacted the efficiency of export processes. In 2023, the average turnaround time of containerised cargo from arrival at ports to vessel sail out has been ~156 hours, of which ~19 hours are spent in customs processes. For inland container depots (ICDs), the turnaround time is estimated at ~128 hours, of which ~32 hours are spent in customs processes.⁷ Thus, considering the growth in containerised traffic owing to exports growth, port authorities will need to envisage both capacity expansion and technology-led customs process enhancement.

Readiness to address the implications of climate change and recent mitigation measures will impact international trade. Both pricing and non-pricing policies for climate mitigation have accelerated during the last 10 years. Since these policies and initiatives will impact both access and competitiveness, exporters across the globe will need to reflect on **carbonisation (R5)**⁵ within their respective value chains.

This paper proposes VIKSIT as a strategic framework for enabling India to achieve its ambition of USD 1 trillion merchandise exports. With the VIKSIT framework, we aim to provide a strategic pathway that can be adopted by both public and private sector stakeholders, to strategise for exports growth. This framework blends sector-specific strategies with overall export ecosystem enablement measures, to trigger thought and action. Each letter within the VIKSIT acronym defines a growth acceleration vector that is crucial from both lenses: firm-level growth and ecosystem growth.

1 World Bank Open Data

2 ITC Trade Map

3 PwC research and analysis

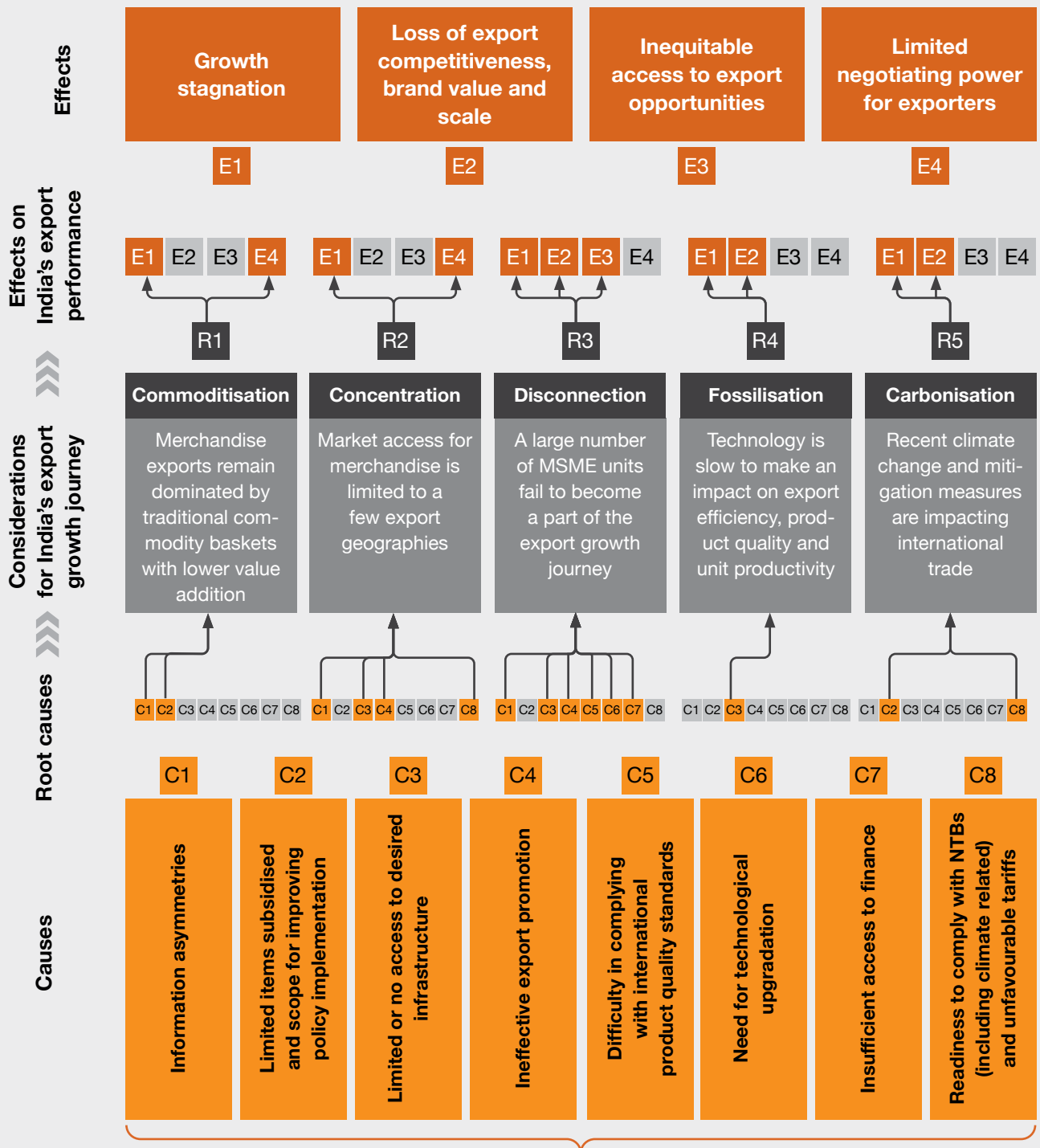
4 Felipe, Jesus and Joseph Anthony Lim. 2005. 'Export or domestic-led growth in Asia?' Asian Development Review 22 (2): 35–75

5 Refer to Figure 1.

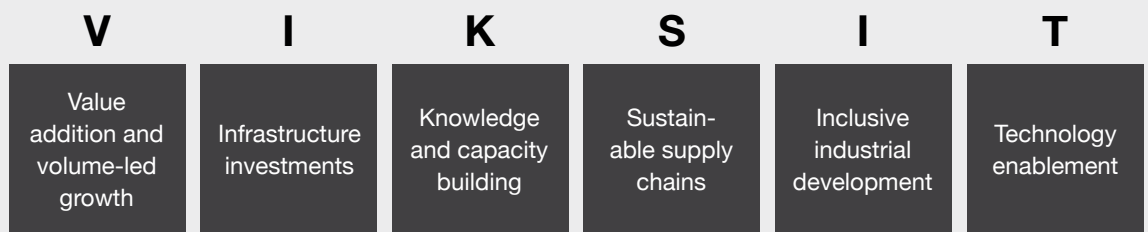
6 Udyam Registration Publication, Registration of Micro, Small and Medium Enterprises (MSMEs) in India (2020-22)

7 Customs Time Release Study, 2023

VIKSIT framework to enable India's export growth



The VIKSIT framework – an approach to address the key challenges that may impact India's export growth potential




The VIKSIT acceleration vectors enable a sharp focus on action areas that will be critical for accelerated exports growth. The individual focus of our vectors 'V', 'I', 'K', 'S', 'I' and 'T' is as follows:

V	strategise for value addition and volume-led growth in exports
I	catalyse infrastructure investments across key export gateways and promote multimodal transport infrastructure
K	promote knowledge sharing and capacity building of exporters
S	enable sustainability in trade and export supply chains by identifying the right set of trading partners and focusing on environment-friendly initiatives
I	ensure inclusive industrial development with a higher focus on MSMEs internationalisation
T	leverage technology for advancing manufacturing and export process efficiency

This report discusses the application of the VIKSIT framework in three sectors – automobiles, electronics and food processing – to demonstrate how it can be used to formulate strategic pathways towards export acceleration. The report also includes sector-agnostic ecosystem enablement measures within the VIKSIT vectors that may also be required for enabling India to achieve USD 1 trillion exports.

The VIKSIT framework advises a technology-driven pathway for the automobile sector, wherein action is led by original equipment manufacturers (OEMs) and followed up by Tier-2 and Tier-3 manufacturers. Based on share of future profit pool, current technology maturity and regulatory push, the report identifies electric vehicles (EVs), EV battery and software-defined vehicle (SDV) enabling technology as the three focus areas for driving exports growth (V). Mobilising investments into building scale and R&D infrastructure for these segments will be critical (I). The role of OEMs will be defining as these players will have to ensure high component carryovers during design, undertake knowledge transfer and maintain relevance of Tier-2 and Tier-3 manufacturers (K). ESG performance across the value chain will be a competitive differentiator for manufacturers (S). While overall exports growth shall improve the financial metrics of MSMEs, the sector growth may also present differentiated avenues for growth (I), e.g. developing recycling capacity, developing Tier-1 suppliers for EV-specific requirements such as aluminium battery casings. Lastly, we envisage OEMs to be the source of the technology push (T) required for emerging segments such as developing full-stack proprietary platforms and establishing commercially viable local value addition, as profit pools are expected to shift.



Electronics export growth shall be driven by backward integration in manufacturing to improve value addition and scale expansion simultaneously. Access to capital, skills and innovation will be required to build sector capabilities. The report suggests that the next phase of electronics exports from India will be driven by (i) consumer electronics and IT hardware, (ii) auto electronics, and (iii) electronic components and PCB assemblies. While current capabilities largely rest with design and assembly, India may lay focus on incremental localisation **(V)**. Make versus buy analysis shall be undertaken to strategically select potential localisation nodes. The scale expansion envisaged may require the set-up of sector-focused infrastructure – development of specialised storage options, air connectivity to Tier-2 and Tier-3 cities with electronics manufacturing clusters (EMCs), and provision of infrastructure as a service at EMCs **(I)**. Considering the knowledge-driven nature of electronics, joint ventures with global partners may be critical to build manufacturing capabilities and workforce skills for localising products with high bill of materials (BoM) contribution and import dependency **(K)**. While India develops electronics capabilities, it will be critical to focus on supplier diversification and sustainable sourcing **(S)**. Adequate supply and size of credit to MSMEs shall be necessary to ensure engagement in new-age production processes to ensure alignment **(I)**. Creation of innovation garages to drive collaboration with startups to bridge the innovation capability gaps may be envisaged **(T)**.

For food processing, it will be crucial to move up from primary processing to cater to the demand for secondary and above, and diversify towards convenience, ready to eat/cook alternatives while ensuring alignment with global food standards. The report suggests three key product segments that may drive growth of exports from the food processing sector, viz. bread and bakery products, protein concentrates, and cane or beet sugar **(V)**. Developing clusters in proximity to ports with supporting infrastructure such as testing and quality assurance labs will be required for accelerating exports **(I)**. The sector attracts one of the most stringent NTBs owing to food safety related aspects. Hence, one of the top priorities will be to advance both processing and production to ensure regulatory alignment with target markets **(K)**. Further, addressing the NTB requirement of markets and consumer sensitivity towards the environment will also require exporters to take into account the hidden water and carbon footprint of their products **(S)**. Considering the stringent NTB requirements and evolving nature of demand, it will be crucial to create awareness and support MSME R&D for development of suitable products **(I)**. Technology can play a key role in streamlining sector operations, e.g. blockchain for addressing traceability, IoT for smart warehousing and cold chain management **(T)**.

Public sector interventions towards creating a robust export ecosystem are critical in the journey towards USD 1 trillion merchandise exports. The Government of India has a huge role to play in the creation of an enabling ecosystem that can accelerate India's merchandise exports to USD 1 trillion and then sustain the same. The Centre and state governments need to mobilise private sector investments towards export-oriented businesses from emerging sectors as well as uplift MSME performance in exports **(V)**. Infrastructure investments into capacity expansion of seaports and air cargo stations along with efficiency improvement measures are required. Significant investments need to be infused into developing industrial infrastructure such as economic zones, testing and certification labs, and port-led industrial parks **(I)**. Sustained export performance will need knowledge transfer on product standards, quality, consumer preferences, and upgrading of manufacturing capabilities, workforce skills and product development R&D **(K)**. Sustained performance will also depend on developing long-term partners by expanding the coverage of India's trade agreements to new geographies. Expansion to such markets may also require Indian manufacturers to transition towards environmentally sensitive exports. Policy support may have to be envisaged in this regard **(S)**. While institutional architecture of export promotion has been deepened up to the district level, MSME participation has been limited and can be further expanded significantly. Expansion of export promotion services provided by State Export Promotion Councils may be envisaged. Moreover, setting up of an apex body for export promotion by the Central government and setting up of State Export Promotion Councils in all Indian states which currently do not have them to facilitate a well-coordinated approach to drive exports (especially by MSMEs) may be explored **(I)**. Lastly, India's capabilities in information technology need to be extensively leveraged to improve export process efficiency, lower the burden of multiple compliances and reduce the time to export **(T)**.



Table of contents

01 India's export growth trajectory and potential 10

02 Considerations for India's export growth journey 24

03 VIKSIT – an approach for enabling exports 32

04 Applying the VIKSIT framework to select sectors 38

05 Other export ecosystem enablers 102





01 India's export growth trajectory and potential

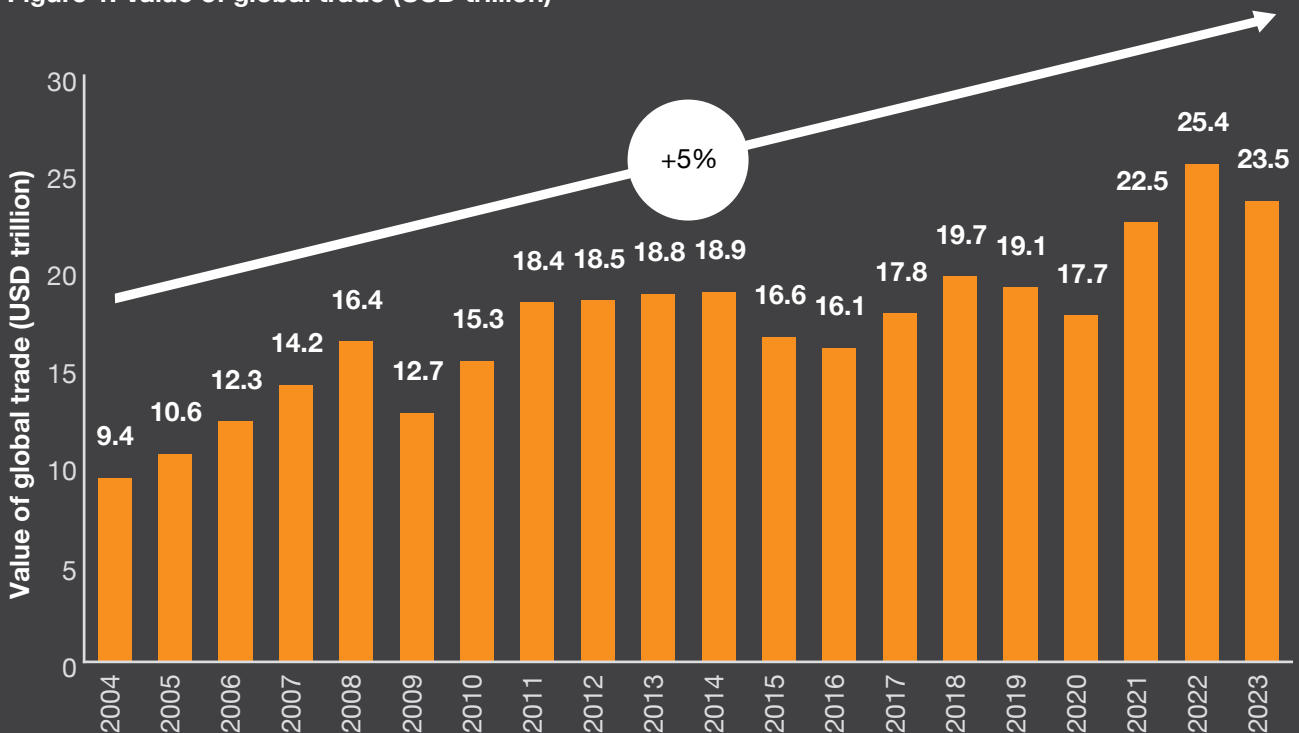


1.1

Global trade in goods has increased at a compounded annual growth rate (CAGR) of 5% over the last 20 years with significant structural shifts¹

During the period 2004-2023, global trade in goods has seen a healthy CAGR of 5%² despite suffering shocks such as the great recession of 2008 and the COVID-19 pandemic.

Figure 1: Value of global trade (USD trillion)



Source: Official portal of ITC Trade Map, www.trademap.org




The last decade has seen an increase in trade of electronics, electrical equipment and mechanical appliances, chemicals, automobiles and processed food. This may be attributed to technological advancements and disruptions that have been impacting business-to-business (B2B) and business-to-consumer (B2C) production as well as consumption patterns. For example, the push towards renewable energy has boosted the demand for solar photovoltaics (PVs) and power equipment. Similarly, disruptions in consumer electronics are sustaining the high demand for products in various sub-segments such as displays and printed circuit boards (PCBs).

1 Official website of ITC TradeMap, Yearly Trade Statistics, accessed on 30 June 2024

2 Ibid.

Table 1: Top sectors in terms of share in global trade

Rank	Sector	Share in global trade		
		2013	2023	
Rank 1	Electronics, electrical machinery and mechanical appliances	24.2%	26.6%	↑
Rank 2	Mineral products and oils	19.4%	16.1%	↓
Rank 3	Chemicals including pharma	8.9%	10.3%	↑
Rank 4	Automobiles including aircraft and locomotives	9%	9.5%	↑
Rank 5	Base metals	6.6%	6.6%	■
Rank 6	Plastic and rubber	4.3%	4%	↓
Rank 7	Gems and jewellery	3.8%	3.7%	↓
Rank 8	Food processing	3%	3.4%	↑
Rank 9	Textiles and apparels	3.7%	3.3%	↓
Rank 10	Optical, photographic, medical and surgical instruments	3.2%	3.2%	■
Others		13.8%	13.4%	

 Increase in share
  Decrease in share
  No change

Source: Official portal of ITC Trade Map, www.trademap.org

1.2

In 2023, the top 10 exporting countries serviced more than 50% of the global demand

China, the US and Germany accounted for approximately 30% of the global exports. India climbed up the ranks, from 19th in 2013 to 17th in 2023 (Table 2).

Table 2: Top countries in terms of share in global trade

Rank	Country	Share in global trade		
		2013	2023	
Rank 1	China	11.7%	14.6%	↑
Rank 2	US	8.4%	8.7%	↑
Rank 3	Germany	7.7%	7.3%	↓
Rank 4	Netherlands	3.1%	3.2%	↑
Rank 5	Japan	3.8%	3.1%	↓
Rank 6	Italy	2.75%	2.9%	↑
Rank 7	France	3%	2.7%	↓
Rank 8	Korea	3%	2.7%	↓
Rank 9	Mexico	2%	2.5%	↑
Rank 10	Hong Kong	2.8%	2.5%	↓
Rank 17	India	1.78%	1.85%	↑

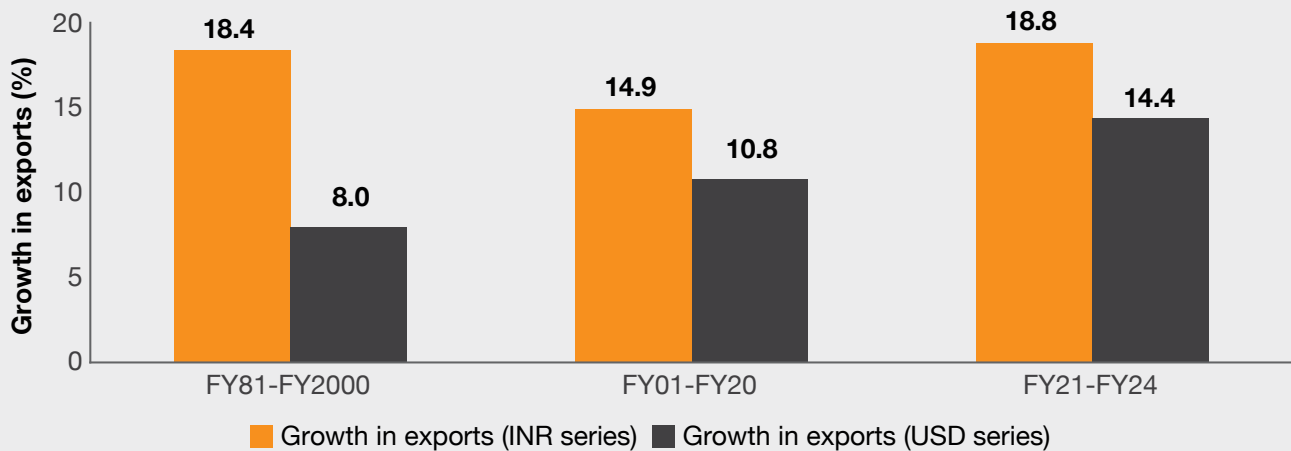
↑ Increase in share ↓ Decrease in share

Source: Official portal of ITC Trade Map, www.trademap.org

Achieving India's aspirations: Scenario evaluation

In FY22, India crossed the USD 400 billion merchandise exports mark for the first time. The Government of India has set an ambitious target of achieving USD 1 trillion merchandise exports by FY30. Based on the analysis of the export trends since the '80s, it is worth evaluating three scenarios along with timelines to gauge India's future export growth potential. The following figure shows India's export growth trend in terms of both INR and USD. A higher growth in INR indicates a gradual depreciation of INR against USD (see Figure 2).

Figure 2: Growth in exports – INR versus USD



Source: The Reserve Bank of India, accessed on 27 June 2024

As the figure indicates, post-COVID-19, the average export growth rate of India is approximately 14.4% in terms of USD. The growth rate in export in terms of INR, however, is 18.8% in the same period. This mismatch is primarily driven by the rupee depreciation.

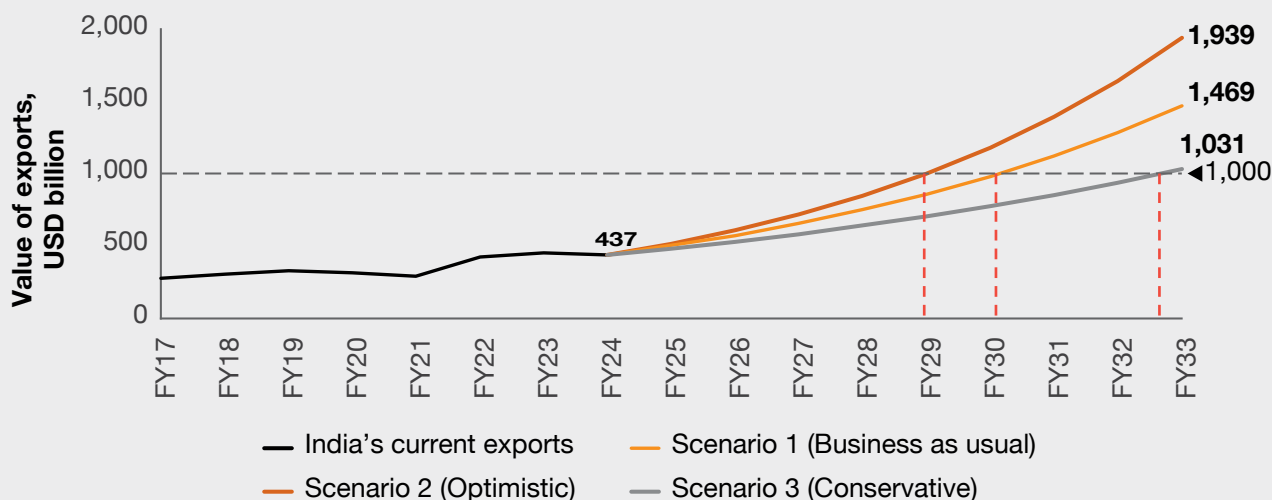
To develop the possible scenarios, several key factors may be considered to ensure a comprehensive analysis. First, an examination of India's historical export performance is necessary to understand the trends and patterns. Second, it is important to consider economic recovery and shifting global dynamics to assess the export growth trajectory post-COVID-19. Additionally, insights from international examples also need to be factored in to identify successful strategies and potential pitfalls. By integrating these perspectives, the methodology adopted aims to provide a robust framework for forecasting India's export potential and outlining achievable pathways to reach USD 1 trillion in exports.

Several South-east Asian countries have enjoyed extensive export growth – Thailand, for instance, has an export-driven economy. The country enjoyed double-digit growth of exports on an average of 23% per year from 1986 to 1995,³ although its growth rate declined to 7.1% after the US recession in 2008. The Chinese economy, on the other hand, enjoyed significant growth during its inflection period. Chinese exports rose by an average of 5.7% in the 1980s, 12.4% in the 1990s, and 20.3% between 2000 and 2003.⁴

3 Bhanupong Nidhiprabha (2017). The Rise and Fall of Thailand's Export-Oriented Industries. Asian Economic Papers; 16 (3). page 128–150.

4 Ruete, Javier Silva (2006) The Development of China's Export Performance, Presentation by Javier Silva-Ruete, Alternate Executive Director, IMF.

Figure 3: Export simulation analysis



Source: PwC research and analysis

It is evident, therefore, that countries enjoy higher export growth rate when external factors are favourable.

Exports are higher when global economic conditions are favourable and there is political stability, technological advancements, stable environmental conditions, and a well-performing US economy.

The following three scenarios provide a forecast of India's journey towards achieving USD 1 trillion exports.

Scenario 1: Business as usual

With the world having pressed the reset button in the post-COVID-19 scenario, the export growth rate can be assumed to be 14.45%. India's growing global significance coupled with its faster recovery from pandemic shocks and its strategic positioning have created an opportunity for higher economic and trade integration. This average growth rate also takes into consideration supply chain disruptions arising from the Russia-Ukraine conflict, high inflation and growth stagnation in key economies such as the US, Germany, Japan and the UK. Therefore, if India's exports grow at 14.5%, it will achieve USD 1 trillion exports by early 2030.

Scenario 2: Optimistic

An optimistic situation connotes global, political and economic stability. This scenario differs from the previous one as it disregards most of the negative factors in the post-COVID-19 era. Here, an annual export growth rate of 18% is assumed. This figure is benchmarked against export performance from 1986 to 1995 and India's average export growth rate in the COVID-19 period.⁵ As this scenario envisages a favourable environment, India could reach its target in four years (2028-29).

Scenario 3: Conservative

In the past, the global economy has experienced numerous economic, political and health-related disruptions. The world witnessed the Mexican Peso crisis in 1994, Asian financial crisis in 1997-98, and the US financial crisis in 2008. The Iraq crisis occurred in the '90s and currently there is the Russia-Ukraine conflict.

An estimate by the NBER journal indicates that real world trade fell by about 15% from Q1, 2008 to Q1, 2009.⁶ Therefore, this scenario factors in such events that may occur in the future and accordingly pegs the average export growth rate at 10%. Aligned to this growth rate, India is expected to achieve its USD 1 trillion exports target by 2032-33.

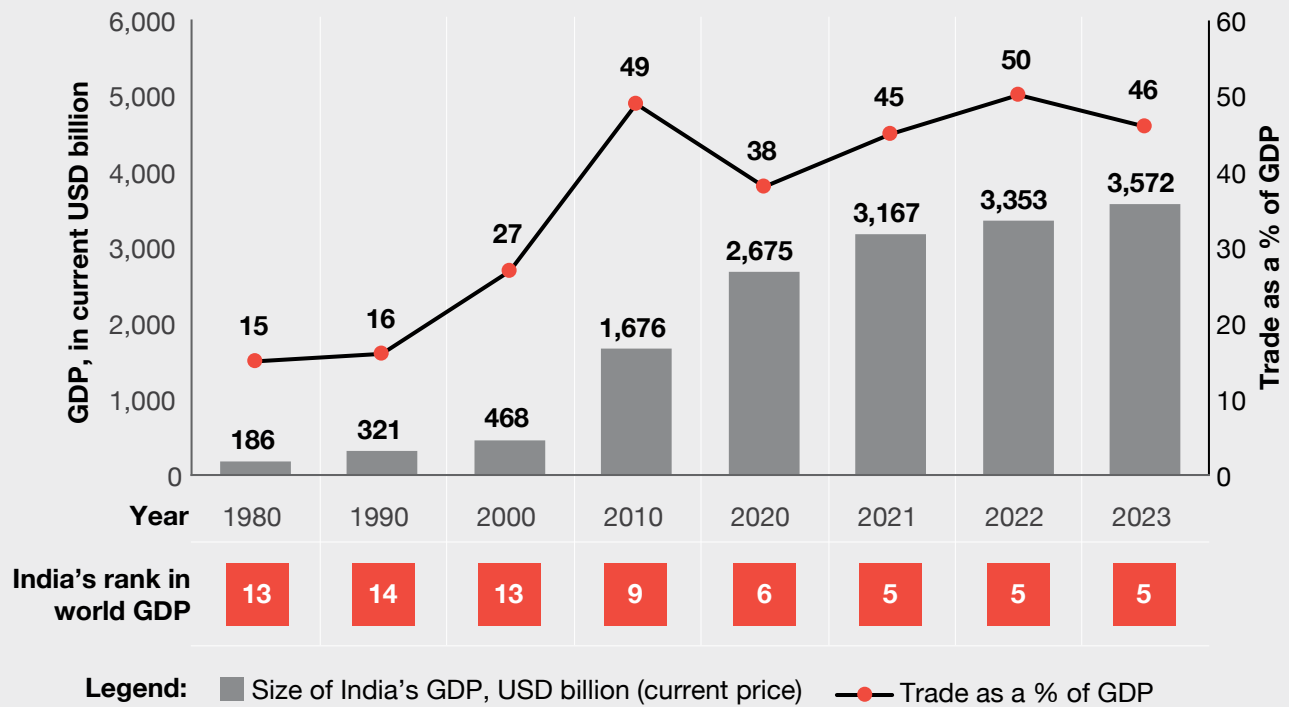
5 Felipe, Jesus and Joseph Anthony Lim. 2005. "Export or Domestic-Led Growth in Asia?" Asian Development Review 22 (2): 35-75

6 Bems, R., Johnson, R. C., & Yi, K. M. (2013). The great trade collapse. Annu. Rev. Econ., 5(1), 375-400.

From control to free trade, India has made strides

India’s evolution from the 14th largest economy in the 1990s – when it pursued state-controlled development – to becoming the fifth largest (Figure 4) after it transformed into a market-driven, liberal economy reveals the significance of trade in its economic composition.

Figure 4: India’s GDP, trade as a % of GDP and rank in world GDP

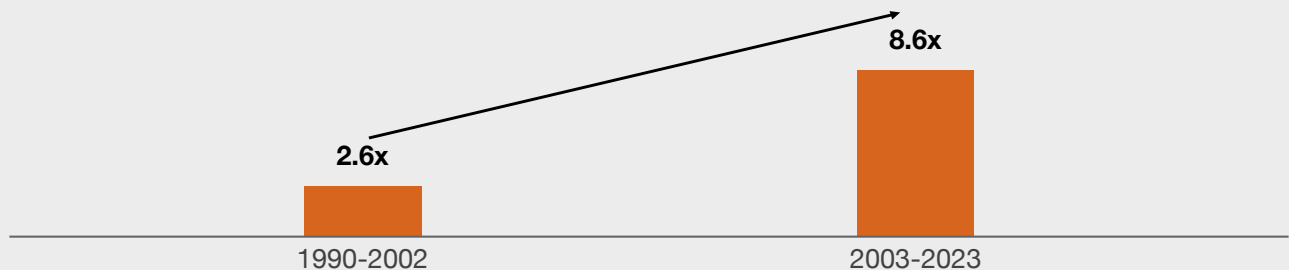


Source: World Economic Outlook, April 2024 and data.worldbank.org

Note: Ranks are based on GDP at current prices, Trade as a % of GDP is the sum of exports and imports of goods and services measured as a share of gross domestic product.

While merchandise and services trade made up just 15% of India’s gross domestic product (GDP) (at current prices in INR crore) in the 1990s, it was as high as 46% in 2023 (Figure 4). This growth is primarily attributable to three decades of structural reforms in the country and its proactive efforts towards remodelling international trade.

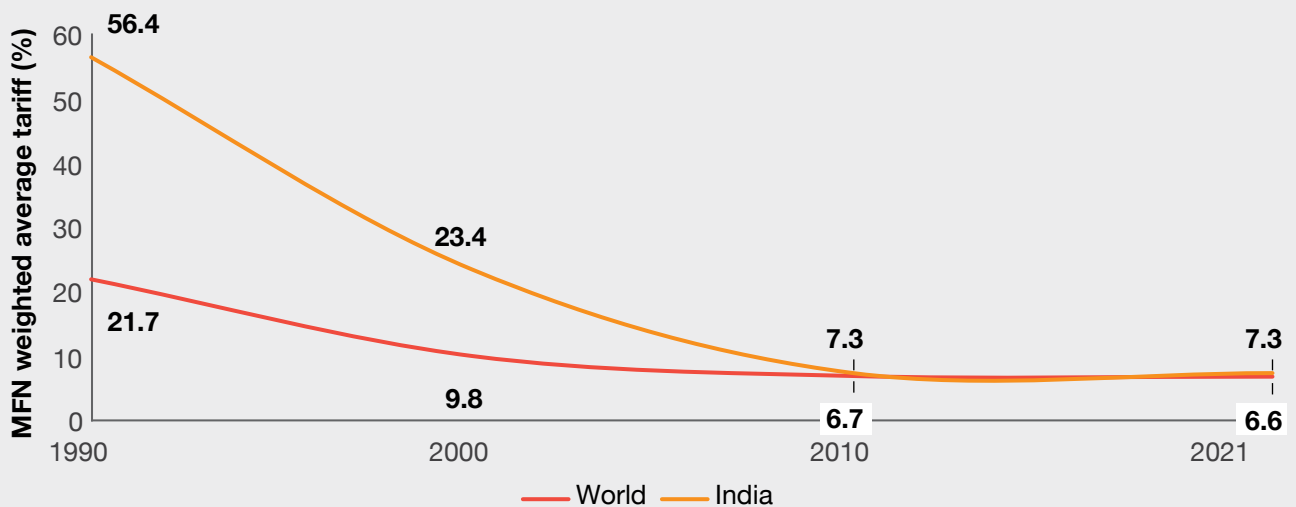
Figure 5: Growth in exports over the years



Source: CSO, MoSPI



Figure 6: MFN weighted average tariff (%)



Source: CSO, MoSPI

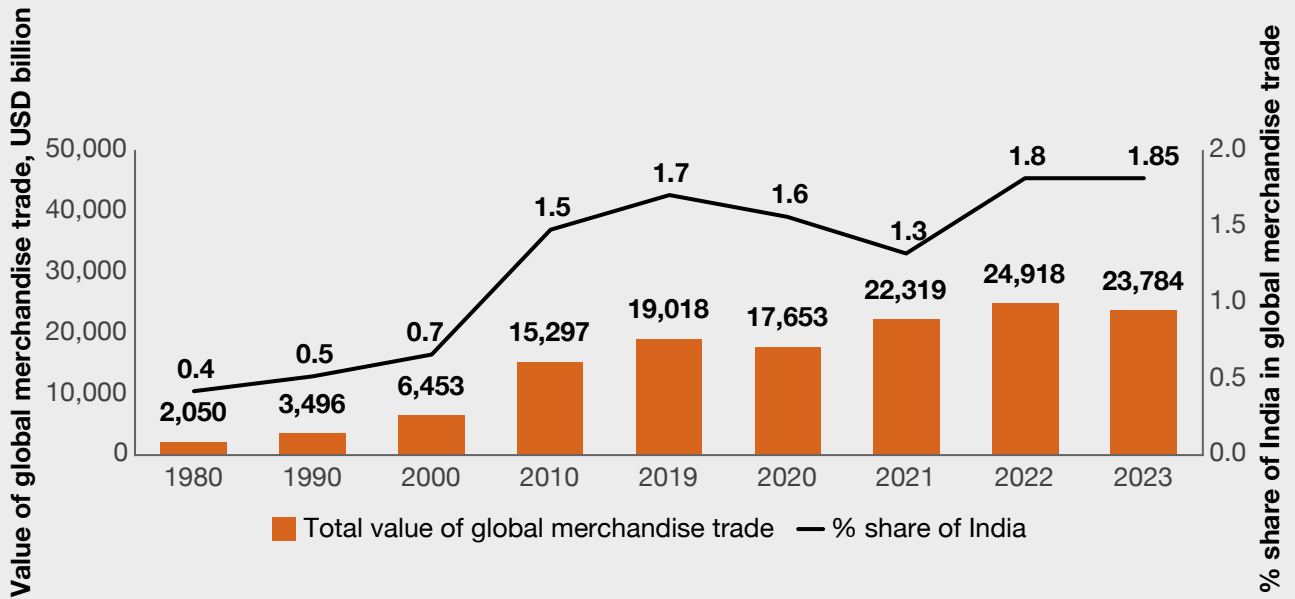
The rising contribution of trade to India's growth has been facilitated by the reduction in the global weighted average Most Favoured Nation (MFN) rates from 21.7% in 1990 to 6.6% in 2021 (Figure 6). Not only did imports expand, but exports also grew in multiples. As seen from Figure 5, the nation's exports increased by 8.6 times during the period 2003-2023. This was approximately 3.5 times the growth registered by India's exports during the period 1990-2002.

In 2023-24, India's merchandise exports stood at USD 437 billion, recording growth rates that are on a par with those of other Asian manufacturing hubs such as China and Vietnam.

India's share in global trade has increased by 2x

There is a remarkable improvement in India's contribution to world exports. India's contribution to global trade was 0.5% in 1990 and increased significantly to 1.85% in 2023 (Figure 7).

Figure 7: India's share in global merchandise trade (%)



Source: UNCTAD



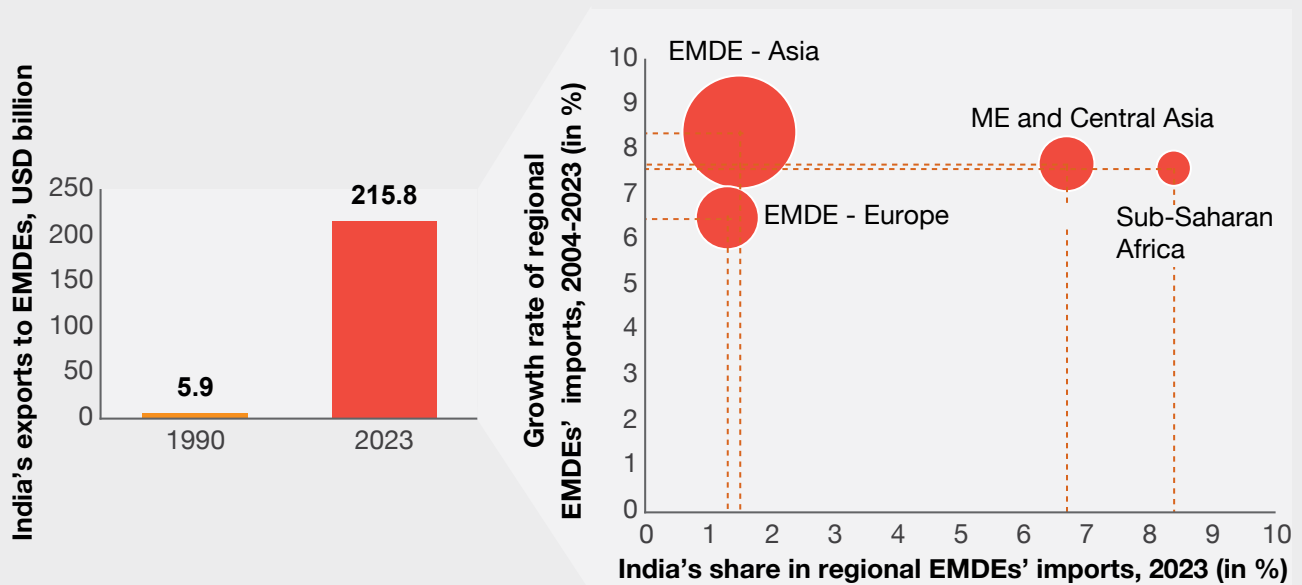


1.6

India has made new partners in trade

India's export focus has significantly expanded to cover emerging and developing countries including those in Sub-Saharan Africa, the Middle East and Asia. The exports from India to emerging markets and developing economies (EMDEs) have increased from USD 5.9 billion in 1990 to USD 215.8 billion in 2023 (Figure 8).

Figure 8: India's exports to specific EMDEs



Source: IMF data portal, ITC Trade Map

This successful diversification meant that by 2023-24, the number of countries to which India exported more than USD 5 billion worth of goods and services stood at 25 and the number of countries with export values of over USD 1 billion stood at 60.⁷

7 International Monetary Fund (IMF) data portal

India's export basket has diversified with a revealed comparative advantage in over 1,400 commodities

An analysis of India's exports during 2023-24 shows that its exports to the newer markets have increased by USD 459.83 million at the HS-2 category level. Further, India registered a 200% growth in export of the 469 commodities (at HS-2 level), each with an export value of more than USD 0.5 million.⁸

In the last three decades, India's export basket has diversified in terms of both markets and commodities. While India had RCA (>1) in 986 commodities in 1990, this has expanded to 1,433 commodities in 2023.⁹ India's export basket in the previous decade mostly consisted of agricultural commodities, but the same has now diversified to cover electronics, pharmaceuticals, engineering products, and food items. A closer look indicates that India's export basket that largely contained labour-intensive commodities in the 1990s has undergone a significant transformation to now include commodities with a high degree of capital dependence in production.

8 UN COMTRADE data from WITS. Accessed on 21 June 2024 at HS-17 2-digit level

9 HS-6 digit level data extracted from World Integrated Trade Solutions. (Accessed on 18 June 2024)





1.8

Bilateral and regional trading partnerships have fuelled India's trade

India has signed 20 trade agreements¹⁰ with its partners including some recent ones with the UAE, Australia, and the European Free Trade Association (EFTA) covering Iceland, Liechtenstein, Norway and Switzerland. Through these trade agreements, India has created access to an aggregated market size of USD 7.15 trillion, and this is expected to increase to USD 9.37 trillion with the conclusion of the ongoing negotiations with the UK, Gulf Cooperation Council (GCC), Peru, European Union and Oman. An analysis of the trade data shows that there is a considerable increase in the exports observed before and post conclusion of the FTAs. For instance, the conclusion of India-UAE CEPA led to a 27% increase in the exports from India to the UAE between 2021-22 and 2023-24.¹¹

In the past decade, India's exports have outperformed the global growth rates and are continuing to gallop. During this period, India has achieved sectoral and geographical diversification of its exports, weathering macroeconomic shocks, while also enhancing its competitiveness to cover a larger basket of goods, including those which are witnessing significant emergence and growth based on disruptive global changes such as technological innovation and the thrust on sustainability. Timely and strategic agreements with major importing partners have also provided a further fillip to India's export growth. However, the target of achieving USD 1 trillion worth of exports would necessitate a significant acceleration of all of the above coupled with a paradigm shift for India to corner a much larger share of the new global opportunities thrown up by supply chain realignments as well as the new and emerging demand from sunrise sectors.

Having said that, India's stride from USD 36.8 billion exports in 1999-2000 to USD 437 billion in 2023-24 as well as the fact that India's foreign trade has increased by 24.86 times in value since liberalisation¹² speaks volumes about its potential for growth and its capability to realise its goal.

10 Free Trade Agreements (FTA) as well as Preferential Trade Agreements (PTA)

11 Ministry of Commerce, Government of India; Share calculated using data from UN COMTRADE, World Integrated Trade Solutions

12 Handbook of statistics on Indian economy, Reserve Bank of India



1.9

Post-COVID, role of MSMEs in India's exports has expanded

The share of MSMEs in total manufacturing output in India is around 36%. The share of MSME-related product exports in the country's exports is around 45%.¹³ Data published by the Directorate General of Commercial Intelligence and Statistics (DGCIS)¹⁴ has revealed that exports registered by all three categories of MSMEs have grown between FY20-21 and FY22-23.

Table 3: MSME exports in USD million

MSME type	MSME exports, in USD million (% share of category in overall exports)		
	FY20-21	FY21-22	FY22-23
Micro	16,829 (19%)	25,186 (21%)	29,877 (24%)
Small	33,857 (38%)	44,184 (37%)	45,087 (36%)
Medium	37,694 (43%)	49,919 (42%)	50,562 (40%)
Total	88,380	1,19,288	1,25,526

Source: Ministry of Micro, Small & Medium Enterprises, press release dated 8 February 2024

Note: Some of the figures have been rounded off.

The MSME export basket is dominated by products such as, rice, marine products, readymade garments, organic and inorganic chemicals and leather products. The exports of these products constitute nearly 62% of the total export value of the top 10 MSME-export commodity groups.

¹³ Ministry of Micro, Small & Medium Enterprises, press release dated 8 February 2024

¹⁴ Merchandise EXIM Status Report of India's MSME Sector, DGCIS, January 2024



Table 4: Share of commodity groups in total MSME exports during FY22-23 in terms of value

Commodity groups	% share in total MSME exports during FY22-23 in terms of value
Engineering goods	19.64
Gems and jewellery	12.3
Readymade garments	8.52
Rice	6.22
Organic and inorganic chemicals	5.7
Marine products	4.8
Drugs and pharmaceuticals	3.86
Cotton yarn/fabrics/madeups/handloom products	3.65
Electronic goods	3.63
Leather and leather manufacturers	2.71
Others	28.97

Source: DGCIS data, 2024

02 Considerations for India's export growth journey



It is true that India has outperformed many other countries in export growth. Through tactical diversification of both geography and sectoral focus, it has been able to avoid adverse impacts of global macroeconomic uncertainties. Nonetheless, to achieve the target of USD 1 trillion of merchandise exports, it is imperative to chalk out a strategic roadmap to realise the opportunities arising from breakthrough disruptions. Moreover, there is a need to focus on the internal and external impediments that may have a bearing on India's exports potential.

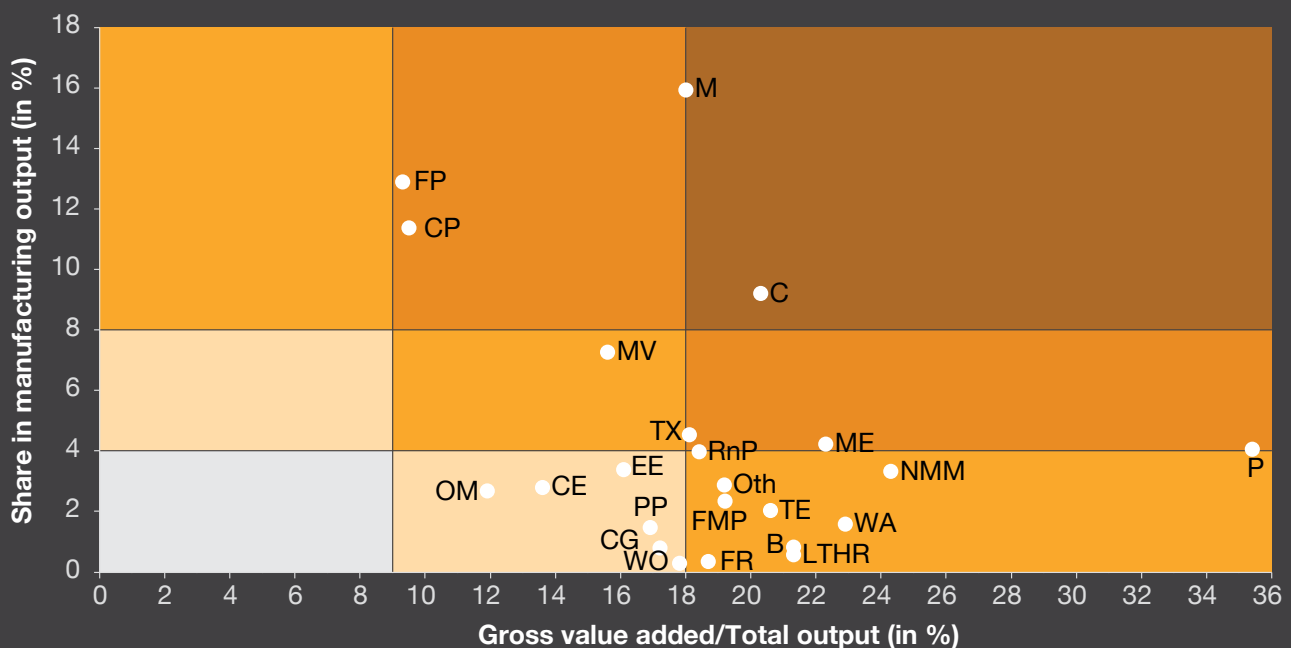
2.1

Commoditisation

Merchandise exports are dominated by traditional commodity baskets with relatively lower value addition

Most high value adding sectors of the Indian economy have a relatively low share in the manufacturing output. For instance, while the pharmaceuticals sector has a high gross value added (GVA) to industrial output ratio of 35.4%, it contributes to only ~4% of India's manufacturing output. Such sectors need to be enabled and incentivised to scale up their products/manufacturing activity.

Figure 9: Share in manufacturing output and value addition as a % of sector output – India (FY21-22)



- M: Basic metals
- C: Chemicals
- P: Pharmaceuticals
- FP: Food products
- CP: Coke and petroleum
- MV: Motor vehicles
- ME: Machinery and equipment
- TX: Textiles
- NMM: Other non-metallic minerals
- RnP: Rubber and plastics
- Oth: Others
- EE: Electrical equipment
- FMP: Fabricated metal products
- TE: Transport equipment
- WA: Wearing apparel
- CE: Computer, electronics and optical products
- OM: Other manufacturing
- PP: Paper and paper products
- B: Beverages
- LTHR: Leather and related products
- FR: Furniture
- CG: Cotton ginning, cleaning, bailing
- WO: Wood and products of wood

Source: Annual Survey of Industries (ASI), 2021-22, MoSPI

Further, a comparative analysis between India and Germany (a country that has already achieved USD 1 trillion in exports) for value addition to output ratio indicates a high potential for improving value addition, especially for furniture, electrical equipment, fabricated metal products, machinery and equipment, rubber and plastics, and motor vehicles.

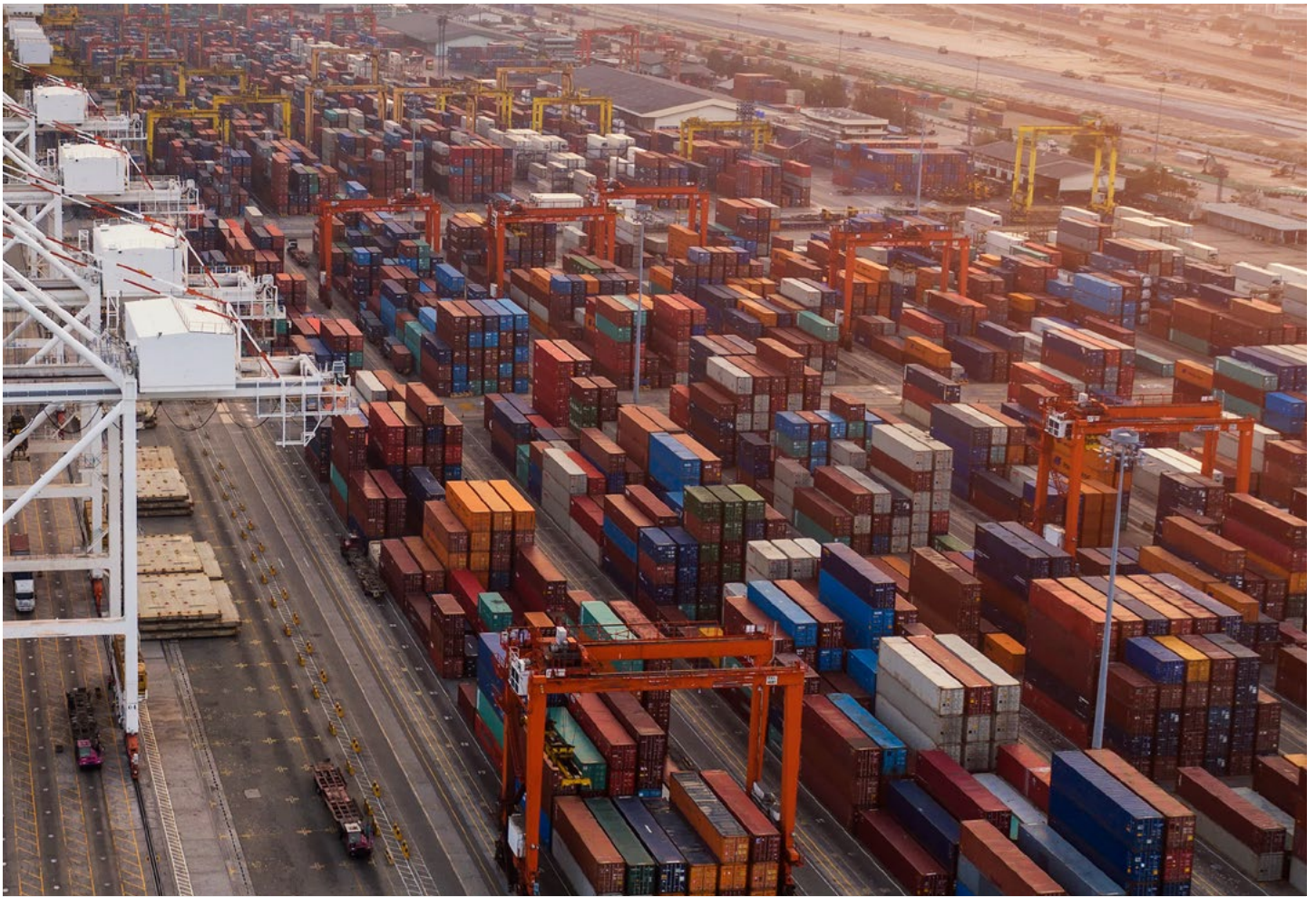
Table 5: Gross value added to output ratio of key manufacturing activities – India versus Germany

No.	Category	Gross value added to output ratio	
		Germany (CY 21)	India (FY 22)
1.	Furniture and other manufacturing	44.0%	12.6%
2.	Electrical equipment	39.2%	16.1%
3.	Fabricated metal products	40.7%	19.2%
4.	Machinery and equipment	39.3%	22.3%
5.	Rubber and plastics	35.1%	18.4%
6.	Motor vehicles	30.6%	15.6%
7.	Textiles, wearing apparel, leather and related products	33.6%	19.5%
8.	Food products including beverages and tobacco	24.8%	10.8%
9.	Wood and products of wood and cork, except furniture	30.8%	17.8%
10.	Other non-metallic minerals	36.4%	24.3%
11.	Other transport equipment	32.5%	20.6%
12.	Chemicals	31.4%	20.3%
13.	Pharmaceuticals	46.5%	35.4%
14.	Paper and paper products	25.5%	16.9%
15.	Coke and petroleum	9.0%	9.5%
16.	Basic metals	17.0%	18.0%

Source: ASI FY 22, OECD data CY 21, PwC analysis

Note: CY – Calendar year

Undertaking strategic initiatives to improve the value addition ratio of select sectors highlighted earlier and scaling up the size of manufacturing activity of current high value added sectors should be a key strategic area for India. Emphasis needs to be laid upon (i) undertaking initiatives for improving value addition such as supply chain localisation for such sectors, and (ii) attracting investments in sectors with high value addition ratio such as pharmaceuticals, machinery and equipment.



2.2

Concentration

Limited market access for merchandise exports

Owing to informational asymmetries and trade protection measures (tariff and non-tariff) imposed by importing countries, market access could become a key constraint for export growth enhancement. For instance, in the context of the US, the authorisation requirements are often quite complex involving multiple layers of agreements and protocols. The impact of such requirements is not only cost seeking but also time seeking, resulting in an overall silent burden for the exporter. Further, depending on the sector and requirements in question, the regulatory regime could be modulated by the importing countries to regulate market access through Technical Barriers to Trade (TBTs) and Sanitary and Phytosanitary Measure (SPS) measures.

India currently has 20 trade agreements and more than seven ongoing trade negotiations with various jurisdictions. With specific chapters on TBTs, SPS measures, and Intellectual Property Rights, the regulatory regime of the other jurisdictions could be expected to become relatively predictable, so market access for exports can be ensured. However, barriers may still be expected, but the institutional provisions that establish specific forums for redressal, such as the regular Joint Monitoring Committees, could be useful.



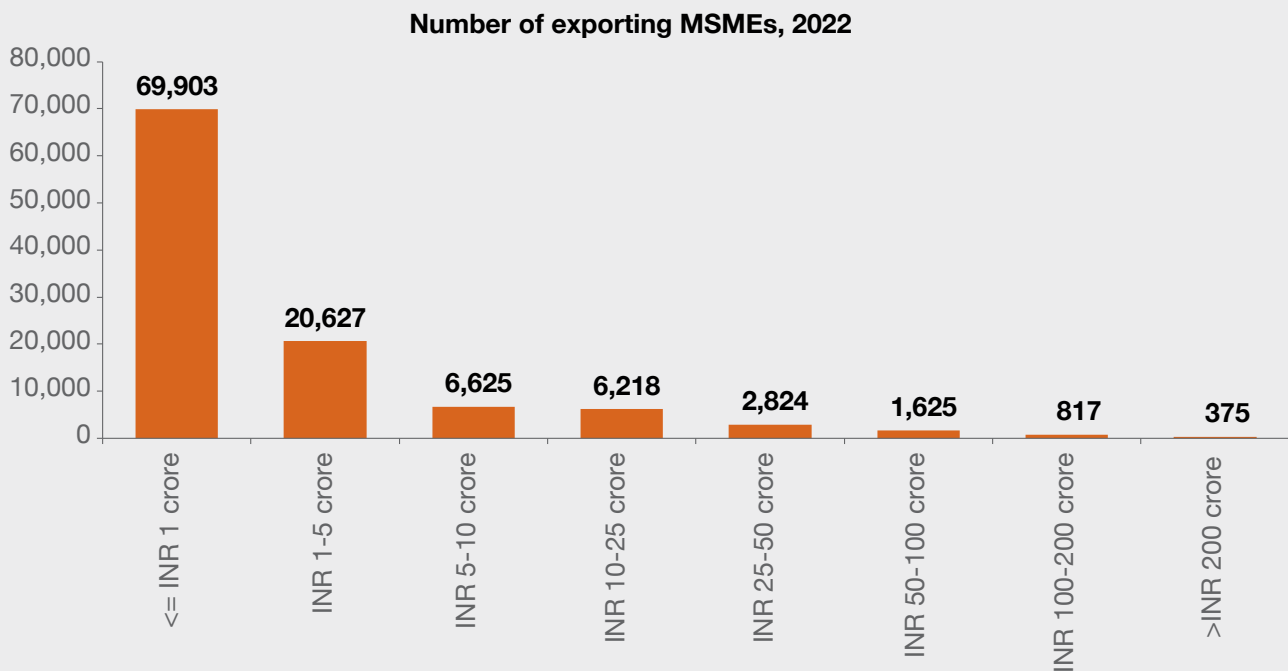
2.3

Disconnection

Several MSME units struggle to become a part of the export growth journey

Out of the 80 lakh MSMEs registered on the Udyam portal, only 1.36%, i.e. 1.09 lakh MSMEs, are exporting units; ~64% units have an export turnover of less than INR 1 crore (~USD 125,000). ~1,200 units have an export turnover of more than INR 100 crore (~USD 12.5 million). Information asymmetries and limited capacity of handholding support have led to high risk aversion and a low propensity amongst MSMEs to undertake exports.

Figure 10: Export turnover-wise distribution of exporting MSMEs in India, 2022



Source: Udyam Registration Publication, Registration of Micro, Small and Medium Enterprises (MSMEs) in India (2020-22) https://www.dcmsme.gov.in/UDYAM_Publication_with_tables_final20220622.pdf

MSME-specific challenges need to be addressed to improve their propensity to export and unlock their export growth potential, especially pertaining to four key dimensions – business environment, export procedure, access to finance, and access to markets and information.

Any measure to address the challenges of low value addition in Indian exports will also need to comprehensively address the issues faced by the MSME exporters. In its latest report, ‘Boosting Exports from MSMEs’, NITI Aayog has identified four distinctive types of challenges impacting the ability of MSMEs to export competitively. These increase the transaction costs and time for staying in business, thereby depriving the MSME leadership of the mental and financial space to invest in building scale and climbing up the value ladder.

Table 6: Challenges faced by MSMEs

Challenges in business environment	Export procedure	Access to finance	Access to markets and information
<ul style="list-style-type: none"> • Despite numerous policy changes initiated by the Government of India, MSMEs continue to face a disproportionately large number of regulations to establish and function. • On many occasions, hurdles arise because the intent behind the policy does not get translated on the ground during its execution. • Time-consuming certification processes. • Duties on sample and e-commerce projects increase the transaction cost of export pilots and projects. • Delays in claiming benefits associated with export incentives. 	<ul style="list-style-type: none"> • Repeated filing of similar documentation with different authorities. • High volume of paperwork to be completed. • Delays in shipments due to random procedures (e.g. customs inspections). • Tedious payment reconciliation processes. 	<ul style="list-style-type: none"> • Micro-category of MSMEs faces a severe financial servicing deficit due to its demand for smaller project sizes. • Access to working capital finance continues to be a challenge, especially for micro and small enterprises. 	<ul style="list-style-type: none"> • Limited as well as fragmented knowledge about accessing global markets. • Difficulty in attracting and locating buyers. • Lack of verifiable sources about buyers and market sizes. • Absence of tools and channels to do product and country specific market research. • Dearth of information on shipment and post-shipment processes to be followed to take exports to their logical conclusion. • Scattered information on government support schemes.

Therefore, addressing the challenges that MSMEs grapple with would significantly help India to set itself on the path of achieving its goal of USD 1 trillion of merchandise exports.

Fossilisation

Technology is slow to make an impact on export efficiency, product quality and unit productivity

The adoption of advanced technologies in the Indian manufacturing and export sectors has been slow, resulting in suboptimal export performance, poor quality of export products, and low workforce and company productivity. The slow pace of integration of modern technologies in the export process is leading to inefficiencies and higher costs, making Indian products less competitive on the global stage. There have been cases of rejected export shipments on account of quality control, SPS-TBT conformity issues and outdated manufacturing practices that tarnish the reputation of Indian goods, and eradicating buyers' trust.

In 2023, average turnaround time of export containers from arriving at Indian ports or container freight stations (CFSs) to vessel sail out has been ~156 hours. While ~12% (~19 hours) of the total time is accounted for the customs regulatory processes, the rest of the time includes different activities related to stuffing at CFSs; or transit to terminal from CFSs; or waiting time for vessel to arrive. The turnaround time also differs across different ports – the JNPA port has the lowest at ~102 hours for direct port export (DPE) and ~165 hours for CFS bound cargo, while Mundra port has the highest ~320 hours.

JNPA port has been able to reduce its time for customs clearance processes within five hours for DPE containers by taking measures such as establishing an extended yard (parking plaza) which has twin benefits of avoiding queuing outside port gates and faster customs clearance processes for electronically sealed (E-seal) containers. However, time for customs clearance ranges between 29 to 41 hours for the CFS bound cargo, including at Nhava Sheva JNPA port, Chennai ChPA port, Mundra port and Kolkata SMPA port, which also impacts the cargo evacuation and the overall turnaround time for the exports. Similarly, for the inland container depots (ICD) bound cargo, turnaround time of containers from ICD gate-in to ICD gate-out is ~128 hours, with ~25% (~32 hours) of total time accounted for customs-related processes.

Further, India is engaging in strategic trade treaties with Middle Eastern and European countries, such as the Comprehensive Economic Partnership Agreement (CEPA) and the proposed India-EU Free Trade Agreement. These agreements will significantly increase traffic for Indian ports, necessitating streamlined trade operations and modernised facilities. The India-Middle East-Europe Economic Corridor (IMEC), proposed at the G-20 meeting, highlights the strategic importance of Indian ports by linking them to Europe via the Middle East, enhancing trade flows and driving investments in port modernisation.

Owing to the anticipated increase as well as the current growth in export volume, port level capacity and efficiency challenges will need to be addressed. These include challenges such as cargo evacuation process enhancement, integration of multiple documentation systems, RoRo capacity augmentation, need for Partner Government Agencies (PGAs) infrastructure, and challenges pertaining to expansion of port-led industrialisation projects. Likewise, the aviation infrastructure of India will also need enhancement for solving process efficiency to improve terminal throughput, using technology for cargo inspection, expansion of fleet with wide body aircraft to cater to increased export volume, and expanding the air freight station infrastructure.



2.5

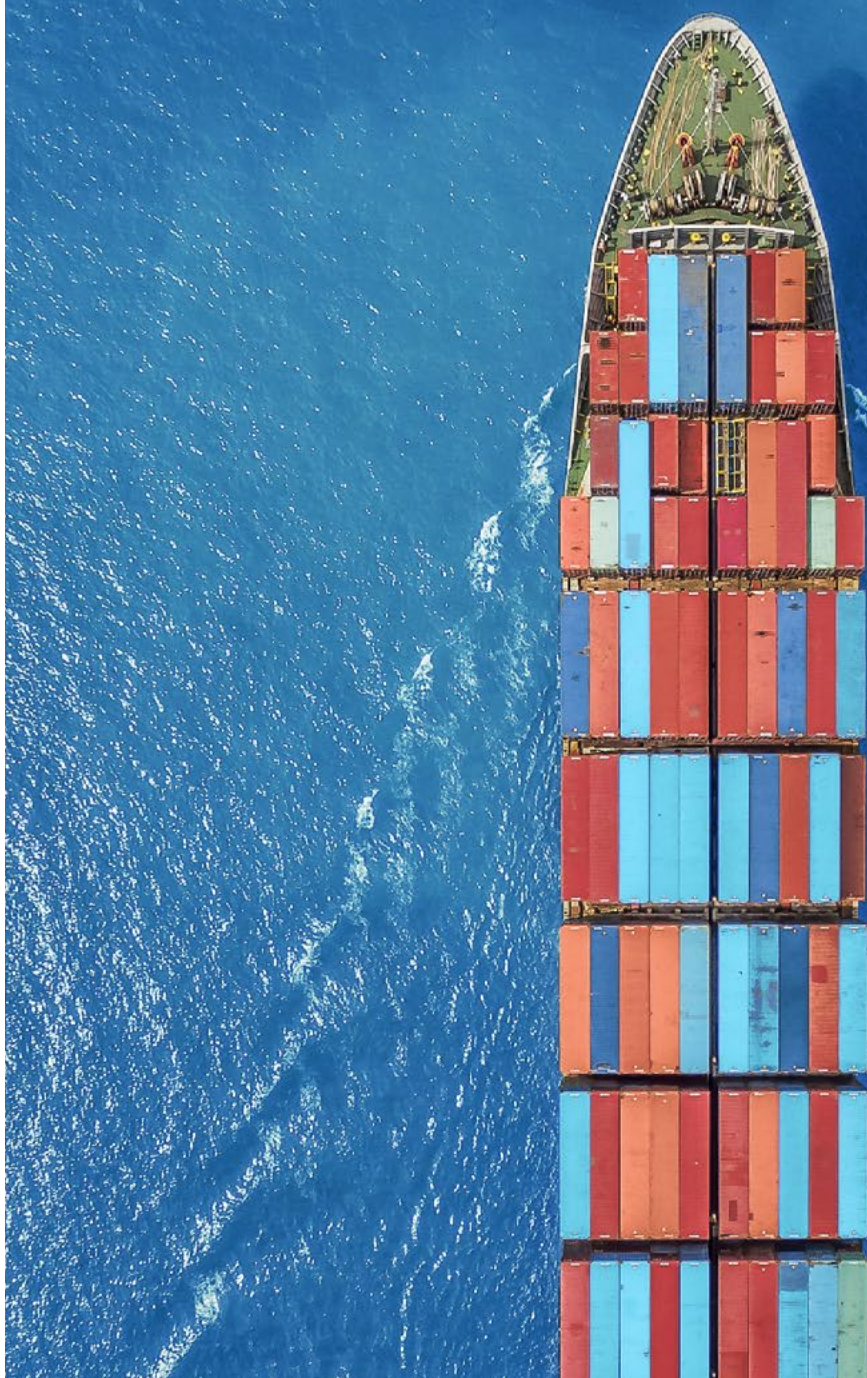
Carbonisation

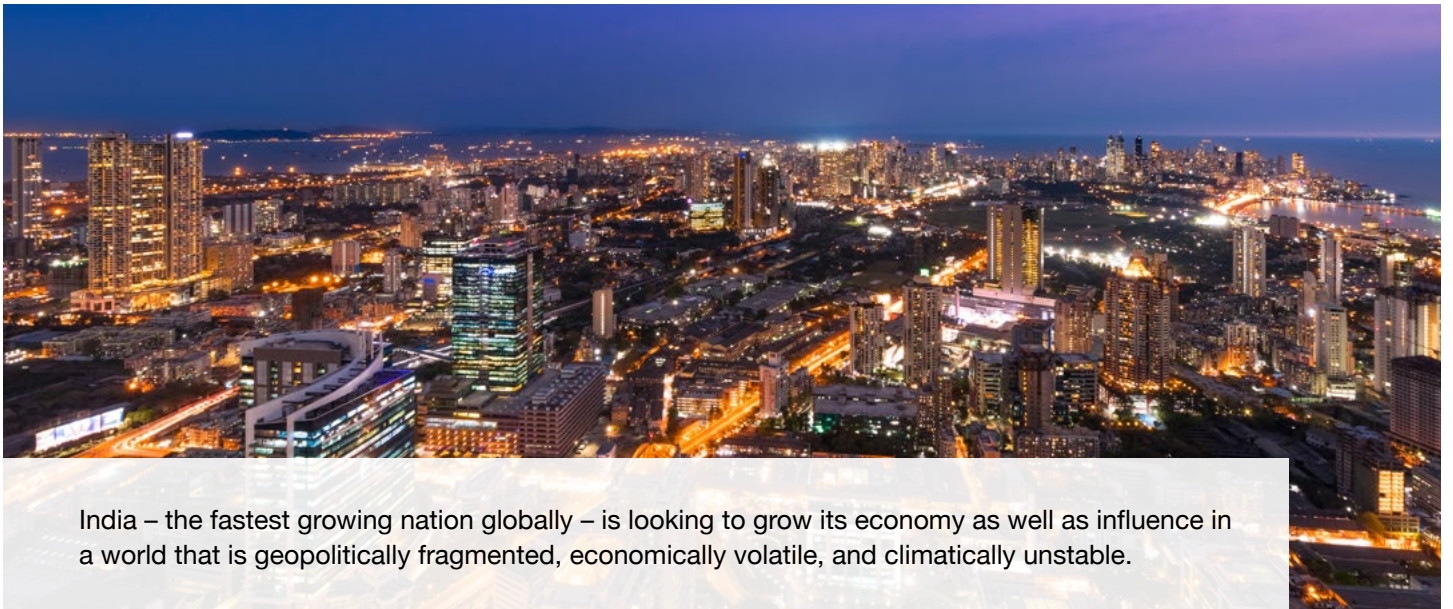
Recent climate change and mitigation measures are impacting international trade

Global climate mitigation initiatives have accelerated in the last 10 years. Both pricing and non-pricing policies are in full swing such as carbon taxes, European Union Emission Trading System (EU ETS), EV incentives, energy efficient building codes, ISO certification, and registration, evaluation, authorisation, and restriction of chemicals (REACH). The European Union (EU) has Corporate Sustainability Due Diligence Directive (CSDDD) and Carbon Border Adjustment Mechanism (CBAM) which mandate a firm to ensure sustainable practices throughout its supply chain and carbon emission reporting. Similarly, the UK has established the Streamlined Energy and Carbon Reporting (SECR), and Canada has institutionalised the Canadian Net-Zero Emissions Accountability Act.

It is expected that Indian exporters could be negatively impacted as most may not be prepared to operate in this complex business environment. Adopting these sustainability practices will impact competitiveness of Indian products in the short term. Greening initiatives such as net zero commitments and CBAM will also need export ecosystem enablers to transform, for example, port authorities will need to undertake a comprehensive approach towards greening of port infrastructure.

03 VIKSIT – an approach for enabling exports





India – the fastest growing nation globally – is looking to grow its economy as well as influence in a world that is geopolitically fragmented, economically volatile, and climatically unstable.

3.1

Introducing the VIKSIT framework for exports

From a geopolitical standpoint, the world is now polynodal rather than multipolar. The world is no longer centred around cohesive centres of power as no single state is now able to address problems such as global warming or cybersecurity on its own. The influence of a nation is now determined by how well it collaborates to solve a problem and not by how well it is coercing support to do the same.

Perceived from an economic lens, business cycles are now replaced with cycles of volatility. Over the last five years, the world has witnessed a lingering COVID-19 pandemic, the conflict in Ukraine, inflation, lower consumer demand, energy shortage, refugee crises and digital disruption resulting from the rise of AI – some of them at the same time.

And from a climate perspective, an increasingly warmer Earth is giving rise to climate catastrophes driving supply chain disruptions like never before. For example, the recent drought in the Panama Canal causing major supply chain disruptions globally was driven by below-normal rainfall linked to the natural climate cycle El Niño.

These three externalities, i.e. polynodal world order, cycles of socioeconomic volatility and climate-led economic disruptions, have implications for our nation's ability to create, access and maintain export markets. Their impact on India's exports could be countered by leveraging the nation's best-known strengths – its diversity, demography and digitality.

India's diverse agroclimatic zones, population and practices provide an essence of many global resources and end-markets to our exporters within one nation. The young demography of India stands to provide a secure long-term talent pool for our manufacturing and services exporters. Our robust digital public infrastructure and growing populace of digital natives could help exporters embrace digital technologies at a faster pace, reducing their transaction costs of driving export value.

However, to leverage these strengths for creating, accessing, and maintaining markets, we need an action-driven paradigm that is indigenous and plays to our strengths; is inspiring for its people and the world at large; and is impactful at scale. Most importantly, it should be able to address impediments India would face in its ambitious export-led-growth journey.



The challenges Indian exporters face, as detailed in the earlier chapter, throw up the following five major considerations for the nation's future export growth journey (see Figure 11), which on actualisation can have significant effects:

01

Commoditisation

This is about merchandise exports remaining dominated by traditional commodity baskets which we have been exporting earlier. The actualisation of this challenge can lead to reduced negotiating power of our exporting community and could also impact the income generation of exporters.

02

Concentration

This is about India restricting itself to a limited number of geographies as its export destinations. Besides exposing the nation to outcomes associated with actualisation of commoditisation, greater dependency on a few export markets or concentration can also prompt the export destinations to start arm-twisting India with an application of non-tariff barriers (NTBs).

03

Disconnection

This is about being unable to transmit the benefits of trade to the MSME sector, and its actualisation can result in a sluggish export growth and inability to realise the complete potential, and loss of competitiveness and brand value.

04

Fossilisation

This is about technology infusion not helping the country make desired strides in the areas of efficiency, workforce productivity and quality. Its actualisation can result in loss of export competitiveness and brand, over and above the losses associated with per capita incomes of the workforce and reduced negotiating power of India's exporting communities.

05

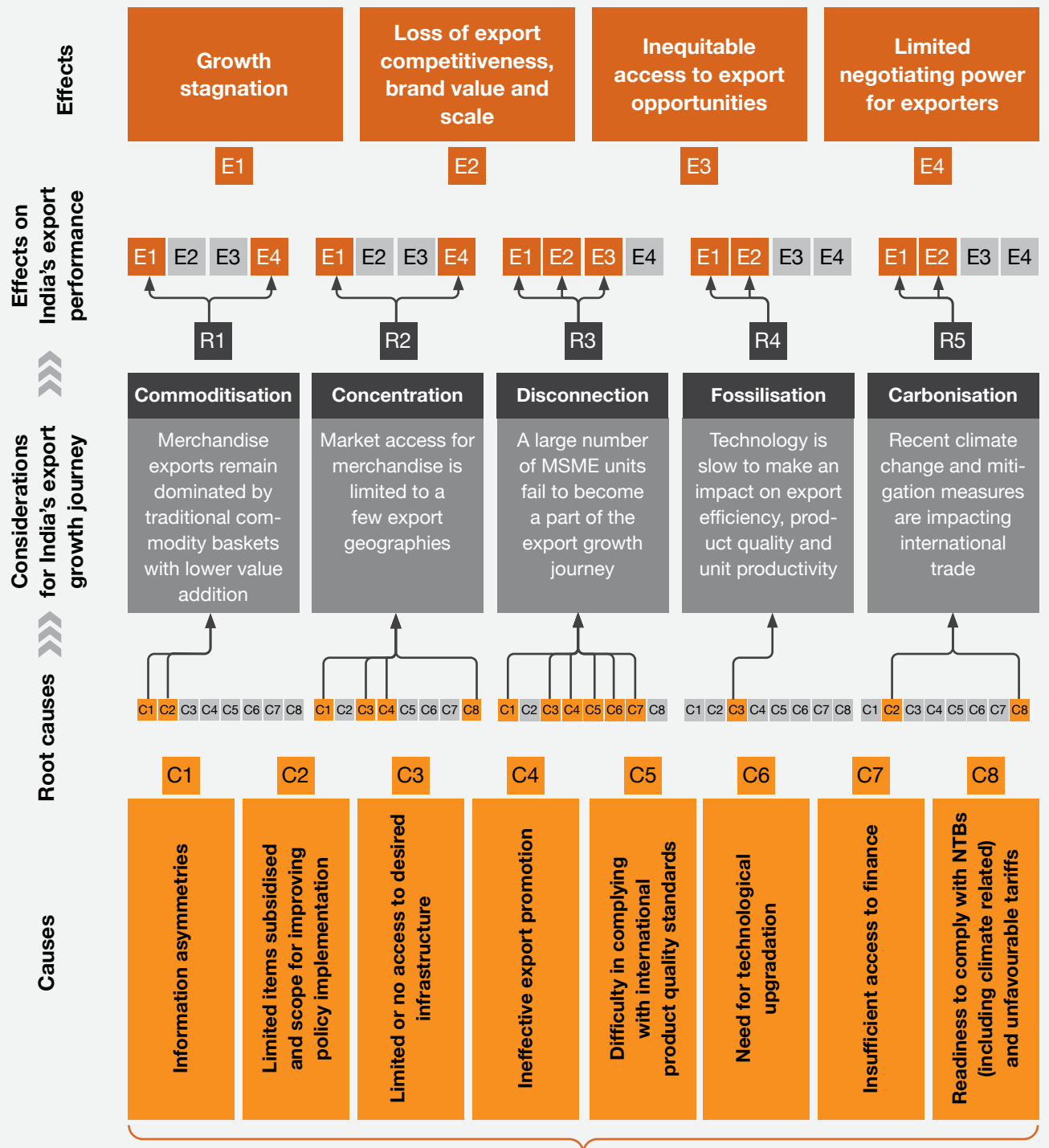
Carbonisation

This is about the growing impact of intensifying climate change mitigation measures on export growth. On its actualisation, India's exports would be subjected to NTBs and would face loss of competitiveness.

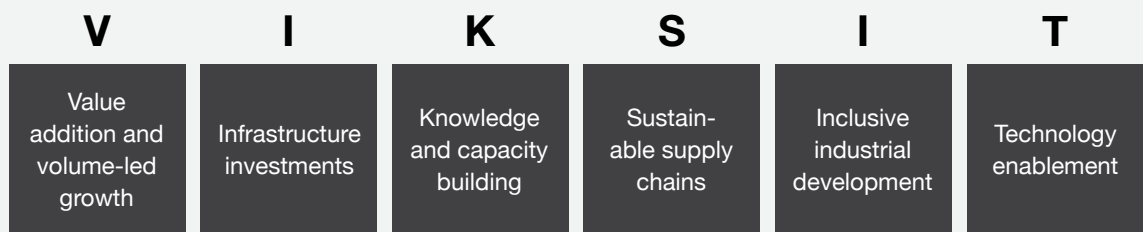
To address these impediments it is important to identify what causes them. There are multiple factors responsible for them to arise. For example, a combination of poor know-how, lack of quality, and lack of process and product standardisation accentuate the probability of commodification. In a similar vein, factors such as outdated technologies, poor access to infrastructure, and information asymmetries, upon coming together, can fossilise the country's exports.

We propose the VIKSIT framework to root out these causes.

Figure 11: Applying the VIKSIT framework to enable India to achieve its export growth ambition



The VIKSIT framework –
 an approach to address the key challenges that may impact India's export growth potential





VIKSIT is about:

V

Value addition and volume-led growth: Building on the strengths to leverage market opportunities, while maintaining a balance between value (high-tech and value-add sectors) and volume-driven (employment intensive sectors) exports

I

Infrastructure investments: Focused investments in infrastructure to promote development of competitive supply chains

K

Knowledge and capacity building: Empowering the export workforce and companies with the right competencies and capabilities, limiting information asymmetries in the system

S

Sustainable supply chains: Sustainability of supply chains to be driven by focusing on quality of manufacturing, eco-friendly modes of transportation and identifying the right set of trading partners

I

Inclusive industrial development: Enabling India's MSMEs to export by providing them with the right information, the right technology, appropriate financial and subsidy support, as well as helping them improve product and process standards

T

Technology enablement: Exporters and export ecosystem enabled with the right digital, business as well as production technologies to help them become more competitive vis-à-vis standards and overcome product value and quality deficits





Applying the VIKSIT framework across the entire value chain of select potential sectors would significantly contribute to India's USD 1 trillion export growth story. This framework is aimed at providing comprehensive guidance to all stakeholders – triggering both thought and action along different dimensions to solve current bottlenecks and propel India's exports.

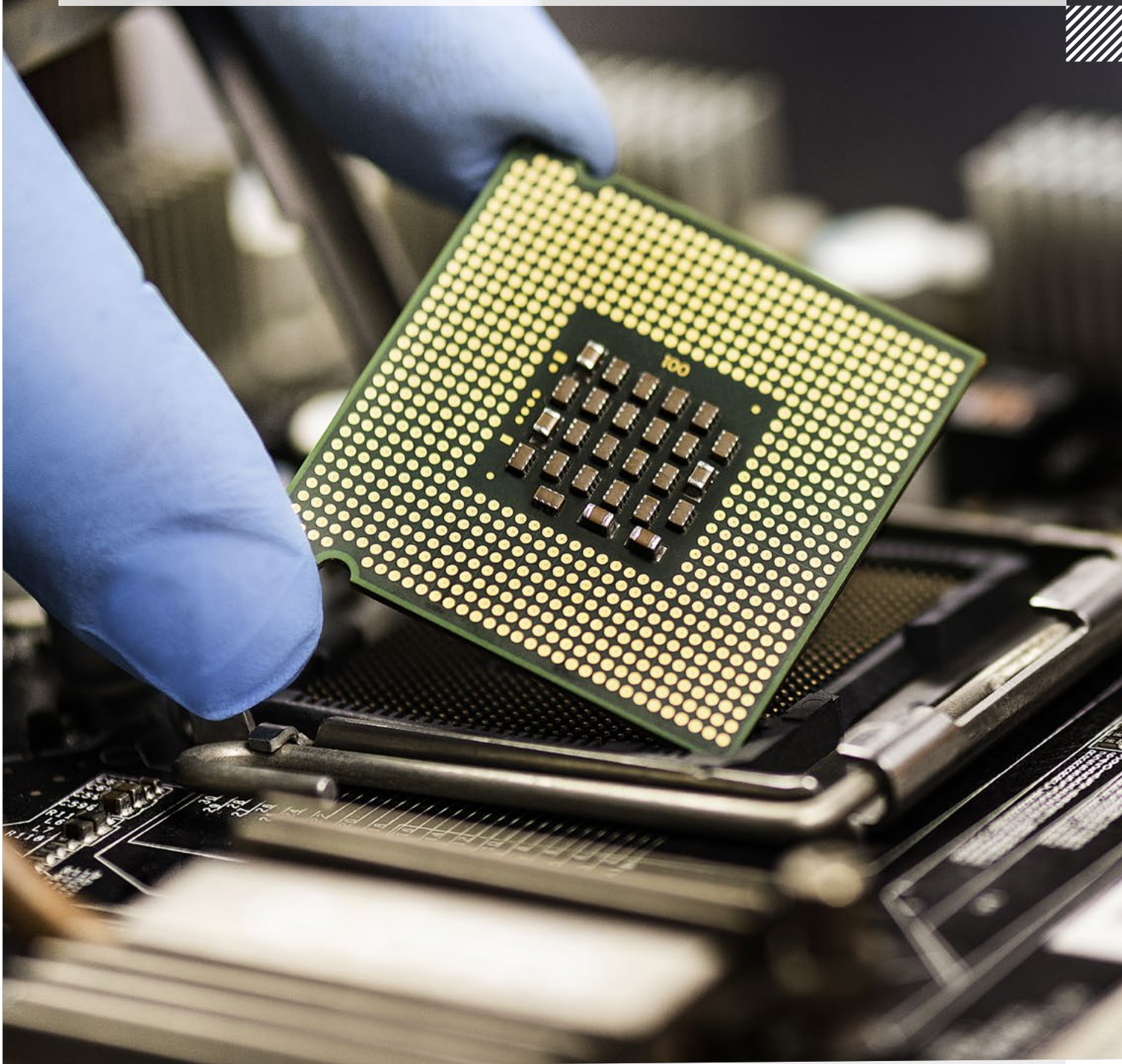
The following sections look at India's export potential in three specific high-priority sectors and attempt to lay the foundation for adopting the VIKSIT framework. The VIKSIT framework is meant to trigger thoughtful action to enable sector exports and competitiveness, which in turn could support India's goal of reaching USD 1 trillion in exports.

This approach blends sector-specific strategies with broader support systems, creating a powerful synergy that could boost export growth. By addressing the unique needs of each sector and leveraging common enablers, India can adopt a holistic approach to achieve its export goals.

Three key sector cases – electronics, automobiles and food processing – are evaluated in the following sections using the VIKSIT framework. The discussions have a sector-specific approach: a sector overview is followed by an assessment of the current export performance and identification of potential export opportunities. Thereafter, the key strategic imperatives within these pillars of 'V', 'I', 'K', 'S', 'I' and 'T' are analysed for each of the sectors to evaluate the support ecosystem required for enabling India to achieve USD 1 trillion exports.



04 Applying the VIKSIT framework to select sectors



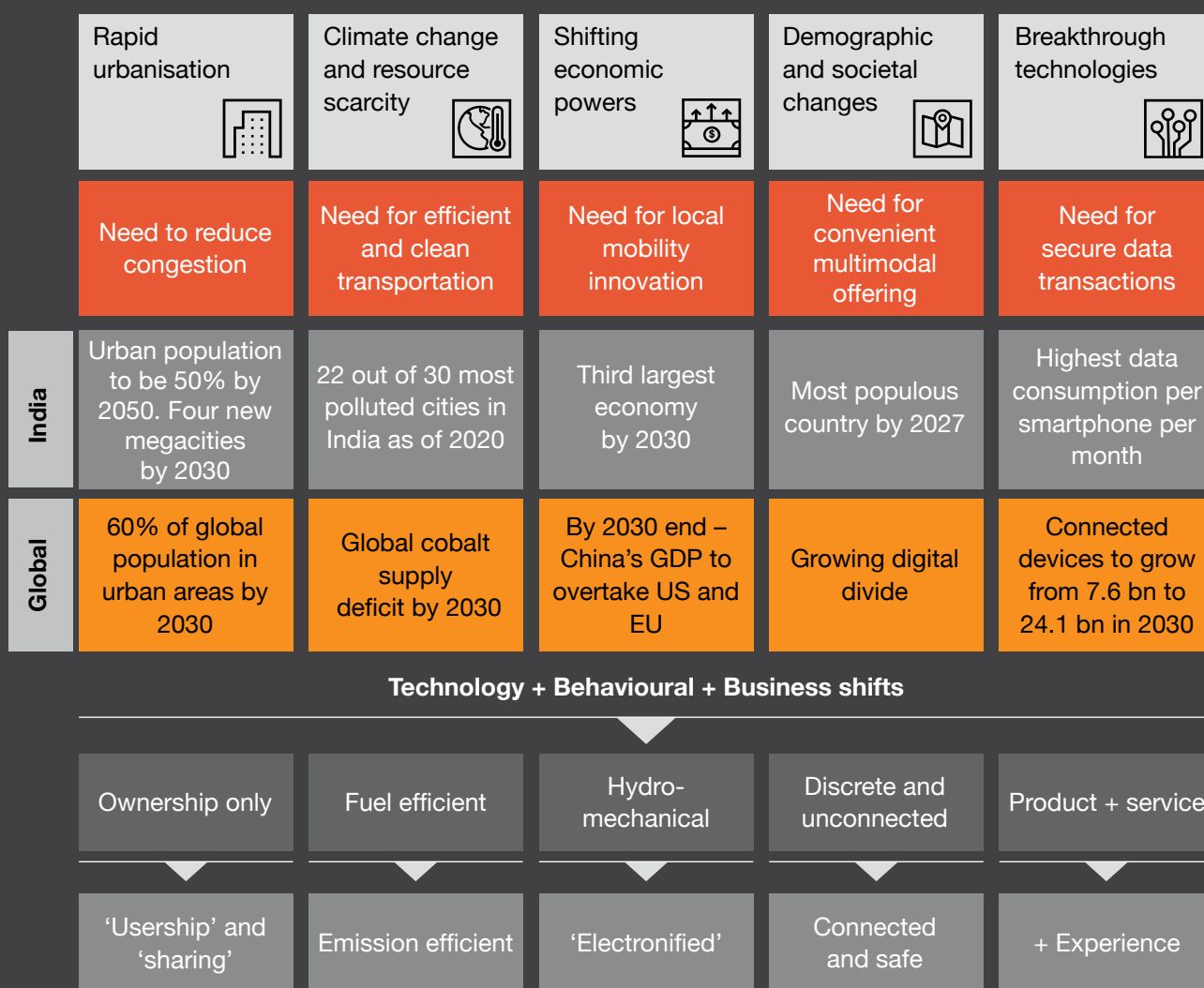
Automobile

Overview of the Indian automotive industry

With a revenue of ~USD 150 billion, the Indian automotive sector is a significant contributor to the country's overall GDP, contributing a 6.5%¹⁵ share in FY 2023. The sector is also a major driver of employment in the country, generating direct and indirect employment of 37 million.¹⁶ As of FY 2023, India was the largest three-wheeler and tractor manufacturer, second-largest two-wheeler and bus manufacturer and third-largest passenger vehicle and heavy-duty truck manufacturer in the world.¹⁷

Five global trends are transforming the automotive industry and the future of mobility, causing technology, behavioural and business model shifts.

Figure 12: Global trends causing technology, behavioural and business model shifts



Source: PwC analysis

15 SIAM Annual Report 2023

16 <https://www.investindia.gov.in/sector/automobile>

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

India's current export scenario

Indian automotive merchandise exports accounted for ~7% of India's overall merchandise exports in FY 2023.¹⁸ In FY 2023, exports stood at USD 33.2 billion,¹⁹ growing at a ~7% CAGR between FY 2019 and FY 2023. Of the USD 33.2 billion exports in FY 2023, automotive OEM exports stood at USD 13.1 billion²⁰ and automotive component exports stood at USD 20.1 billion.²¹

Automotive OEMs

Automotive OEM production in India primarily caters to the Indian market due to robust domestic demand, with the three-wheeler segment being the exception. In FY 2019, while two wheelers made up most of the vehicle production units in India, only 13% of them were being exported. On the other hand, 45% of the three wheelers and 17% of the passenger vehicles being produced in India were being exported. In FY 2023, while vehicle production of two wheelers dropped by 20%, share of exports increased to 19%. Similarly, production units of three wheelers decreased by 32%, while passenger units increased by almost 14%. However, the share of exports for these have decreased to 43% and 14%, respectively.

Table 7: Indian automotive OEM production and exports (in units) and segment-wise percentage share of exports

	Two wheeler	Three wheeler	Passenger vehicle	Commercial vehicle	Tractor
FY 2019 vehicle production (units)	2,44,99,777	12,68,833	40,28,471	11,12,405	8,86,995
FY 2019 vehicle exports (units)	32,80,841	5,67,683	6,76,192	99,933	91,792
FY2019 % share of units exported	13%	45%	17%	9%	10%
FY 2019 % share in total no. of units exported	70%	12%	14%	2%	2%
FY 2023 vehicle production (units)	1,94,59,009	8,55,696	45,87,116	10,35,626	10,71,162
FY 2023 vehicle exports (units)	36,52,122	3,65,549	6,62,703	78,645	1,24,542
FY2023 % share of units exported	19%	43%	14%	8%	12%
FY 2023 % share in total no. of units exported	75%	7%	14%	2%	3%

Source: SIAM, ATMA

18 Ministry of Commerce and Industry

19 Ibid.

20 Ibid.

21 ACMA

A further analysis of the segment-wise share in total vehicle exports both in terms of units and value (in USD billion) is presented in Table 7. In FY 2019, the two-wheeler segment accounted for 70% of vehicle exports, with a total of 32,80,841 units. This was followed by the three-wheeler segment, which made up 12% of exports with 5,67,683 units. The passenger vehicle segment contributed 14% to exports, with 6,76,192 units being shipped. The commercial vehicle segment had a 2% share in exports, with 99,933 units being exported. The tractor segment accounted for 2% of exports, with 91,792 units being shipped.

Comparatively, in FY 2023, the two-wheeler segment has continued to dominate exports, with a 75% share and 36,52,122 units being exported. The three-wheeler segment has witnessed a slight decrease in its share, dropping to 7% with 3,65,549 units being exported. The passenger vehicle segment has maintained its 14% share, with 6,62,703 units being shipped. The commercial vehicle segment has also maintained its 2% share, with 78,645 units being exported. The tractor segment has increased its share to 3% with 1,24,542 units being shipped.

Overall, the two-wheeler segment is the largest contributor to vehicle exports, followed by the passenger vehicle segment. The three-wheeler, commercial vehicle and tractor segments have smaller shares of exports.

Some vehicle segments have witnessed a decrease in exports from FY 2019 to FY 2023, like three wheelers and passenger vehicles. However, two wheelers, commercial vehicles and tractors have witnessed growth in exports during this duration. Passenger vehicles have maintained their majority in exports over the years.

Table 8: Automotive OEM exports (value in USD billion)

Vehicle segment	FY 2019 exports	% share FY 2019	FY 2023 exports	% share FY 2023
Two wheeler	2.22	19%	2.79	21%
Three wheeler	0.74	6%	0.49	4%
Passenger vehicles	6.22	53%	6.2	47%
Commercial vehicles	1.62	14%	2.13	16%
Tractor	0.97	8%	1.49	11%

Sources: SIAM, ATMA

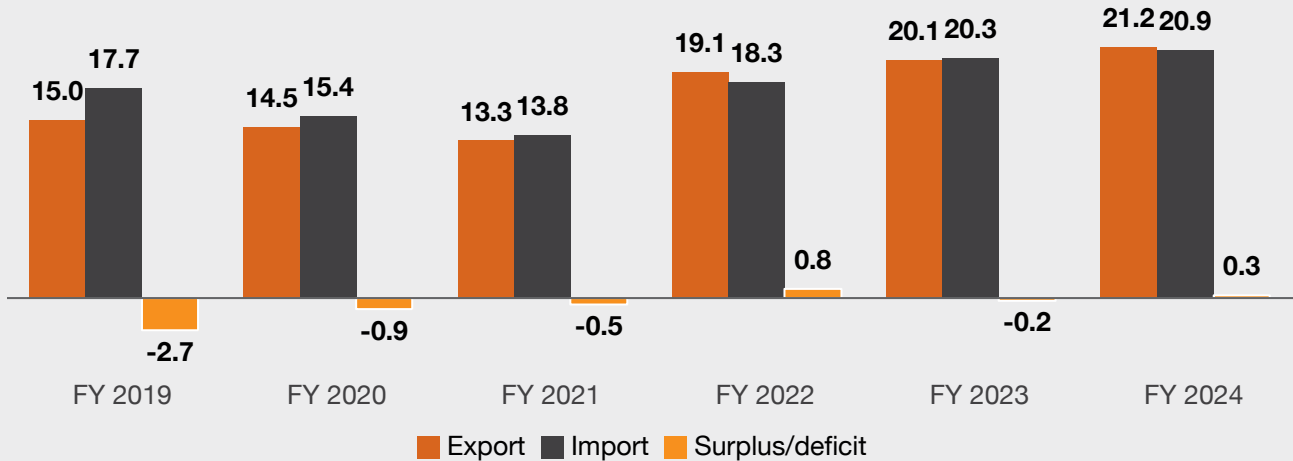
Key observations

- The two-wheeler and three-wheeler segments are low-ticket, volume-driven segments. Their share in units exported is high vis-à-vis the value of their exports.
- The passenger vehicle segment is a higher-ticket value driven segment.
- Commercial vehicles and tractors are higher-ticket value driven segments. However, the export volumes are small.
- Low-tonnage commercial vehicles dominate India's exports, whereas globally the demand is for higher-tonnage commercial vehicles.
- High-powered tractors dominate India's exports; however, low exports result from a lack of global cost-competitiveness due to a small production base for high-powered tractors.

Automotive components

The Indian automotive component sector has transformed from a net importer of automotive components to a net exporter. From FY 2019 to FY 2024, the export value consistently increased, from USD 15 billion to USD 21.2 billion, a CAGR of over 7%. However, there were fluctuations in the trade surplus/deficit. In FY 2019, 2020 and 2021 there was a trade deficit of USD 2.7 billion, USD 0.9 billion and USD 0.5 billion, respectively. In FY 2022, there was a trade surplus of USD 0.8 billion, but this turned into a trade deficit of USD 0.2 billion in FY 2023. In FY 2024, India once again witnessed a trade surplus of USD 0.3 billion as exports increased by a higher percentage than imports.

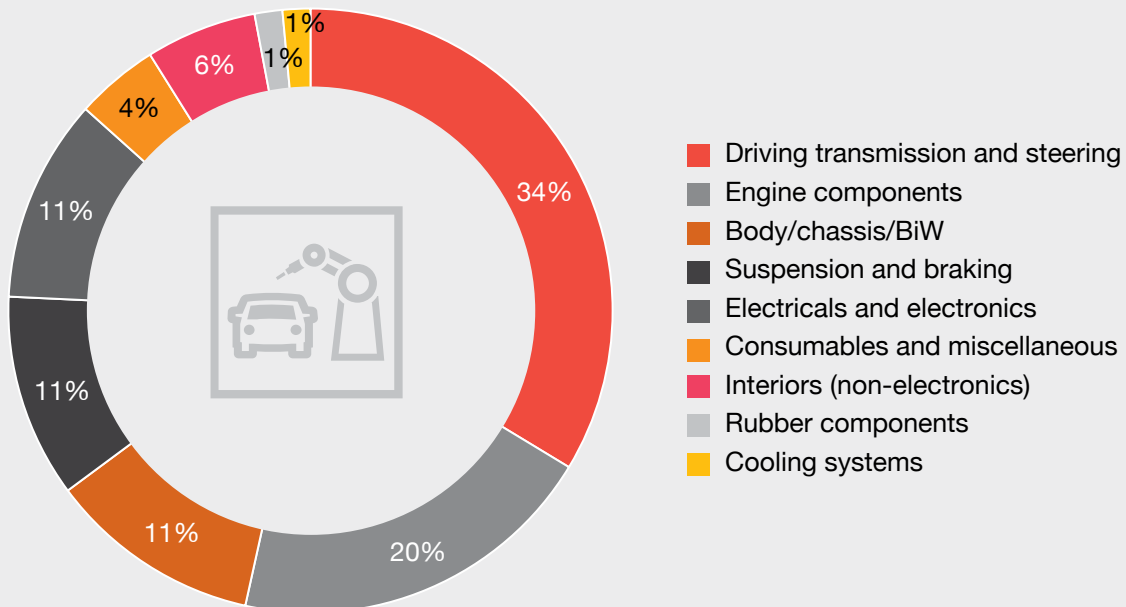
Figure 13: Annual Indian automotive component exports, imports and trade surplus/deficit (USD billion)



Source: Ministry of Commerce, Government of India

The figure below shows the split of automotive component segments exported from India in FY 2023.

Figure 14: Aggregate split of automotive components exported from India in FY 2023



Source: Ministry of Commerce, Government of India; ACMA, PwC analysis

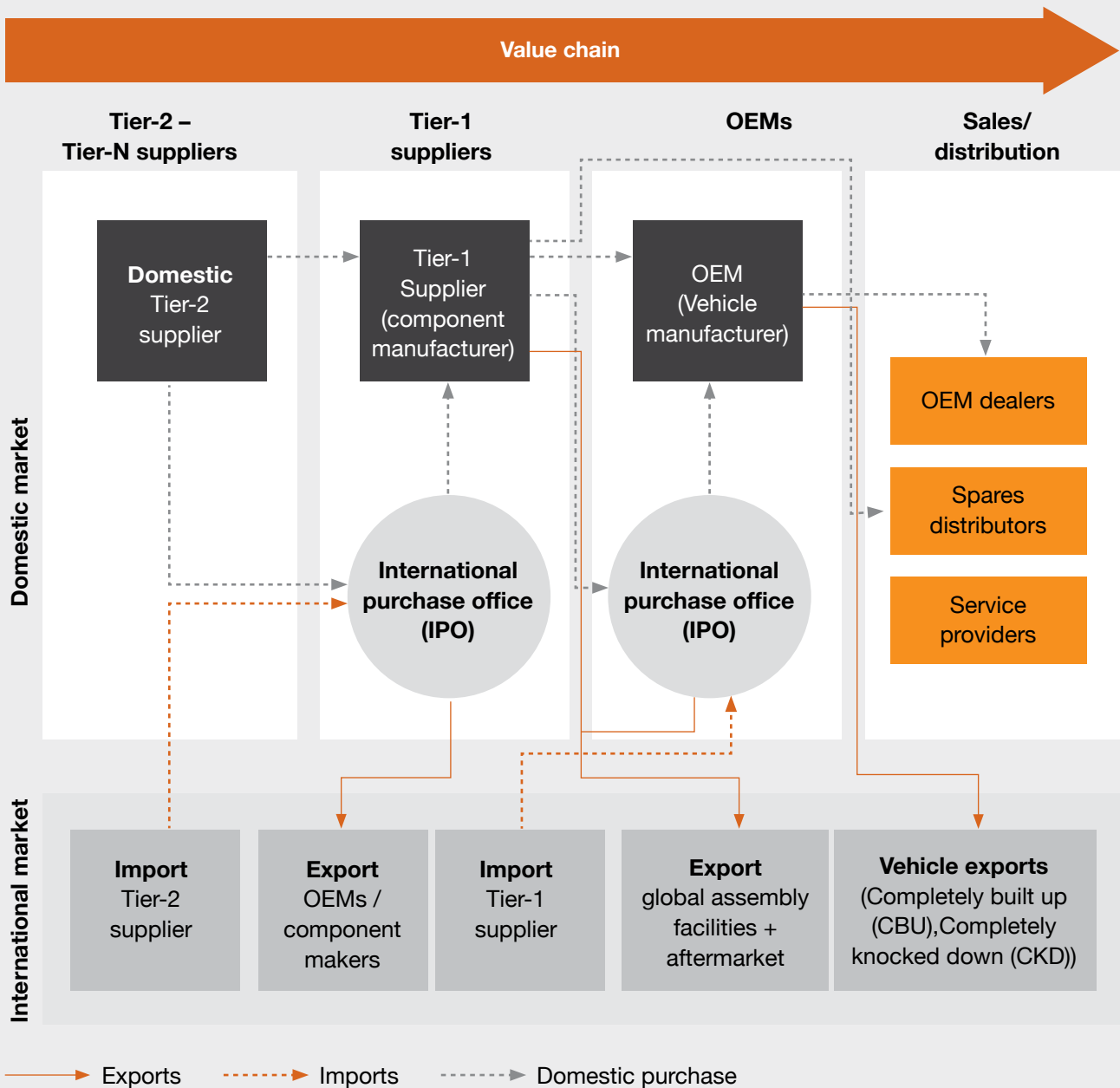
Note: As some of the figures have been rounded off, they don't add up to 100.

The drive transmission and steering and engine components sub-segments have a dominant share and constitute 54% of the total export value. Both segments have also grown at a CAGR of 7-8% between FY 2019 to FY 2023.

The automotive sector value chain has the following key stakeholders:

1. **Suppliers:** Automotive component makers, software and technology developers, charging infrastructure providers among others. Suppliers are classified into tiers depending on their value addition and type of goods they supply (e.g. system versus part).
2. **International purchase offices (IPOs):** Automotive component procurement houses that purchase components for an automotive company's global manufacturing operations.
3. **Original equipment manufacturers (OEMs):** The companies that produce the finished vehicles which are assembled with systems, subsystems and components supplied by various tiered component manufacturers.
4. **Aftermarket:** OEM appointed dealers, manufacturers and sellers of automotive spare parts and OEM appointed service providers.

Figure 15: Value chain of the Indian automotive industry



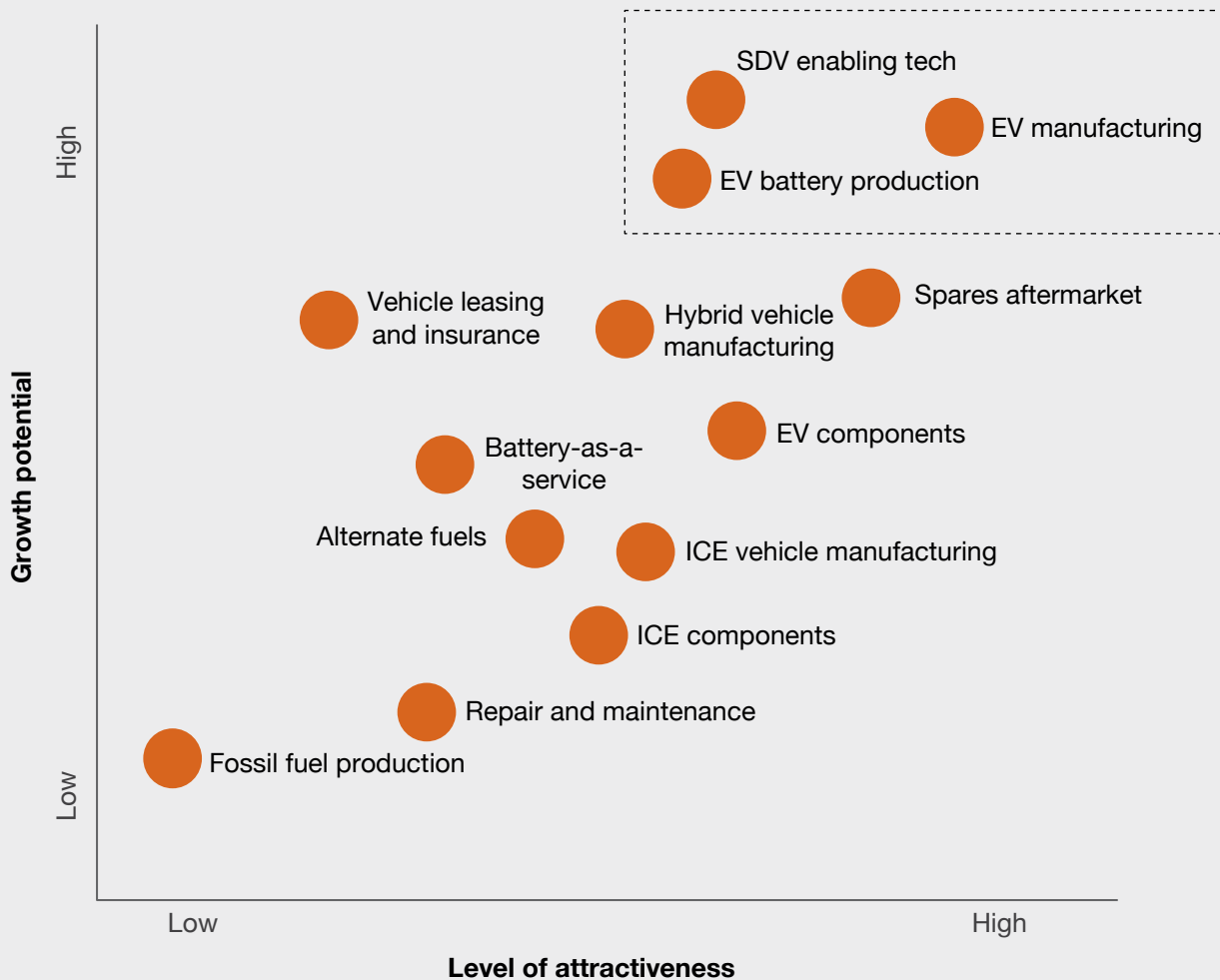
Source: PwC analysis



4.1.1 Value addition and volume-led growth

To identify export opportunities in this sector, we analysed opportunities with high growth potential (based on expected future share of global profit pool) and high attractiveness (based on current technology maturity and regulatory push). These are hence the export opportunities to be pursued by the Indian automotive sector in order to set itself on a higher value-addition trajectory.

Figure 16: Export opportunity attractiveness



Source: PwC analysis

Based on the assessment, we believe that export opportunities for EV manufacturing and sale, EV battery manufacturing and sale, and software-defined vehicle (SDV) enabling technology should be pursued towards building India's USD 1 trillion export growth story.

Electric vehicles (EVs)

Global battery electric vehicle (BEV) sales in 2023 crossed 10 million units, with the annual BEV sales in the top 28 electric vehicle markets growing at 28% vis-à-vis internal combustion engine (ICE) vehicle sales growth of 5%.²²

As per a recent analysis by the International Energy Agency (IEA), the stock of EVs across all modes except two-wheelers and three-wheelers is expected to grow from less than 45 million vehicles in 2023 to 250 million vehicles in 2030.²³

The growing potential for EV exports is reflected in the fact that India's EV exports grew at a CAGR of 88% from USD 3.55 million in FY 2019 to USD 43.88 million in FY 2023.²⁴

Over the past few years, policies at the central level — PLI Schemes for auto and auto components, Phased Manufacturing Programme (PMP) — and at the state level have aimed at providing incentives for EV manufacturing and sales. Indian OEMs in the EV space have announced investments and global companies have either already initiated investment in manufacturing facilities within India or are in the process of finalising their plans.

It is estimated that investments worth over USD 11 billion are being planned by auto OEMs to develop and expand EV manufacturing capabilities in India. Additionally, multiple EV models are under development by various auto OEMs to not only cater to the growing domestic market but to also use India as a base to export to different parts of the world.²⁵

While the global BEV market is expected to continue growing, finding solutions to challenges like government protectionism and reduced incentives and supply chain challenges due to geopolitical conflicts will be key. The US and European countries such as Germany, France and the UK are the biggest markets for passenger EVs outside China. However, companies looking to export to these countries are expected to meet stringent regulatory requirements. For example, the US has Federal Motor Vehicle Safety Standards (FMVSS) that impose stringent requirements for design, performance, and durability.

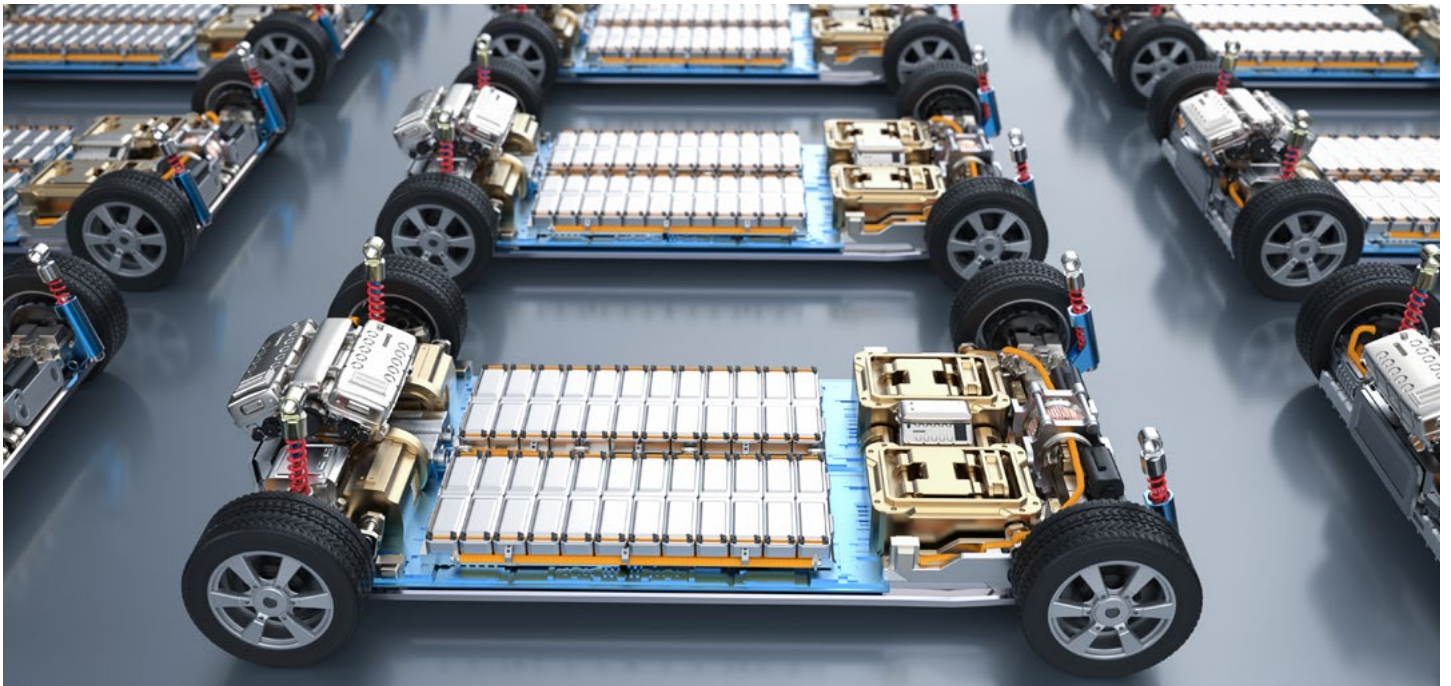
22 PwC Strategy & EV Sales Review Q4 2023

23 <https://www.iea.org/reports/global-ev-outlook-2024/outlook-for-electric-mobility>

24 Department of Commerce, India

25 PwC analysis





EV battery

Growth in EV sales is pushing up the demand for batteries, with the global battery market estimated to reach USD 116 billion by FY 2030.²⁶ Batteries form a major portion of EV costs. However, the price of lithium-ion batteries, which dominate the current battery market, is expected to reduce from USD 132/kWh in 2021 to USD 58/kWh by 2030²⁷ as the automotive ecosystem players collaborate to scale up manufacturing.

Reducing the need for critical materials will be important for supply chain sustainability and resilience. A strong R&D focus on both alternate cell chemistries (e.g. sodium ion) as well as advanced battery technologies that require smaller quantities of critical materials is key. This can be supported by innovative R&D strategies (platform approach, integrated simulations, thermal design, etc.), supplier collaboration (sharing of development costs) and a push towards localisation.

As India develops its EV production and technology, it will need to localise EV battery production across the three phases of cells, modules and packs. India has historically imported cells from countries such as China, South Korea and Japan. While policies like the PLI Scheme for advanced cell chemistry (ACC) and Faster Adoption of Manufacturing Electric Vehicles (FAME) have spurred investments and partnerships, OEMs need to invest heavily in local cell manufacturing facilities.

EV cells, modules and pack manufacturing seem to be primarily centred around the western and southern India manufacturing clusters.

The US and European countries are the biggest markets for EV batteries, outside of China. However, companies exporting to these countries have to adhere to stringent conditions. For example, the European Green Deal imposes some regulations for battery players such as setting a maximum threshold for the full lifecycle carbon footprint, supply chain due diligence, separate registration application for each member state where the batteries are sold, and certification of battery recycling components.

26 Ibid.

27 Bloomberg NEF Battery Price Survey 2021



SDV enabling technology

With the advent of SDVs, the value share of software in the automotive industry is rapidly increasing. The global automotive software and electronics segment is expected to double and reach ~USD 400 billion by FY 2030 from the current ~ USD 200 billion.²⁸

As connected and automated vehicle use cases develop, a strong demand is expected to arise for hardware such as ADAS sensors and integrated software solution packages such as vehicle-to-mobile integration solutions (e.g. mirroring, payments) and vehicle-to-grid (bi-directional charging).

Given the changes in the electrical and electronic architecture, there is a need to develop software capabilities across the hardware (sensors, actuators, power components) integration, as well as computation, operating system, and middleware layers.

R&D capabilities in SDV enabling technologies can be promoted through global capability centres (GCCs) which contribute to ~25% of technology export revenues from India.²⁹ India accounts for over 50% share of the global GCC industry and is recognised as the 'global GCC capital'. There are currently over 50 automotive GCCs in India with key functional capabilities such as engineering research and development (ER&D), integrated systems and information technology services such as software development and next-gen innovation in areas such as ADAS, generative AI and in-vehicle data analytics.

GCCs in India are predominantly in the metros and Tier-1 cities, with cities in the west and south India such as Pune, Bengaluru, Hyderabad, and Chennai commanding 88% of the share.

The Government has taken steps to not only promote manufacturing through incentives such as PLI but is also working closely with the automotive sector to create state-of-the-art testing, validation, and R&D infrastructure in the country. The National Automotive Testing and R&D Infrastructure Project (NATRiP) is a step in this direction with ~USD 450 million investment by the Central Government,³⁰ aimed at setting up centres for testing and homologation (ICAT, Haryana and GARC, Tamil Nadu), automotive proving grounds and test tracks (NATRAX, Madhya Pradesh), etc. The project also aimed at setting up 10 centres of excellence (CoEs) for R&D in the areas of powertrains, components, materials, etc.

Thus, as vehicles become more connected, smarter and autonomous, they will become a natural extension of our living spaces. This provides an enormous opportunity for the nation to export not only state-of-the-art vehicles but also a host of enabling services that will drive value addition when the consumer is in the vehicle.

28 PwC analysis

29 NASSCOM

30 Ministry of Heavy Industries Annual Report 2019

Suggestions for the private sector

- Don't focus only on smart vehicles, but also on smart services that can be exported with them. That would be the differentiator for India and more importantly will play to its strengths already existing in the field of software services and digital service engineering.
- To make the most of this opportunity, vehicle exporters must start collaborating with global players in industries such as fast-moving consumer goods, retail, telecom, travel, tourism and others to identify the value-added services that can be embedded as a part of the 360-degree experience to be delivered to the customer when they are in the vehicle. To make the most of the connected mobility commerce industry, vehicle manufacturing exporters must start partnering with FinTechs and digital commerce startups to deliver last-mile, hyper-personalised engagement.
- Exporting cars containing a similar palette of technologies as those deployed by our competitors will not allow us to penetrate export markets effectively. This is because our exporters would not be able to match the 'scale-effect' already achieved by our competitors. Considering the same, it's very important to be radically innovative in terms of the value-add we provide to our users in the technology lifecycle and to explore how we could export the same while keeping in mind the need to service such technologies in our export markets at competitive prices.

Suggestions for the Government

- While continuing with the existing PLI Scheme, the government must institutionalise an innovation-linked incentive scheme — specifically for next-gen industries and technologies such as smart mobility, hydrogen ICE and fuel cell. Under this scheme, manufacturing entities driving disruptive innovations within the smart mobility vehicles as well as the services must be suitably rewarded with tax benefits and other incentives.

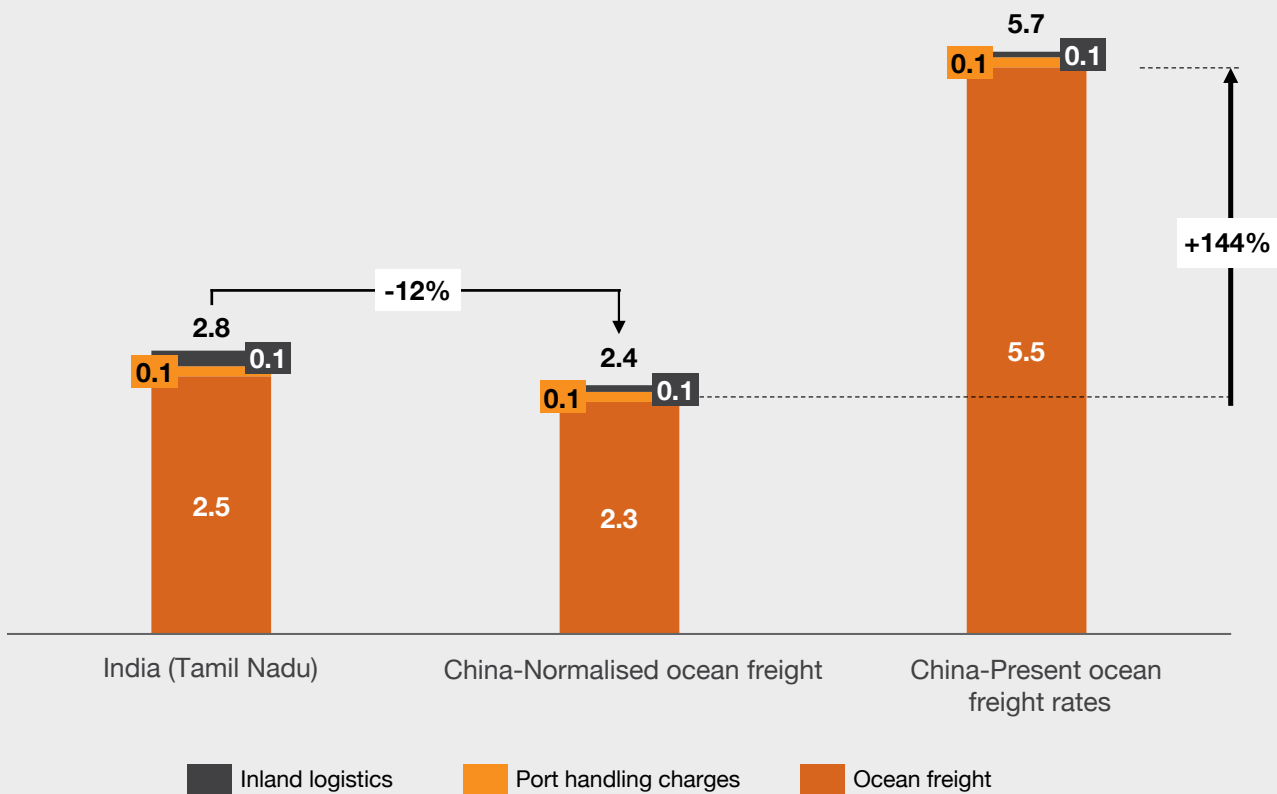


4.1.2 Infrastructure investments

As large global automotive companies undertake their ‘China plus one’ strategy, India can become the favoured manufacturing and export hub. Automobile exports from India and China are important for the manufacturing and export economies of both countries. China has a well-developed logistics infrastructure, including extensive rail and road links and advanced port facilities which contribute to relatively lower logistics costs and higher efficiency in the export process. However, in recent months, owing to multiple factors like port congestion, shortage of equipment and longer shipping routes, vessel freight charges from China have increased significantly.

The chart below compares the TLC between the China (Shanghai)-Germany corridor and India (Chennai)-Germany corridor. Both the locations, i.e. Shanghai and Chennai, are known for their automobile industry, and a substantial number of vehicles and automotive components are exported from these areas through the ports located in the region.

Figure 17: Total logistics cost (TLC) comparison of India-Germany and China-Germany corridor for 40 ft containers



Source: PwC analysis

On the whole, China’s automotive sector is more competitive than India’s from a logistics cost standpoint. High demand, economies of scale, and more efficiencies with Chinese mega ports mean that ocean freight is relatively lower for movement from China to exporting countries. Even though the ocean freight rates for the China-European corridor have increased by ~150%³¹ – owing to increased congestion at Chinese ports and the Red Sea crisis forcing vessels to take longer routes – experts believe this hike to be temporary. Another reason for China’s competitiveness is inland logistics. In India, road transportation per tonne per km is in the range of INR 3 to 4 per tonne per km, which is significantly lower in the case of China, where it is in the range of INR 2-2.4 per tonne per km. Also, the average speed of a truck/trailer in China is ~90 km per hour, while in India it is ~60 km per hour, which further adds to the time it takes for goods to reach the port.³²

31 PwC analysis

32 Ibid.



Suggestions for the private sector

- Smart cars as well as their smart electrical batteries will require smart manufacturing. The private sector must invest in Industry 4.0 manufacturing platforms that break down silos, facilitate consolidation of systems and help unlock the power of real-time data-driven analysis across the enterprise. The end-to-end organisational visibility achieved as a result will help them stay cost-competitive and drive more collaborative innovation.
- Enhance investments in infrastructure that enable advanced R&D, testing and validation capabilities for advanced technology products to meet global requirements.
- Invest in building scale to meet the expected increase in global requirements for EVs, batteries and SDV technologies.
- Ensure alignment of private-sector logistics operators to cater to the automotive exports growth. With automotive OEMs and component manufacturers focused on growing their exports, logistics operators also need to augment their capacity and services. For instance, RoRo terminal operators having PPP agreements can focus on improving operational efficiency through digitisation and debottleneck their capacity; Automotive Freight Train Operators (AFTOs) can focus on investing in BCACBM rakes to augment their rail carry capacity, as they offer double stacking for small cars (hatchbacks), thus reducing exports logistics cost for the industry.



Suggestions for the Government

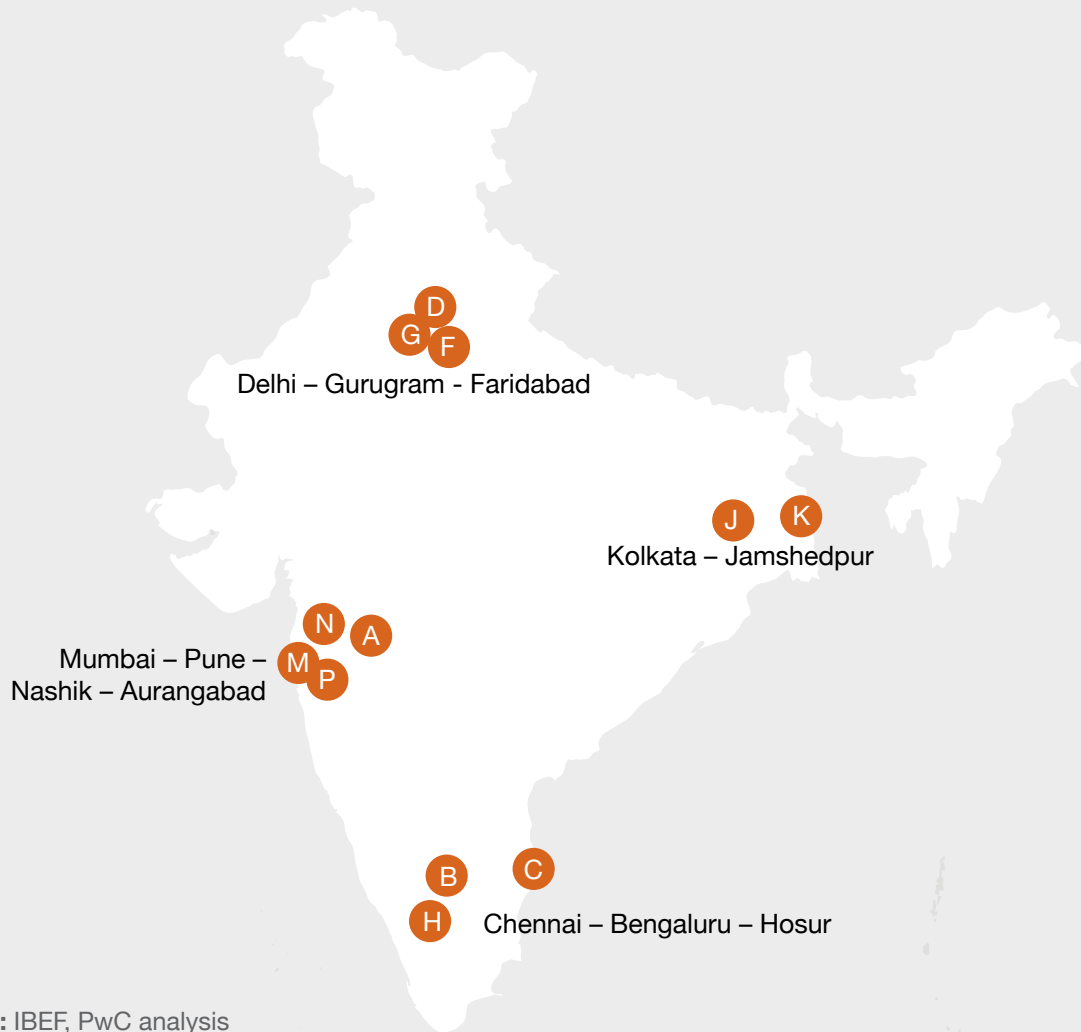
- Develop hubs in India to focus on targeted select technologies by creating a comprehensive infrastructure master plan for the sector at a national level.
- Maintain a consistent focus on driving policies that further enhance ease of doing business, thereby attracting global companies to increase investments in manufacturing.
- Introduce schemes on the same lines as the PLI Scheme that would provide incentives for new manufacturing ecosystems. This will help lower production costs and boost exports.
- Augment RoRo terminal capacity to meet the export volumes of manufacturers based in southern India. In FY23, ~6.2 lakh vehicles were exported through RoRo terminals with Chennai and Ennore ports catering to ~50% of the volumes, followed by Mundra at ~25%. Further, RoRo ports on eastern coast are at ~85% utilisation levels. With a conservative growth rate of 7-8%, Indian automotive exports are projected to reach ~12 lakh vehicles by FY30. As a result, the RoRo vehicle handling capacity is expected to be saturated, especially at Chennai and Ennore ports.
- Structural reforms to promote hinterland movement by rail for vehicle exports shall be undertaken. The inclusion of the steel sector in the Carbon Border Adjustment Mechanism (CBAM) in Europe may increase the cost for European importers of automotive vehicles and components, as steel is a key input in auto manufacturing. This makes it necessary for automotive manufacturers to align their net-zero goals with global competing countries. Rail can be used for cargo movement between hinterland and ports as it has significantly lower carbon emissions compared to road transportation. Furthermore, the cost of rail movement in India is INR 10-12/km/vehicle, as opposed to INR 12-14/km/vehicle for road, making rail logistics marginally cost efficient. However, less than 2% of total vehicles exported by automotive OEMs are moved through rail, while in case of domestic inland movements it is ~ 18% higher. A few structural reforms are required to improve the adoption of automotive rail freight transportation for export movement.
 - **Augmentation of rail infrastructure at rail terminals:** Augmenting the rail terminals/ IR goods sheds in proximity to manufacturing hubs can be evaluated. This could include developing parking yards, ramps for loading vehicles and CCTV security.
 - **R&D to modify wagons for double-stacked movement for SUVs:** Existing design of BCACBM wagons has limitations for double stacking of SUVs, only hatchbacks can be double stacked. Research Design and Standards Organisation (RDSO) along with private sector collaboration can evaluate modifying design of BCACBM wagons to double stack SUVs and increase wagon load capacity.
- **Incentives for empty returns of rakes:** Indian Railways can evaluate whether to allow Automotive Freight Train Operators (AFTO) to carry cargo of other industries or have truck-on-truck operations to partially offset empty returns costs, in case of exports movement. Indian Railways can also offer additional rebates on empty returns linked to cargo volumes moved on specific routes connecting ports.

4.1.3 Sustainable supply chains

Current manufacturing and export logistics setup

Four specific regions in the country have become large automotive manufacturing clusters.

Figure 18: Key Indian automotive manufacturing clusters

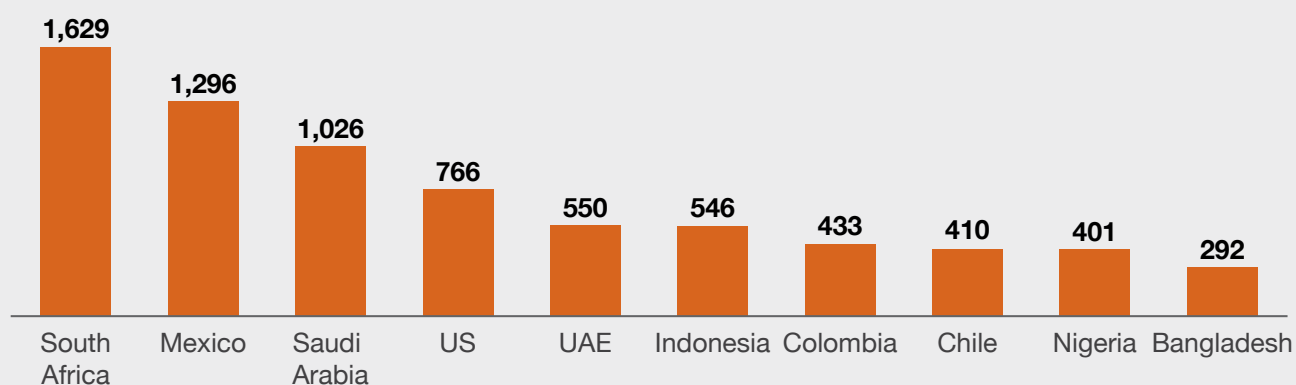


Export markets for automobiles

The top four export markets for Indian original equipment manufacturers (OEMs) are South Africa, Mexico, Saudi Arabia and the US. These countries collectively account for 36% of the total Indian OEM exports, demonstrating their significant role in the international trade landscape for Indian manufacturers. The strong presence in these markets highlights the competitive edge and the high demand for Indian OEM products in regions with diverse economic and industrial backgrounds.

In addition to these major markets, other prominent destinations for Indian OEM exports include the UAE, Indonesia, Colombia, Chile, Nigeria and Bangladesh. Together, these countries make up 19% of the total exports. This diversified market base underscores the broad appeal and reliability of Indian OEM products across various regions, contributing to the overall growth and resilience of India's export sector.

Figure 19: Key export markets for Indian OEMs (FY 2023, in USD million)



Source: Ministry of Commerce, Government of India

Table 9: Top 10 countries and their share in Indian OEMs' exports, FY 2023

Top 10 countries	Share of exports FY 2023
South Africa	12%
Mexico	10%
Saudi Arabia	8%
US	6%
UAE	4%
Indonesia	4%
Colombia	3%
Chile	3%
Nigeria	3%
Bangladesh	2%

Source: Ministry of Commerce, Government of India

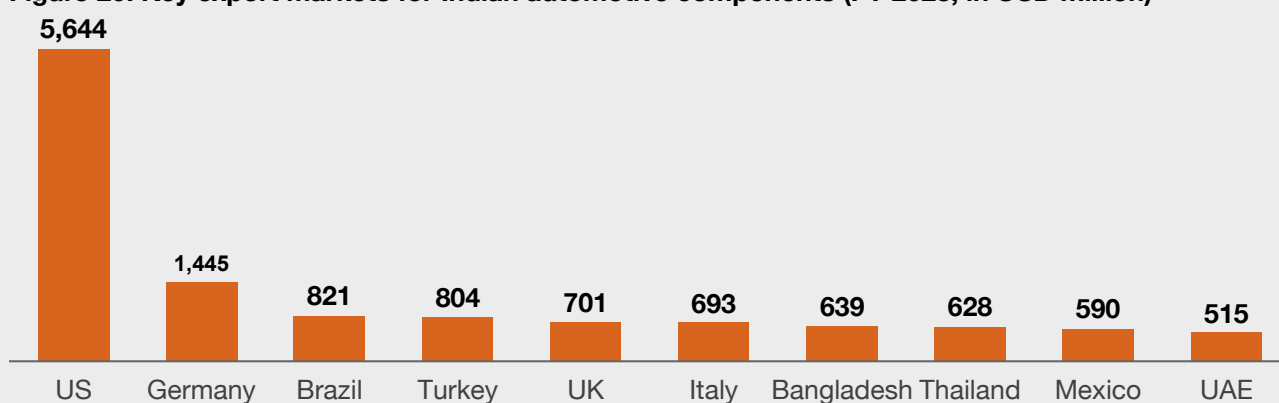
Export markets for auto-components

The top export market for Indian automotive components is the US, which accounts for a substantial 28% of the total exports. In monetary terms, this translates to USD 5,644 million in exports, underscoring the strong trade relationship and high demand for Indian automotive components in the US market.

The significant export volume to the US highlights the quality and competitiveness of Indian automotive products, positioning them favourably in one of the world's largest automotive markets.

Following the US, other significant markets for Indian automotive components include Germany, Brazil and Turkey. These three countries collectively account for over 15% of the total exports, amounting to USD 3,070 million. This diversification into major European and South American markets further illustrates the global reach and acceptance of Indian automotive components. Additionally, other key export destinations for these components include the UK, Italy, Bangladesh, Thailand, Mexico and the UAE.

Figure 20: Key export markets for Indian automotive components (FY 2023, in USD million)



Source: Automotive Component Manufacturers Association of India (ACMA)

Table 10: Top 10 countries and their share in Indian automotive component exports, FY 2023

Top 10 countries	Share of exports FY 2023
US	28%
Germany	7%
Brazil	4%
Turkey	4%
UK	3%
Italy	3%
Bangladesh	3%
Thailand	3%
Mexico	3%
UAE	3%

Source: Automotive Component Manufacturers Association of India (ACMA)

Trade competitiveness

Analysis of the trade competitiveness of Indian automotive sector by way of favourable tariff rates throws up significant opportunities for accelerated growth of Indian exports to these countries.

Table 11: Tariff rates for India's automotive exports to key target markets

HS Code	Description	Value of global imports (in billion USD)	Immediate priority (% of global imports)	Tariff rate for India	Tariff favourable to compete	Competitor (tariff, trade agreement)
8703	Motor cars or other ICE vehicles for transport of <10 persons	971	US (21.6%)	2.5%	No	Mexico (0%, USMCA) Japan (2.5%, 8703 not covered under US – Japan Trade Agreement) Canada (0%, USMCA)
			Germany (10.2%)	1.5%-10%	In a few cases	US (5-10%, No trade agreement between US and Germany yet) Spain (0%, Regional Group, EU) Czech Republic (0%, Regional Group, EU)
8507	Electric accumulators, including separators therefore, whether or not rectangular (including square)	155.6	US (19.1%)	2.5% - 3.5%	In a few cases	China (2.5% - 3.5%, 8507 not covered in the Economic and Trade Agreement between US and China)
			Germany (16.8%)	0% - 3.7%	No	China (0%-3.7%, no trade agreement Germany and China yet) Poland (0%, Regional Group, EU) Hungary (0%, Regional Group, EU)

Source: MacMap, <https://www.macmap.org/>

However, there are current and emerging non-tariff measures in most of the attractive countries for export, which the Indian industry would need to be aware of and must overcome through active support from GoI and its bilateral and free-trade agreements with these countries.

Table 12: Illustrative non-tariff measures notified by target markets

Product	HS Code	Name of target country	Non-tariff measures with the potential to serve as non-tariff barriers
EVs	870380	US, Europe (Germany, France, UK)	<p>US: Regulatory regime with stringent standards (Federal Motor Vehicle Safety Standards on design, performance, durability alongside standards by the Society of Automotive Engineers on vehicular mobility)</p> <p>EU is signatory to the 1958 Agreement but most developing countries, including India, are not a part of it.</p>
EV battery	85076000	US, Europe (Germany, France, UK)	<p>US: Regulatory regime with non-eligibility of tax credits if EVs contain battery made by foreign entities of concern (FEOC) + vehicles placed in service must not have batteries containing critical mineral extracted, processed or recycled by a FEOC + must be assembled in North America (with 40% of critical minerals used to create battery extracted or processed in the US or a country with an FTA with the US)</p> <p>EU: Differentiated regulatory regime as India is not a signatory to the 1958 Agreement, while the EU is; the Draft EU batteries Regulation under the European Green Deal posits certain cumbersome requirements—for instance, setting a maximum threshold for the full life cycle carbon footprint, supply chain due diligence, separate registration application for each member state where the batteries are sold, certification of battery recycling components</p>
SDV enabling technology	Not indicated	US, Europe (Germany, France, UK)	EU: EU-centric collaborative approach prioritised

Source: <https://www.macmap.org/en/query/regulatory-requirement>

Brand differentiation for automobile manufacturers in future is going to be defined not only by their individual ESG performance but also that of their entire supply chain.

Electric vehicles are considered to be sustainable due to their lower or near-zero tailpipe emissions. However, some of the processes used to create EV batteries and electric motors, accounting for the major value of the EV, are not carbon neutral. If the ESG factors associated with the EV battery supply chain are considered, then mining and material generation practices also need to be included for such evaluation. And this is where there is a lot of progress to be made. For example, the high-pressure acid leaching (HPAL) process used to create battery-grade nickel is energy intensive. It also generates significant amounts of CO2 emissions and produces waste tailings that can remain acidic for decades.

New European rules for EV batteries are on their way in. On 17 August 2023, the new EU Battery Regulation came into force.³³ Battery manufacturers will need to identify and address actual or potential challenges to prevent or mitigate adverse impacts of the mineral supply chain in relation to a list of specific categories. Risk categories to be assessed include air pollution, water use, soil protection and biodiversity (environmental) as well as health and safety, labour rights, human rights, and community life (social). An approved independent body will ensure that due diligence procedures have been followed. The new rules will apply from August 2025.³⁴

Suggestions for the private sector

- EV manufacturers must make their ESG performance across the supply chain their key competitive differentiator in export markets. To begin with, they must undertake detailed assessments of their EV battery supply chains going all the way back to mineral extraction.
- A new business opportunity that companies may want to explore is to open recycling capacities for EV batteries within Europe which can be used by them locally when they export their vehicles to European geographies, thus making their vehicles more competitive.
- They must also focus on developing Tier-1 suppliers for EV-specific requirements such as aluminium battery casings and lightweight castings/forgings.

Suggestions for the Government

- The Government has already provided USD 3.5 billion in incentives over a five-year period till 2026 under the Clean Tech Scheme to promote export of clean-technology vehicles. Besides, under phase-II of the Faster Adoption and Manufacturing of Electric Vehicles (FAME) India Scheme, subsidy amounting to USD 697 million has been given to electric vehicle manufactures on sale of 11,53,079 EVs as on 1 December 2023.³⁵
- Going forward, the Government must ensure that rules being developed meet the requirements of our export geographies associated with EVs and their value chain do not become non-tariff barriers creating negative incentives for Indian businesses to invest in India.
- The Government must also use and expand its trade and geopolitical alliances to create more sustainable sources of raw materials for our electrical battery and vehicle manufacturers as long-term planning.
- The Government must promote regulations that drive localisation of supply chains for critical components such as batteries, motors, ECUs, DC-converters and onboard chargers.

33 https://environment.ec.europa.eu/news/new-law-more-sustainable-circular-and-safe-batteries-enters-force-2023-08-17_en

34 Ibid.

35 <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1982777>

4.1.4 Knowledge and capacity building

The automotive industry is a highly tiered one. If the technical as well as business knowledge is monopolised by the OEMs/Tier-1 manufacturers, then their suppliers won't be able to deliver the desired value to them on time and in a competitive manner.

Suggestions for the private sector

- OEMs must ensure high-component carryovers in EV design from existing ICE products to ensure reduced complexity.
- There must be closer collaboration between OEMs, Tier-1 manufacturers as well as Tier-2 manufacturers right from the stage when the architecture of the vehicle is being designed.
- OEMs in collaboration with the Government must incubate CoEs and develop technology innovation clusters to support supply chain localisation for advanced technologies.
- They must embrace open innovation and collaborate with India's startup ecosystem on advanced technology development, e.g. alternate materials.
- OEMs, Tier-1 and Tier-2 manufacturing exporters must realise that in the era of smart, connected and sustainable mobility, the knowledge can be put to action only if they empower and train their mechanical engineers to start closely collaborating with counterparts in fields of electronics, electrical and information technology. To better transmit the information about changes in the plans to the shop floor workforce, the manufacturer-exporters would require generalist engineers who can simplify the messaging and drive collaboration across various departments.

Suggestions for the Government

- Governments must proactively change the curriculum in engineering schools and colleges to ensure that students are exposed to the latest in the fields of smart, connected, and sustainable mobility.
- The Government could expand the ambit of CSR to include skilling initiatives that large OEMs and Tier-1 manufacturers can extend to workforce in Tier-2 and Tier-3 entities across their value chain.
- In collaboration with the private sector, the Government must launch a series of skill-building initiatives that will prepare our youth to engage with opportunities emanating from the smart mobility space. These skillsets can include areas such as EV product design, EV servicing, software-defined vehicle design, testing and debugging, and design and manufacturing of embedded/IoT solutions. This can be achieved through schemes promoting fundamental R&D through domestic engineering centres as well as GCCs in turn, creating greater employment opportunities for STEM graduates.
- Additionally, there should be a focus on building skills and capabilities required to serve the MSME industry through targeted interventions under the National Skills Policy.

4.1.5 Inclusive industrial development

According to the India Brand Equity Foundation's (IBEF) Automobile Industry Report 2024,³⁶ the EV industry is estimated to create ~5 crore jobs by 2030, giving it a very inclusive character. As mentioned in earlier sections of this chapter, several export opportunities stand to open in the fields of enabling services that will enhance the ownership experience associated with smart, connected, and sustainable vehicles. These will unlock a wide range of high quality, high-income employment opportunities for our youth.

Moreover, the automotive industry is unique as it is tiered. The Tier-2 and Tier-3 players in the automotive industries are largely MSMEs. They are the backbone of the sector and are responsible for more than 60% of the total employment within the sector.³⁷ Any growth in the overall exports would assume proportional growth in the financial and operational metrics of the MSMEs, thereby percolating the economic benefits throughout the hierarchy.

Suggestions for the private sector

- Companies must hold workshops in engineering and management schools to create excitement among students about the opportunities that would open in the sphere of enabling services.
- Under the route of industry-academia partnerships, private automotive entities must explore opportunities to finance promising projects of students and mentor them towards making their innovations commercially viable.
- Industry bodies in the automotive and auto-components space must collaborate with organisations representing the interests of IT & ITeS, retail, FMCG, tourism, city governance and other relevant industries to organise hackathons and competitions aimed at promoting greater cross-fertilisation of knowledge and ideas.

Suggestions for the Government

- Reducing the tax burden on the EV industry would go a long way in incentivising them to become drivers of inclusive growth through skilling initiatives, etc. In this regard, the Government must reduce the GST on EV-spare parts currently burdened with a GST in the range of 18-28%.
- The Government must bring more auto components under the PLI Scheme and work towards distributing the incentives to eligible auto-component MSMEs on a quarterly basis.
- Towards helping auto-component MSMEs increase productivity, the Government must institutionalise a programme wherein MSMEs receive tax benefits for result-oriented collaborations they execute in these areas with R&D institutions of eminence in their region.

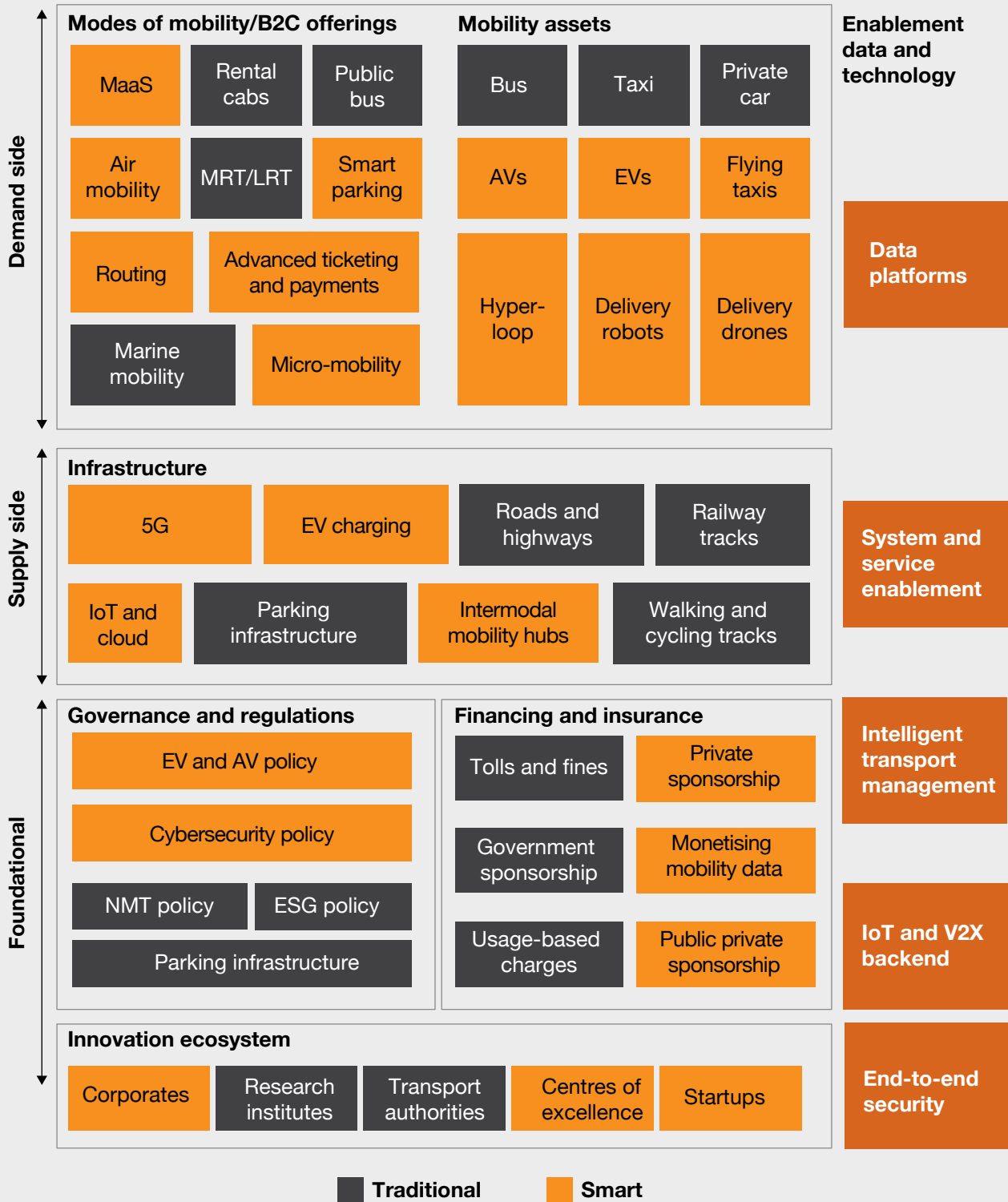
36 <https://www.ibef.org/industry/india-automobiles>

37 <https://www.investindia.gov.in/sector/automobile>

4.1.6 Technology enablement

Leading countries and cities are adopting a multi-layer ecosystem approach to enable smart mobility. The smart mobility ecosystem presents opportunities for automotive industry players while requiring close public-private sector collaboration.

Figure 21: Layers of the smart mobility ecosystem

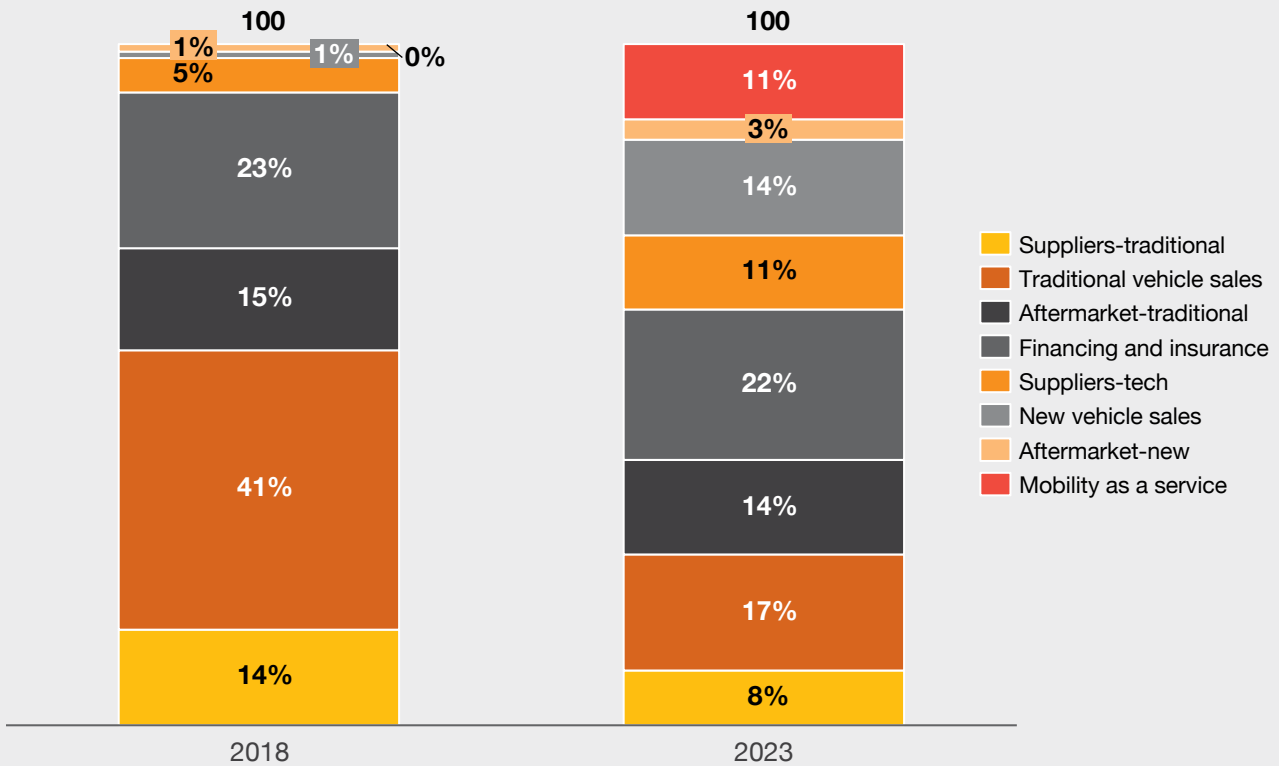


Source: PwC analysis

In the smart mobility ecosystem, traditional components either co-exist with smart mobility components, or in some cases are substituted by them.

The transition from automotive towards smart mobility is reflected in the shifting global automotive profit pools, where the share of new vehicle sales and new components (for electric, connected, shared and autonomous vehicles) increases at the cost of sales of traditional (ICE) vehicles and components.

Figure 22: Shifts in global automotive profit pools



Source: PwC analysis

Smart, connected, and sustainable vehicles are filled with software and technology. Importantly, no single entity will have the technological superiority to drive value with these mobility options. Collaboration with ecosystem players is therefore a must.

While software platforms and digital plants are the infrastructure required to manufacture and test feature-loaded vehicles, what helps them become more customer centric and competitive is the electrical/electronic architecture. The E/E architecture ensures that the cost of owning the vehicle does not spiral due to the growing range of functionalities that get embedded within it resulting from demands in the areas of personalisation, automation and connectivity.

Suggestions for the private sector

Startups present in the Indian mobility ecosystem must mature fast to be at the global level of innovation. Hence, the large OEMs and Tier-1 manufacturers must collaborate with startups towards:

- deploying digital twins for faster and sustainable solution development
- leveraging AI, data analytics, and IoT to optimise battery performance, predictive maintenance, and user experiences, reducing the total cost of ownership
- developing full-stack proprietary platforms (e.g. integrated EV powertrain and transmission units)
- a sound digital-R&D focus will need to be embedded as part of the operating model of OEMs and Tier-1 manufacturers
- towards establishing commercially viable local value addition and standardisation of parts required to drive E/E architecture, OEMs and Tier-1 manufacturers must partner with research institutions of repute and manufacturing startups.

Suggestions for the Government

- Relevant Government bodies must work with multilateral standards agencies to ensure that technologies being developed by local startups are recognised and suitably notified in export jurisdictions.
- Recognising that technologies will be key to driving value in the context of smart, connected and sustainable vehicles, the Government must focus on building regulations that make India a destination of choice for global players to innovate their future technologies.
- A conducive intellectual property protection environment and reward mechanism must be created to enable risk taking in newer areas of technology and innovation.
- Building the digital infrastructure and investing in E/E platforms of the future is expensive. The Government must therefore find WTO-compliant ways of subsidising the cost being incurred by private players to build the desired digital infrastructure and E/E architectures.
- Learning the best practices from frugal innovation that drove Mangalyaan and Chandrayaan projects, the Government must drive industry-academia collaboration that can help the automotive industry innovate world class E/E architectures at minimal costs.

Electronics

Overview of the Indian electronics industry

The electronics industry in India is driven across four key segments that are currently propelling its growth – mobile phones, consumer electronics, IT hardware, and electronic components. Combined, these four segments comprise more than 70% of India’s domestic manufacturing.³⁸ The electronic sector’s transformation in India has been unique. It went from being 78% import-dependent in 2014³⁹ to a period of import substitution between 2017-19, to the present era of export-led growth with policies such as the PLI Scheme for smartphones. International players are showing a keen interest in utilising these local capabilities to diversify their supply chains and establish manufacturing operations in India. India has become a leading global manufacturer and exporter of smartphones and is poised to further hone its export capabilities across the other three major product segments – consumer electronics, electronic components and auto electronics – in the near future. India’s primary export markets is expected to remain North America, West Europe and the Middle East – aligned to the existing export trends.

The electronics sector value chain can be divided into five broad segments:

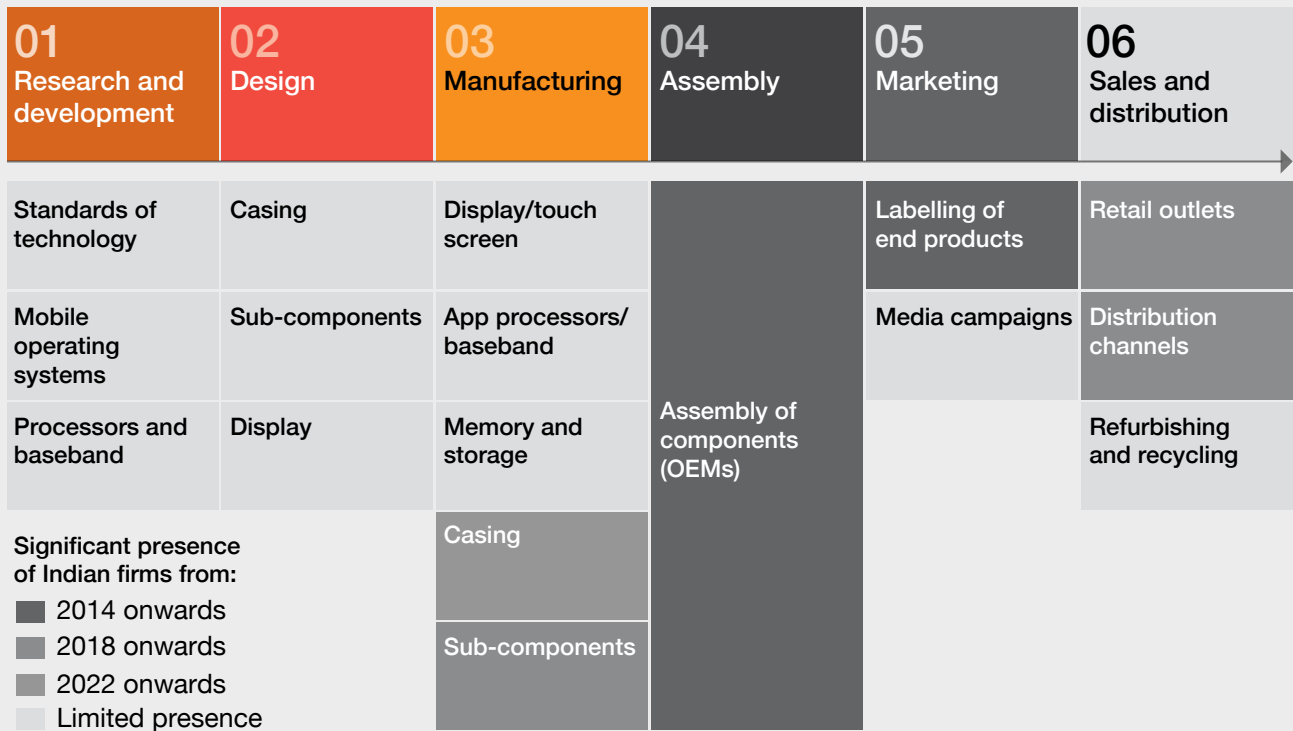
1. **Research and development:** Placed on a relatively higher point in the manufacturing smile curve of electronics, research and development includes aligning products to technology standards and innovations around operating systems, processors and basebands for electronic devices.
2. **Design:** Includes activities of product design, including design of sub-components, casing and display.
3. **Manufacturing:** Comprises all manufacturing-related activities, including those of processors, baseband, memory and storage which come under the purview of semiconductor manufacturing.
4. **Assembly:** This segment comprises assembly of final products as well as sub-assemblies. It witnesses the maximum diversity of players in the value chain ranging from original brand manufacturers (OBMs) and integrated device manufacturers (IDMs) to electronics manufacturing service (EMS) players who assemble and supply finished goods and components to the market. India has been able to make a strong presence in this particular segment of the value chain over the last 5-7 years.
5. **Marketing, sales and distribution:** These segments comprise activities such as labelling of end products, management of distributor channels and outlets, and refurbishment and recycling activities.

Since electronics is a diverse industry with different products and product categories, the smile curve and value capture across the chain may significantly vary depending on the product that is being considered. The typical value chain outlay and India’s presence across segments of an electronics value chain are showcased with the illustrative example of a smartphone value chain in Figure 23.

38 MeitY Annual Report 2022-23 (p. 66)

39 <https://economictimes.indiatimes.com/industry/cons-products/electronics/99-2-per-cent-of-mobiles-made-in-india-ashwini-vaishnav-reviews-meteoric-growth-of-indimobile-sector/articleshow/105496885.cms?from=mdr>

Figure 23: India overlay on a mobile phone value chain

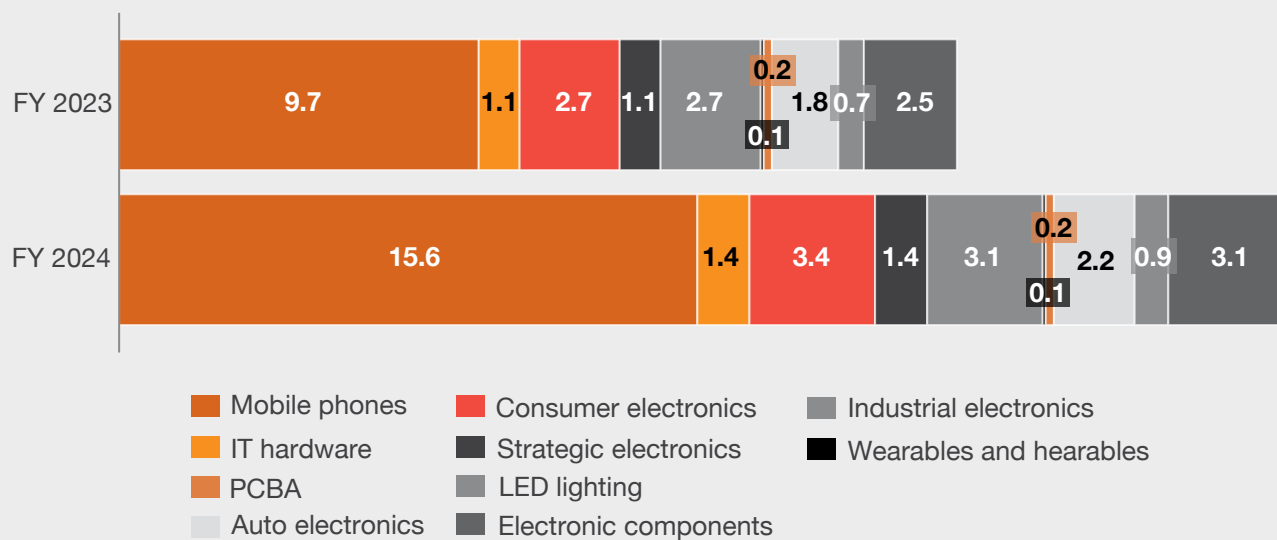


Source: PwC analysis

India's current export scenario

India's domestic electronics production has witnessed a strong growth from USD 60 billion in 2018 to ~USD 102 billion in 2023.⁴⁰ In 2023, India exported approximately USD 23.57 billion of its manufactured electronics. Mobile phones have been the primary driver of exports in India with local assembly and presence of global EMS and OEM players. India is estimated to have exported ~USD 10 billion worth of mobile phones alone, out of its ~USD 23 billion of electronics goods exports in 2023, showing the importance of the product category.

Figure 24: India's estimated exports by product segments (exported value in USD billion)



Source: PwC analysis, India Cellular and Electronics Association (ICEA)

40 <https://retail.economictimes.indiatimes.com/news/consumer-durables-and-information-technology/consumer-electronics/domestic-electronics-manufacturing-up-four-fold-to-rs-8-22-lakh-crore-in-fy23-mos-it/105798134>

India for the world – success story of mobile phone production and export

The global smartphone market is projected to grow to USD 777.5 billion in 2030, growing at a CAGR of ~6.3% from 2024.⁴¹ Various factors such as proliferation of 5G network, increasing disposable income, steep increase in digitisation, internet penetration, rise in e-commerce, among others are influencing the growth of the market. Countries such as the US, Japan, Germany, Hong Kong, Canada and the UK are the top buyers of smartphones, whereas countries such as China, India, Singapore and Vietnam are the top exporters while continuing to be demand hubs. The Chinese smartphone industry, fuelled by economic growth, technological innovation and rapid adoption of 5G, is poised to continue its ascendancy on the global stage. The US smartphone market thrives on the back of AI integration, IoT advancements, and burgeoning trends in mobile payments and e-commerce.

India is the second-largest mobile phone manufacturer globally and is also the second-largest market for smartphones in the world,⁴² making it the fastest growing smartphone market in the world. Production of mobile phones has gone up from 60 million in 2015 to 310 million in 2022 at a CAGR of 26%.

Today, smartphones are the fourth largest export item from India, expected to have reached USD 15.6 billion in FY 2024.⁴³ A trade analysis of globally top importing countries of smartphones and the countries India is exporting smartphones to shows that there is a smooth trade alignment. The US is the top destination for India's smartphone exports – the total value of smartphone shipments from India to the US increased by 158% YoY and were valued at USD 5.6 billion. This is followed by the UAE (USD 2.6 billion), the Netherlands (USD 1.2 billion), and the UK (USD 1.1 billion).⁴⁴

Considering the current growth achieved, PwC analysis shows that India can witness ~USD 56 billion worth of mobile phones exports (national target for FY 2026), by FY 2031-32. By FY 2031-32, India's electronics market can be expected to be touching ~USD 470 billion with total exports close to USD 104 billion.

Consumer electronics and IT hardware – a prospect in export competitiveness

Although India has not fully unlocked its potential in consumer electronics and IT hardware exports, it can become a critical pivot for the future of India's electronics export owing to the global market size. Products like laptops within this segment can become a game-changer for India, like smartphones. The laptop market has witnessed strong growth from USD 113.9 billion in 2023 to USD 120.8 billion in 2024, at a CAGR of 6%. The market is expected to touch USD 160.3 billion in 2028 driven by the ongoing work from home and hybrid work models, advancements in educational technologies, rising digital content creation, and the availability of affordable entry-level options. Anticipated trends involve a focus on extended battery life, larger storage capacities, improved graphics performance, enhanced privacy and security features, and the integration of features conducive to remote work setups.⁴⁵

A national target of USD 25 billion of production has been set by the Government for IT hardware, to meet 100% of the domestic demand and also USD 12-15 billion worth of exports. The market size of laptops and tablets in India is estimated at USD 6 billion in 2023, out of which only 30% is currently assembled in India and the rest is imported.⁴⁶

With this push providing growth, which is similar to current headwinds, we can expect USD 1 billion of laptop export potential by 2030.

41 Research and Markets, Smartphone market, size, global forecast (2024-2030)

42 Livemint, Smartphones fourth largest export item from India

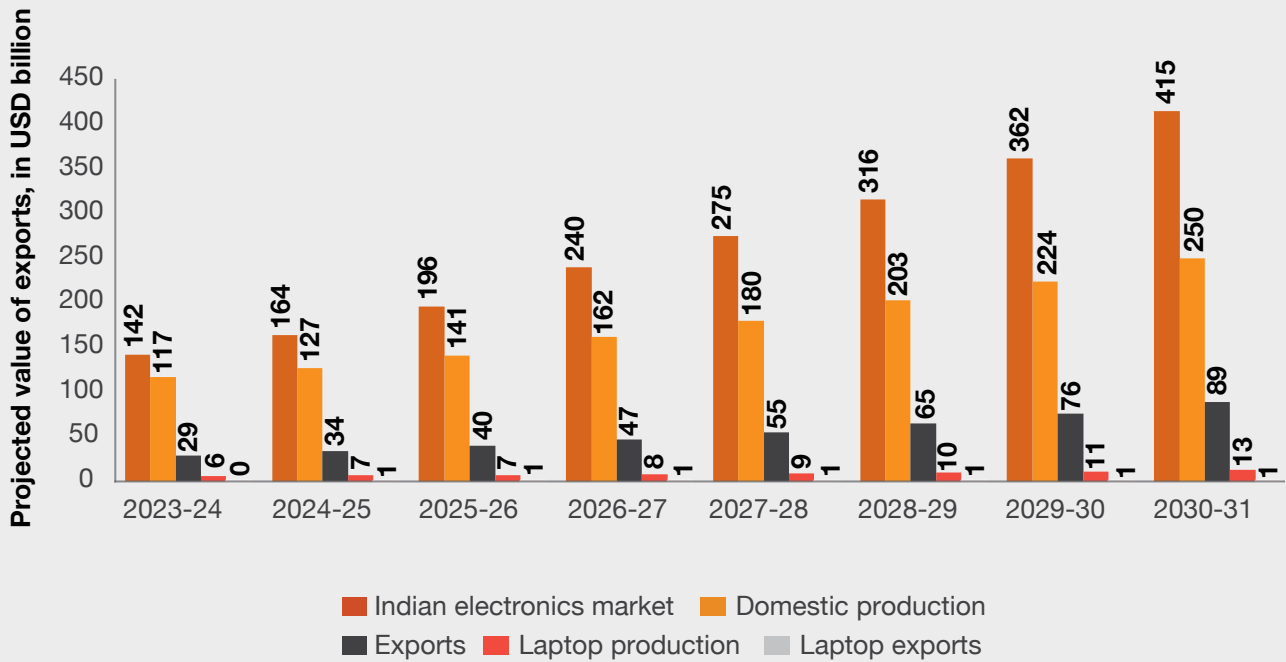
43 Ibid.

44 Ibid.

45 <https://www.researchandmarkets.com/reports/5735167/laptops-global-market-report>

46 https://www.business-standard.com/economy/news/india-s-electronics-exports-increase-23-6-to-29-12-billion-in-fy24-124041600004_1.html

Figure 25: Projected growth for India's laptop exports and production

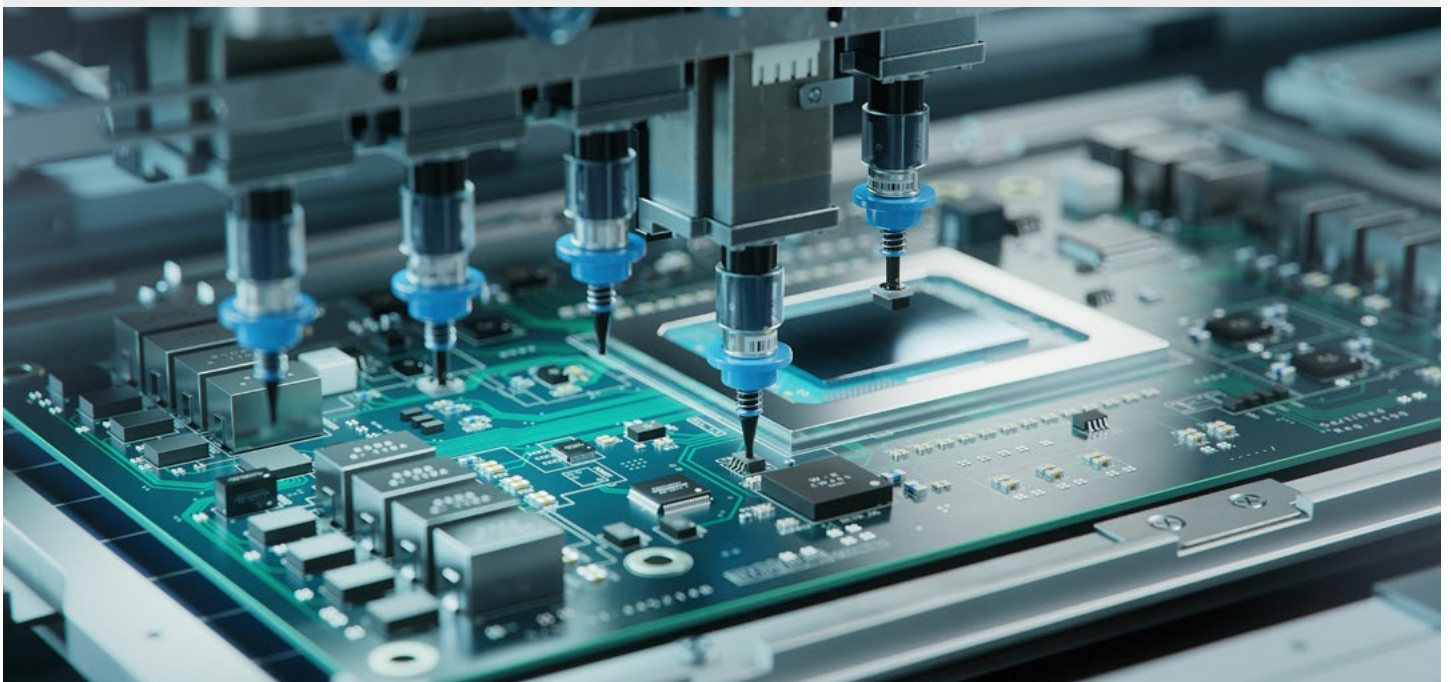


Source: PwC analysis, ICEA

Key observations

- The need for PLI 2.0 highlighted that consumer electronics and IT-hardware-related incentives will need to consider the critical sectoral success factors that drive production and exports in India — especially to offset disability costs.

With newer companies, not part of the PLI, announcing expansion plans, there is also a need to look at organic and structural solutions to production challenges that may address India's cost disabilities in consumer electronics and IT hardware compared to other East Asian nations.

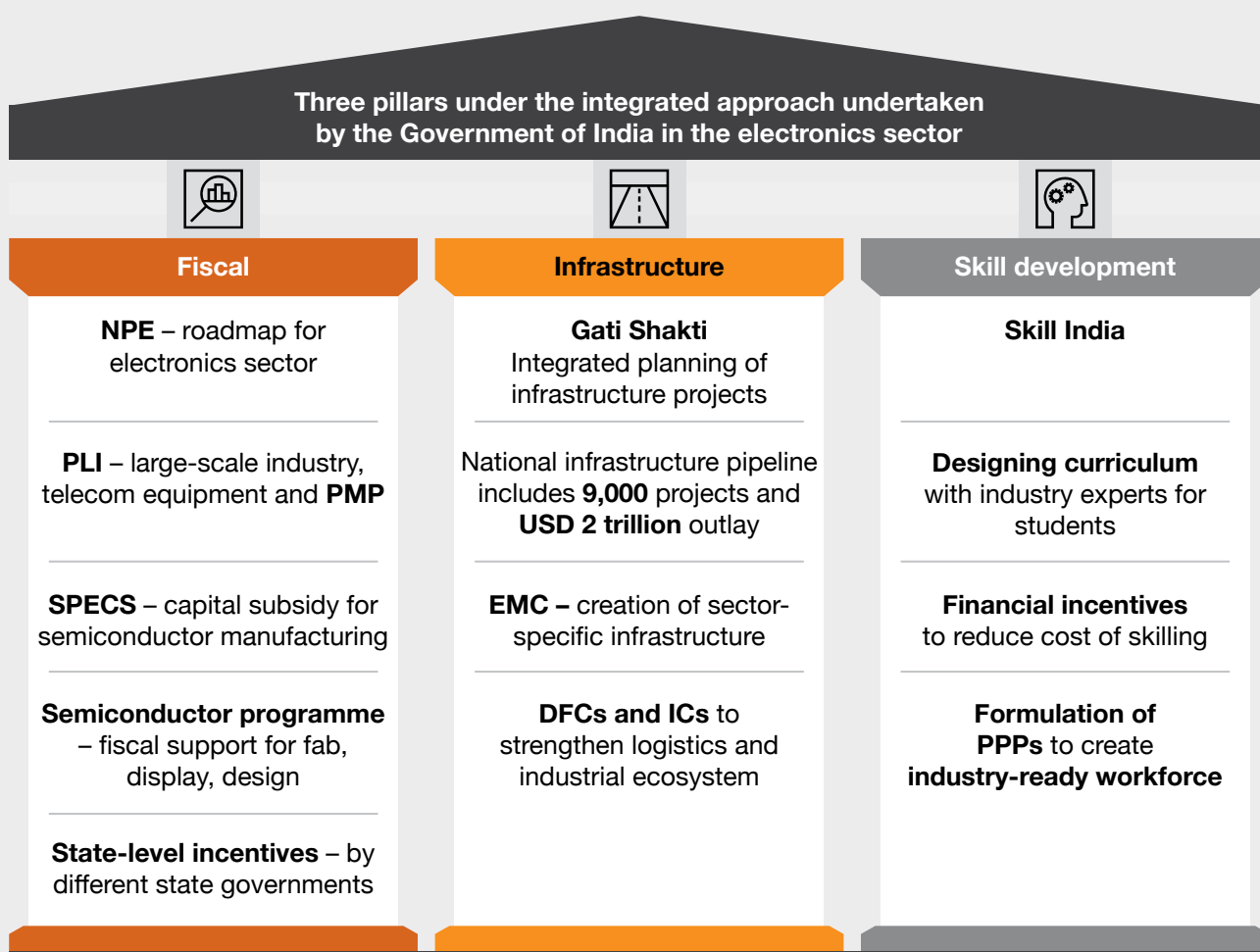


India's policy ecosystem, manufacturing and export infrastructure will further help to realise its electronics export potential

Policy ecosystem overview

Gol has taken various initiatives in terms of providing fiscal incentives, production linked incentives, upgrading infrastructure and developing skills of the talent pool to attract investments and strengthen the electronics supply chain. The current framework of policies of Gol follows an integrated three-tier approach to spur manufacturing in the electronics sector with an attempt to make electronics manufacturing worth USD 300 billion by 2026.⁴⁷ The approach is based on an institutional framework and offers fiscal, infrastructural, and skill development-related support to build a comprehensive ecosystem.

Figure 26: Three-pillar approach of the Government of India in policy development



NPE: National Policy on Electronics

PLI: Production Linked Incentive

PMP: Phased Manufacturing Programme

SPECS: Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors

EMC: Electronics Manufacturing Cluster

DFC: Dedicated freight corridor

IC: Industrial corridor

PPP: Public private partnership

Source: PwC analysis

Gol's fiscal support includes the National Policy of Electronics, PLI schemes, Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS) and Modified Programme for Development of Semiconductor and Display Manufacturing Ecosystem, all of which are complemented by additional state-level incentive policies.

4.2.1 Value addition and volume-led growth

Export opportunities for the electronics sector

While the Indian electronics export story today is largely driven by mobile phones with a contribution from the other segments that have witnessed stronger manufacturing in India, there is some distance that the country must traverse to be export competitive when it comes to electronics as a whole. The industry has been growing at ~15% CAGR, it will need to grow its manufacturing by at least 27-28% to reach the coveted USD 500 billion manufacturing target by 2030.⁴⁸ It is expected that the next phase of electronics exports from India will be driven by product categories such as:

- **Consumer electronics and IT hardware:** This segment is estimated to have a total export potential of ~USD 20 billion by 2030 at the current rate of production growth and can cross USD 100 billion if India manages to achieve its target of USD 500 billion of domestic electronics manufacturing by 2030.⁴⁹ The major product categories that will drive this segment would include laptops and tablets. Other consumer electronics devices that are expected to be exported from India include minor appliances, of which air conditioner exports to the MENA region can become a significant part of this basket.
- **Auto electronics:** With India achieving its potential in automotive manufacturing and the increasing global consumer demand for feature-rich vehicles – including the new-age safety features such as camera-based ADAS – this segment provides a strong opportunity for auto electronics exports from India. At the current pace of growth, auto electronics may contribute ~USD 7 billion in exports by 2030 and can contribute as much as USD 50 billion if India achieves USD 500 billion electronics manufacturing by 2030.⁵⁰
- **Electronic components and PCB assemblies:** Currently, the Indian electronics industry is largely dependent on imports to meet its component demands across segments. While passive and wound components are exported from India, it is expected that initiatives such as the PLI for white goods and state-level incentives will drive India's ability to localise sub-assemblies (including printed circuit board assembly) in India. Major EMS players have already initiated their capacity building and capability expansions for local component manufacturing through strategic joint ventures, while OBMs have started their backward integration to achieve higher value chain localisation in India. At the current rate of growth, India could be exporting around USD 10 billion worth of components by 2030, and this could go as high as USD 77 billion if India manages to achieve USD 500 billion of domestic electronics manufacturing.⁵¹

Key recommendations

While India celebrates its scale in export of electronics commodities, its domestic value addition remains lower compared to that of peers such as China and Vietnam. This makes India unable to leverage its true potential from the economic as well as the technology perspective. Currently, India's presence across the electronics value chain is seen in the segments of assembly and design. With the current announcements of Union Budget 2024-25, the continuation of the PLI in white goods, and the expected focus of the Union Government towards schemes focusing on component manufacturing, India is also expected to expand its footprint across the electronics value chain.

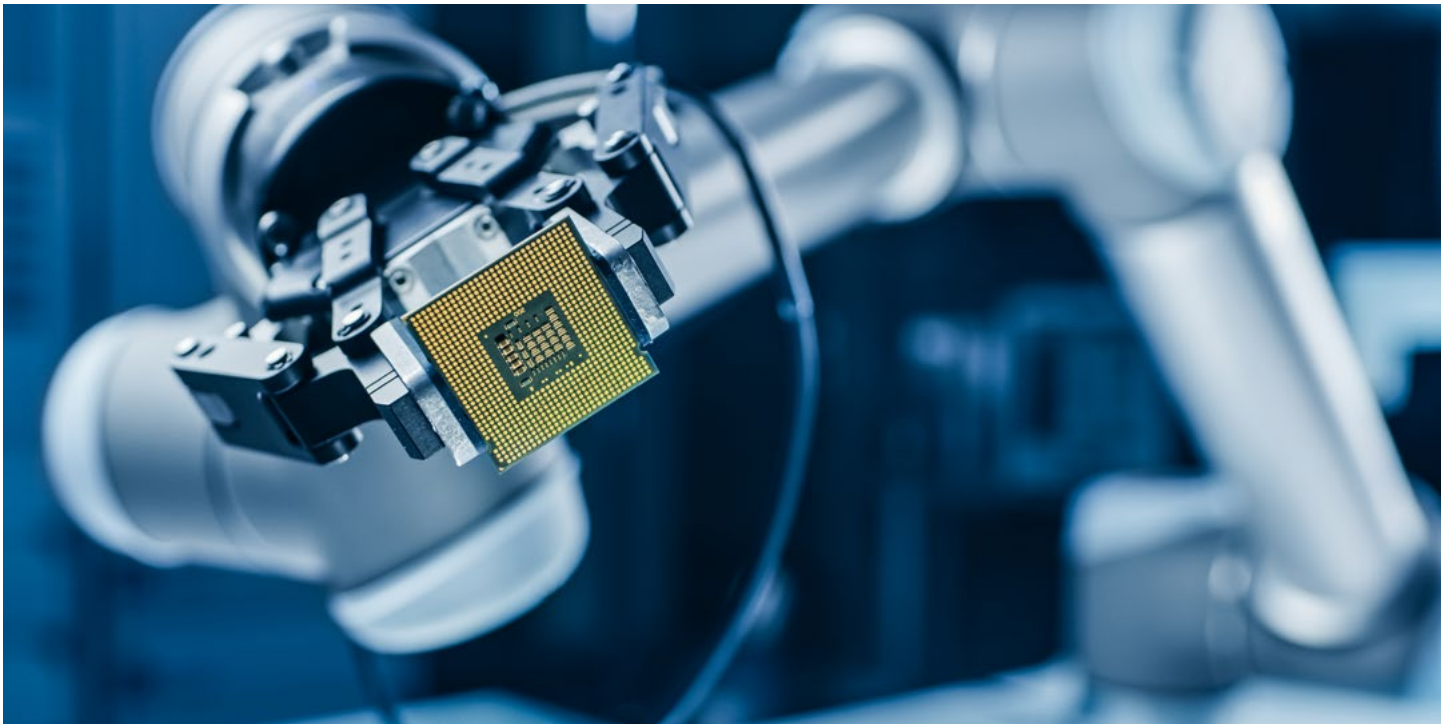
While it is unlikely that any single country can achieve over 50% domestic value addition in electronics, except in some products such as complex semiconductors, India could aim to increase its domestic value addition of around 30-40% in electronics. While North America, Western Europe and the Middle East will remain major export regions, India should proactively explore increasing its electronics export into other regions such as North Africa.

48 PwC analysis, ICEA, CII

49 PwC analysis, MEITY annual report

50 PwC analysis

51 Ibid.



Suggestions for the private sector

- Identify and engage strategically with international technology partners to increase backward integration in manufacturing. Facilitate domestic capability development across critical components which have the potential to hinder production or drive cost disabilities under increased tariff structures.
- Focus on gradually increasing domestic value addition through incremental localisation and skilling/upskilling of labour force to meet the demand. Account and prepare for initial learning curves – such as relatively higher rejection rates for local manufacturing vs imports – for long-term sustainability.
- Undertake end-to-end make vs. buy analysis to understand organic strengths and competitiveness of operations. Focus on value chain localisation through building capabilities in design and R&D along with operational capabilities of manufacturing or assembly.
- Electronics is a dynamic sector wherein technology – both manufacturing as well as that of the final products – keeps changing. To be globally competitive and relevant, it is important to stay on top of the global trends through controlled and strategic sandboxes for emerging technology trends.

Suggestions for the Government

- Simplify and match tariff structures with those of peer economies in the short term to enhance component and sub-assembly ecosystem development. Increase local procurement through phased manufacturing strategies and increasing the tariffs on import of finished sub-assemblies in a phased manner.
- Remove barriers to knowledge and technology transfers that impede the ability of Indian firms to build their own design and R&D capabilities. Facilitate international collaborations from all eligible partners in the short-term through joint ventures, FDI, etc., to boost local capabilities in India – especially for critical components.

4.2.2 Infrastructure investments

Manufacturing and logistics infrastructure

Initiatives such as the Gati Shakti programme, dedicated freight corridors and island container stations, electronics manufacturing clusters, and National Infrastructure Pipeline (NIP) have been enabled to provide the requisite infrastructure conducive to manufacturing across the electronics supply chain.

Figure 27: National infrastructure overview enabling electronics manufacturing

Gati Shakti

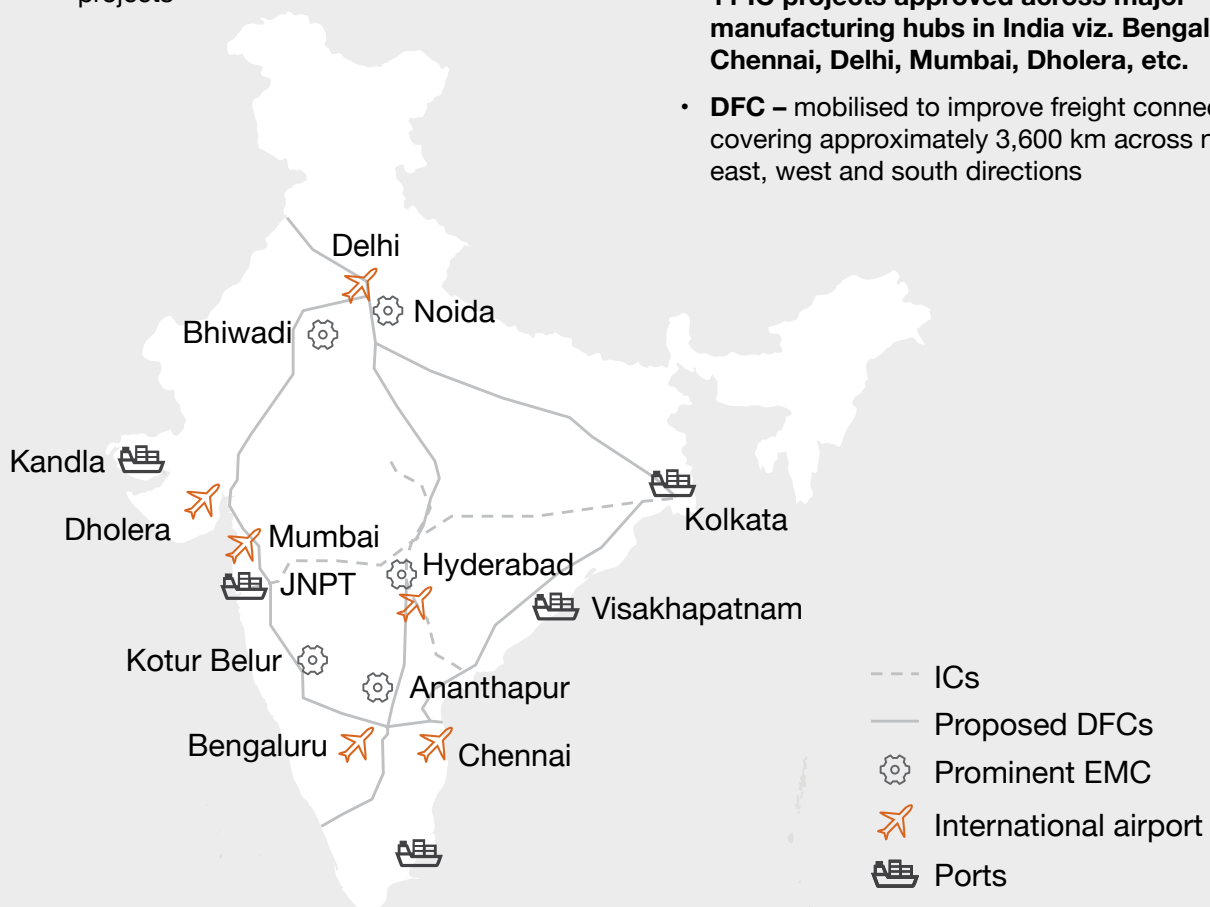
- **National master plan worth USD 1.2 trillion** to improve multi-modal connectivity to prominent economic zones
- Digital platform launched **to bring 16 ministries** together for integrated planning
- **Driven seven engines of growth** – revamping roads, airports, mass transport, logistics infrastructure, railways, ports, waterways
- **Key highlights:**
 - Completing 25,000 km of national highway
 - 400 new generation trains
 - Capacity building for infrastructure projects
 - Unified logistics interface platform
 - Adding steam to 196 critical infrastructure gap projects

National infrastructure pipeline (2019–25)

- **First-of-its-kind comprehensive plan** to raise quality of life and ease of living in India
- **Will attract private sector investments in infrastructure**
- **Top five priority sectors** – roads, urban and housing, railways, power and irrigation
- **Key highlights:**
 - Project cost – USD 1,800 billion
 - 2,073 projects under development
 - 48 sub-sectors identified for development

ICs and DFCs

- **11 IC projects approved across major manufacturing hubs in India viz. Bengaluru, Chennai, Delhi, Mumbai, Dholera, etc.**
- **DFC** – mobilised to improve freight connectivity covering approximately 3,600 km across north, east, west and south directions



Source: PwC analysis, Invest India

Currently, ~31% of all electronics exports and a significant proportion of finished goods are exported by air cargo,⁵² and moving forward, the air cargo infrastructure of India will play a critical role in enabling its electronics and semiconductor exports. Good connectivity and efficient cargo management is a critical and organic method of offsetting India's cost disabilities when it comes to export of electronics.

Electronics air cargo export from the current electronics hubs (Delhi, Bengaluru, Mumbai and Chennai)

Major airports contributing to this trade include Delhi (46%), Bengaluru (22%) and Mumbai (20%)⁵². These airports would continue to dominate the overall electronics export due to presence of electronic hubs in these regions. Hence, these airports would need to enhance their air cargo handling capacity to meet the future demand of electronics export. Current utilisation of the major cargo entry and exit gateways in India ranges from 50-100%.^{53,54} Considering the same, the priorities of the different airports vary, with some airports focusing on enhanced utilisation (Delhi, Bengaluru, etc.), whereas others already have cargo handling capacity expansion plans in the pipeline (Chennai, Madurai, Tuticorin, etc.). As per PwC's analysis, the capital expenditure that may be required to cater to the additional cargo demand (considering USD 100 billion of exports from the electronics sector alone by 2030) at the major airports (Delhi, Bengaluru and Mumbai) may range from INR 100-150 crore.⁵⁴ Besides this, a cargo terminal at an upcoming airport at Jewar with an annual cargo handling capacity of 2,50,000 MT⁵⁵ is proposed to be completed by the end of 2024. Further capacity expansion of the airport by 2030 in different phases will also lead to reduced congestion at Delhi Airport as the same is expected to cater to around 10,00,000 MT of cargo by 2030.⁵⁶

As discussed above, due to high utilisation/congestion at some airports, the capacity expansion/ establishment of new terminals for these airports is already part of the planned infrastructure investments by the Government. For example, Chennai is a major hub of electronics manufacturing and to cater to the rising demand, a new cargo terminal with a capacity of 3,00,000 MT has been planned at the Chennai Airport. In addition, air cargo terminals are also being constructed at other nearby locations, including a 20,000 MT cargo terminal at Madurai Airport, and a 50,000 MT cargo terminal at Tuticorin Airport.⁵⁷ Construction of these terminals would require an aggregate investment of ~INR 200-250 crore.⁵⁸

Moreover, multimodal logistic parks are being planned in the region to integrate air, sea and road transportation to better facilitate air cargo movement. In summary, to cater to USD 100 billion of projected overall electronics export demand by 2030, capital expenditure of INR 300-400 crore⁵⁸ alone may be incurred at major airports to manage the air trade proportion (30-35%) of this overall electronics export demand for capacity enhancement of air cargo terminals.

Upcoming hubs for electronics air cargo exports (Dholera, Bhubaneshwar and Guwahati)⁵⁸

With Government incentives and the USD 1 trillion export target by 2030 in place, new electronics manufacturing hubs are emerging across the country. Three major hubs show significant potential for future electronics export: Dholera, Bhubaneshwar and Guwahati. Air cargo export demand at these locations would be serviced by the nearby airports, i.e. Dholera Airport, Bhubaneshwar and Puri Airport, and Guwahati Airport.⁵⁸ Since the current cargo traffic at these airports is not very significant when compared to the major airports, the capacity utilisation at these airports ranges from 30-50%^{61,58} currently. Moreover, Gol, in line with its ambitious target to achieve 10 million MT of cargo throughput by 2030, has already started planning future capacity expansion/establishment of new terminals in and around these airports.

52 DGCI&S Trade data

53 <https://www.aai.aero/sites/default/files/traffic-news/Jun2k24Annex4-rev.pdf>

54 PwC analysis

55 <https://www.itln.in/aviation/noida-airport-to-add-much-needed-cargo-capacity-for-india-1351255?infinitemscroll=1> – Indian Transport and Logistics News

56 Techno-economic feasibility report - airport at Jewar

57 <https://www.aircargonews.net/airlines/air-cargo-momentum-in-indias-state-of-tamil-nadu/> - Air Cargo News

58 PwC analysis

59 <https://www.dholerametrocity.com/News-Groundwork-of-Dholera-airport-expected-to-start-by-next-January.php>

61 <https://www.aai.aero/sites/default/files/traffic-news/Mar2k24Annex4.pdf>

In June 2022, GOI approved a CapEx of INR 1,305 crore to build Phase I of Dholera Airport by December 2024 which includes building a 3,000 sq m dedicated air cargo complex.⁵⁹ Bhubaneswar Airport has a dedicated air cargo terminal with a cargo handling capacity of 26,490 MT, with capacity utilisation of 37%.⁶⁰ Hence, with the emergence of Bhubaneswar as an electronics hub in future, the airport will have sufficient capacity to cater to the demand. Moreover, Puri Airport is planned to be set up in the vicinity of Bhubaneswar Airport with planned air cargo terminal capacity of 7,000 sq m, which will further augment the air cargo exports and incentivise setting up of electronics industries in the Bhubaneswar-Puri belt. Guwahati houses an international airport with a dedicated cargo terminal capacity of 40,000 MT and capacity utilisation of 57%,⁶¹ with plans to further enhance the capacity with the construction of a new 4,050 sq m cargo terminal in future.⁶²

Sustainability in the air export trade ecosystem

While air cargo is expected to remain the logistics channel of choice for the export of electronic goods, emerging emission norms and the need for sustainable logistics with lower carbon footprint would mean that India's air export trade ecosystem will also have to align with global sustainability norms. It can be achieved in two main ways:

1. Sustainable aviation fuels (SAFs)

The major source of carbon footprint in the air cargo industry is the aviation turbine fuel (ATF) used in aircraft. While sustainable fuels like biofuels and SAF-blended ATF are available, their cost is higher than that of traditional ATF due to their limited availability. Since fuel contributes to ~40% of the operating costs⁶³ of airlines, the high cost of sustainable fuels acts as a deterrent which impacts the overall carbon footprint of the air cargo industry.

2. Multimodal connectivity

The transportation of cargo from the manufacturing/storage hubs to the airport for export forms a crucial part of the overall supply chain for the air cargo industry. Logistics costs in India are comparatively on the higher side, estimated at 8-9% of India's GDP in FY 2022.⁶⁴ Further, India's ranking on the Logistics Performance Index 2023 (India ranks 38 as compared to 19 for China and 17 for the US)⁶⁵ indicates potential for improvement. Higher logistics cost indicates inefficiency and since most of the inland transportation is handled by trucks for air cargo, it also leads to higher carbon footprint.

Two major multimodal cargo hubs are planned in Maharashtra and Uttar Pradesh in the vicinity of Nagpur (MIHAN) and Jewar Airport respectively.

1. The Multimodal international Cargo Hub and Airport (MIHAN): MIHAN is the country's first multi-product special economic zone (SEZ) which is adjacent to an existing international airport. Connectivity to MIHAN is planned with all the four major means of transport, namely rail, road, sea and airports. Land has been allotted to the Container Corporation of India (CONCOR), and a road terminal is planned for parking of 1,000 trucks with open stock yards, warehouses, etc. Two dedicated domestic and international cargo terminals, with ample parking space for air cargo aircraft are in the pipeline. Jawaharlal Nehru Port Trust (JNPT) is developing a dry port less than 40 km from MIHAN,⁶⁶ thus giving a choice to stakeholders to select the most efficient means of transport for inland cargo transportation.

2. Multimodal Cargo Hub at Jewar: This project will comprise a transshipment centre and a warehouse zone for freight forwarders and integrators. The project will also provide transportation facilities to support road-to-road, road-to-air and air-to-road movements.

60 <https://sansad.in/getFile/annex/258/AU1299.pdf?source=pqars>

62 <https://aidcltd.assam.gov.in/information-services/detail/air-cargo-complex-igbi-airport-0>

63 <https://www.businesstoday.in/india/story/atf-prices-slashed-by-rs-1221kl-in-delhi-ahead-of-budget-2024-check-latest-rates-here-415665-2024-02-01>

64 The Economic Times, India's logistics cost

65 <https://lpi.worldbank.org/international/global>

66 <https://www.mihansez.org/Pages/details/mihan-project-an-overview>

Key recommendations

Infrastructure for exports and digital public infrastructure (DPI) for local use cases are equally important for the industry to develop innovative products and use cases for the world. While the infrastructure and offerings have been world-class for some segments – such as smartphones – there is a need to push for proper manufacturing and testing infrastructure for emerging electronics segments such as strategic electronics, wearables and wearables, and industrial electronics to unlock India's manufacturing and export potential across these segments. Furthermore, with several manufacturers looking to de-risk supply chains by diversifying supplier geographies, plug and play or ready infrastructure in India for electronics can enable smooth transition for these companies to move into India. Integrated logistics infrastructure can also contribute to the reduction of the logistics costs, increasing India's export cost competitiveness. Furthermore, since a significant portion of electronics and components is transported through air cargo, adequate air cargo facilities around Tier-2 and Tier-3 cities would help boost Electronics Manufacturing Cluster (EMC) activities in the region.

Suggestions for the private sector

- Strategic electronics such as drones and defence electronics will be critical given India's estimated domestic consumption as well as its export ambitions. Instead of focusing only on the low-hanging fruits of assembly, strategic electronic firms should explore backward integration to localise or integrate high-value activities such as design, research and component manufacturing.
- Infrastructure as a service for electronics manufacturing in India is still an unexplored territory. World-class electronics parks with integrated infrastructure – from design to testing – under one roof can be explored.
- Logistics for electronics is a big market – especially in the APAC region. Not just transportation but also segments such as packaging and warehousing of electronics are moderate-to-high value services which have a lot of potential in India. Furthermore, with global ESG norms kicking in, secure and multimodal movement of electronics would be a critical service that would require several service providers – including logistics startups – to come up in India.

Suggestions for the Government

- While there are several schemes in place to support infrastructure at the Central and state level, the Government needs to ensure that infrastructure development keeps pace with the aspirations of the industry. Connectivity, especially last-mile connectivity, to electronics clusters must be achieved jointly by the Central and the state governments.
- Logistics for electronics can be given a separate sectoral focus under initiatives such as PM Gati Shakti for enabling seamless logistics of electronics capital goods, raw materials and finished products in a sustainable manner.
- Development of Multimodal International Cargo Hubs at or in the vicinity of airports, with mechanised warehouses, specialised storage options, intermodal transfer container terminals may be undertaken.
- Air cargo facilities or air cargo connectivity to Tier-2 and Tier-3 cities with EMCs should be further strengthened to boost manufacturing activities in the region.

4.2.3 Knowledge and capacity building

Electronics is a diverse and complex industry with dynamic knowledge requirements. Geopolitical alignments and restrictions can hinder the flow of knowledge to Indian manufacturers. At the same time, it is extremely difficult to develop components from scratch through academic R&D alone. To make India globally competitive in manufacturing, there needs to be a middle ground for harnessing knowledge from peer nations through IP exchange and catalysing the local ecosystem to develop scalable industrial products that could eventually replace international IP dependency.

Suggestions for the private sector

- Economic complexity mappings must be undertaken to understand existing capabilities and the logical next steps for manufacturing more complex products or components. Owing to the diverse nature of the industry, this will not have a one-size-fits-all approach; hence, it should be undertaken by each industry player by their product segment.
- Joint ventures to localise products with high bill of materials (BoM) contribution and high import dependency are becoming increasingly critical. Identifying global partners and building capabilities and/or long-term supply chain security is key.
- Engage with startups and accelerators to procure relevant technology wherever feasible and scale them up.

Suggestions for the Government

- Restrictions on any policy that prevents international knowledge sharing in the short term, especially for products with high BoM contribution and high import dependency, should be re-evaluated.
- Emphasise knowledge and capacity building in the long term by encouraging and stipulating that larger industry players develop their own IP around products and components.

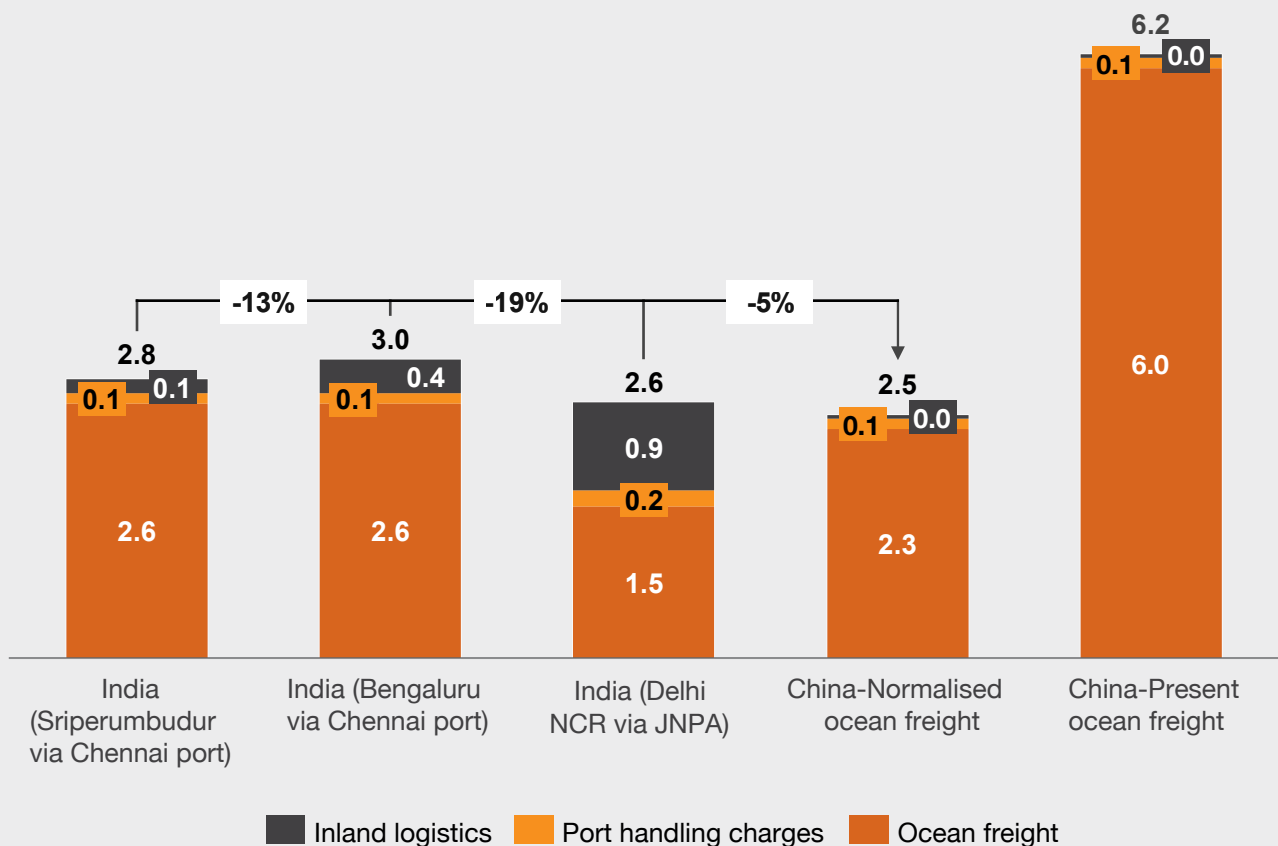


4.2.4 Sustainable supply chains

In recent times, India has emerged as a significant player in the global electronics manufacturing and export market. The electronics industry in India encompasses a wide range of products, including mobile phones, consumer electronics and IT hardware. The growth is fuelled by a favourable policy environment, such as the PLI Scheme and investments from global companies. Major manufacturing centres in India include Chennai, Bengaluru, Noida and Greater Noida. On the other hand, China is the global leader in electronics manufacturing and export. The country's dominance is supported by its extensive industrial base, skilled workforce, advanced infrastructure, and integration into global supply chains. Major manufacturing centres in China include Shenzhen, Guangzhou and Shanghai.

Considering its importance in achieving the target for USD 1 trillion merchandise exports from India, a TLC comparison has been carried out for India and China. A TLC comparison between India and China for exporting electronics to Western countries (the US in this case) is essential for identifying key areas where India can enhance its competitive edge. By understanding the difference in transportation, infrastructure and port charges, India can pinpoint inefficiencies and implement targeted improvements. TLC comparison with China is conducted for transportation of 40 ft containers on the India-US and China (Shandong)-US corridor. Figure 28 below shows the TLC difference across both the corridors.

Figure 28: TLC comparison – electronics – container movement



Source: PwC research and analysis

As discussed in the context of the automotive sector, the geopolitical events influencing cargo movement have also impacted the movement of electronics goods. Since the US is one of the key markets, our report evaluated freight rate increase along the China-US corridor. During the past few months, ocean freight rates for this corridor have increased by approximately 300%. However, this increase is also likely to be temporary, experts believe. Hence, over the long term, ocean freights are expected to return to their normal rates. India's logistics cost vis à vis China's normalised logistics cost is believed to be higher by 5-19% depending on the export gateway. Inland logistics, similar to the automotive sector, is a disability area in terms of both cost and time involved.

Trade competitiveness

WTO's Information Technology Agreement (ITA) and the expanded ITA-II have enabled zero tariff access to most major markets for electronics exports. Since India is also a signatory to this agreement, Indian exports are also marked at zero tariff in its target markets.

Table 13: Tariff rate analysis for identified export opportunities

HS Code	Description	Value of global imports (in USD million)	Immediate priority (% of global imports)	Tariff rate for India	Tariff favourable to compete	Competitor (tariff, trade agreement)
8471	Automatic data processing machines (computers, laptops, etc.)	413	US (25.2%)	0%	In a few cases	China (0%, tariff rate of US) Mexico (0%, USMCA)
			China (8.7%)	0%	In a few cases	Taipei, Chinese (14% - 70%, no FTA between Taiwan and China) Thailand (0%, ASEAN)
8708	Parts and accessories of vehicles (ICE) for transport of persons or goods	469	US (18.8%)	0%	Yes	Canada (0-2.5%, not covered under USMCA) Mexico (0-2.5%, not covered under USMCA)
			Germany (10.1%)	0%-4.5%	In a few cases	Czech Republic (0%, Regional Group, EU) Poland (0%, Regional Group, EU)
			China (5.9%)	0%-6%	Yes	Germany (11% - 100%, no FTA between EU/Germany and China) Japan (11-100%, 8708 not covered under FTA)
8542	Electronic integrated circuits	1,096	China (32%)	0%-3.3%	In a few cases	Chinese Taipei (24%-46%, no FTA between Chinese Taipei and China) South Korea (0%-1.4%, FTA)
			Hong Kong (18.50%)	0-3.3%	In a few cases	China (0%, part of China) Taipei, Chinese (24%-46%, no FTA between Chinese Taipei and Hong Kong, China)

Source: <https://www.macmap.org/>

Non-tariff measures for the electronics sector span all conventional categories such as technical barriers related to testing, inspection, packaging and labelling. Additionally, sensitivities in the electronics sector have run high lately due to technological advancements, data and information-related issues, prevalent use of IT & ITeS across corporate and public sector systems, etc. As an effect of such sensitivities, NTMs on use cases have also been notified, for example, restrictions on import of IT hardware for critical information infrastructure. Addressing such measures could require not only proactiveness in ensuring compliance, but also significant engagement with the relevant stakeholders that shape the non-tariff measures.

Table 14: Select non-tariff measures for identified export opportunities

Product	HS Code	Target country	Non-tariff measures with the potential to serve as non-tariff barriers
IT hardware	8471	UAE, Israel, US	<p>Gulf Cooperation Council (GCC): Stringent technical regulations – for instance, the technical regulation for the restriction of the use of certain hazardous substances in electrical and electronic equipment with two-level conformity assessment procedures (self-declaration of conformity and an additional pre-market testing and model inspection certification scheme), discrepancies in marking regulations, differentiated implementation across GCC members of the regulation, etc.</p> <p>Russia: Ban on purchase and use of foreign IT products for critical information infrastructure operated by public authorities and state-owned (SOEs).</p> <p>Vietnam: Maintains certain import prohibitions on used IT products.</p>
Auto electronics	8708	US, Germany, Mexico	<p>Vietnam: Stringent conformity assessment requirements, for instance through non-acceptance of UN regulations or other internationally-accepted standards.</p>

Source: <https://www.macmap.org/>

Key recommendations

Several key electronics players have committed to achieving sustainable or carbon-neutral supply chains by 2030. It is expected that this would shift location choices to regions which can offer low-emission manufacturing and logistics along with other supply chain strategies such as near-shoring. Furthermore, sustainability is not only an ecological paradigm but also a geopolitical paradigm. Sustainable will not only mean low emissions, but also would mean building long-term security that would enable mineral and component security needed from partner countries for continued manufacturing of electronics. Since India is expected to continue its exports to the North American, West European and Middle East markets, electronics may be given special focus in regional foreign trade agreements (FTAs). Furthermore, India may leverage a balance of trade by sourcing intermediate components or capital goods from regions where it exports final products, creating sustainable trade practices.

Suggestions for the private sector

- Develop adequate adoption and funding strategies to align manufacturing and sourcing practices to global ESG norms and commitments of end users.
- Undertake strategic diversification of sourcing and reduce dependence on single suppliers as far as possible.

Suggestions for the Government

- Adopt a cautious approach while collaborating with new partner countries. Whether these partnerships take the form of investment treaties or trade agreements can be determined based on the part of the value chain vulnerability they are addressing.
- Encourage and incentivise use of green energy for electronics manufacturing as far as possible. Enable electronics manufacturers to harness green energy from grids as a priority sector to reduce the overall carbon footprint of the final product.
- Encourage municipalities to adopt circular economy practices in electronics through collaboration with all stakeholders, including waste management service providers.

4.2.5 Inclusive industrial development

Electronics present immense opportunities for employment generation as well as MSME integration.

However, both of these would require skilling and upskilling of existing human resources and MSME players in India.

Suggestions for the private sector

- Establish or align human resources to skilling and upskilling endeavours in electronics assembly or manufacturing activities wherever feasible.
- Facilitate an 'automation-plus approach' on the factory floor to help migration of labour into automation-augmented manufacturing processes, wherever possible.
- Engage proactively with existing MSME partners and explore possible alignments to develop new capabilities, individually or together, to encourage sustained business relationships even with changing manufacturing practices.

Suggestions for the Government

- Enable skilling and upskilling activities with the key private sector players instead of depending only on academic institutions.
- Enable adequate supply and size of credit to MSMEs to adapt to the changing manufacturing processes in the sector – such as automated soldering instead of human interventions for controller units. It would keep them relevant in the age of automation.

4.2.6 Technology enablement

Smart manufacturing and Industry 4.0 are at the centre of ESDM and semiconductor manufacturing globally. Establishment of manufacturing facilities requires not only capital expenditure but also complex technical know-how to be globally competitive. India would also need to access design capabilities, especially in emerging electronics segments such as PCBA and semiconductors in the short-to-medium term to be able to drive exports in the long term. It would further catalyse India's existing design ecosystem in these product segments that are largely focused on design validation.

Suggestions for the private sector

- Operating models must include technology strategies and innovation garages to enable regular technology assessment and uptake. Firms must undertake horizon scanning and outreach to check for any disruptive technology threats that disable cost advantages for their production systems.
- Startups have a strong capability to supply bridge technologies, especially on aspects of AI/ML, design, etc. Companies must actively explore possible synergies with startups in these aspects. Furthermore, they should encourage technology scouting initiatives through dedicated innovation programmes, as is being done by several global players.

Suggestions for the Government

- Technology standards, definitions and certifications would be crucial to drive technology enablement in the sector. The Government should have regular interactions with industry bodies and update or align standards and definitions responsively.
- A conducive intellectual property protection environment and reward mechanism needs to be put in place to drive 'Innovate in India' for local as well as global firms.



Food processing

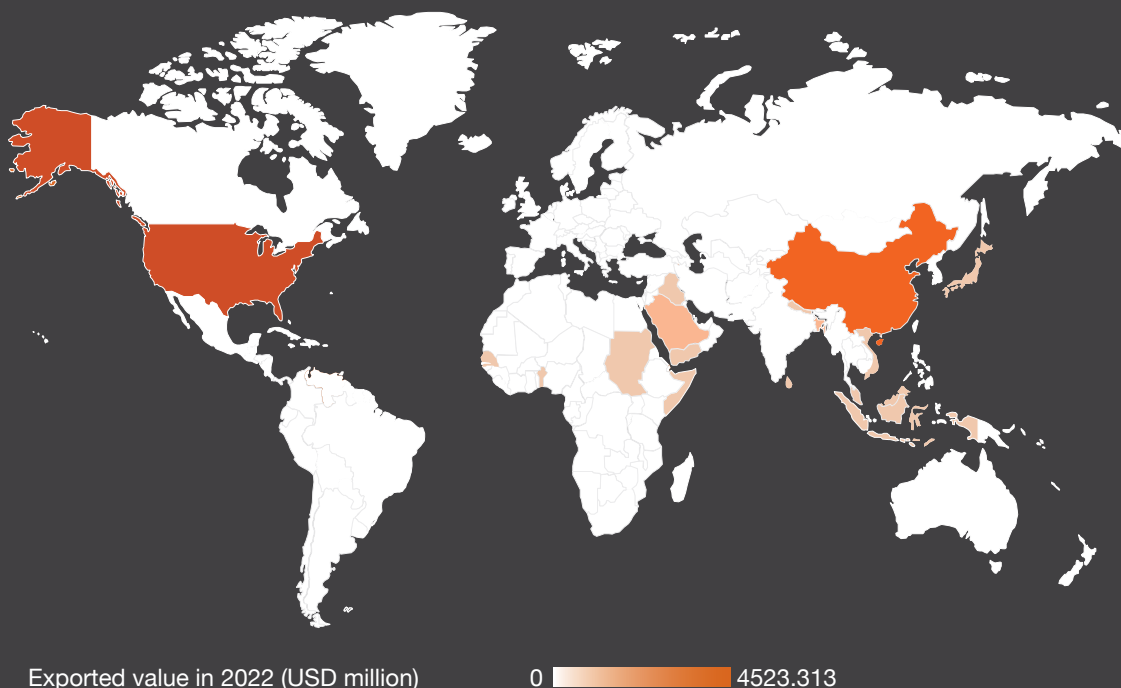
Overview of the Indian food processing industry

India's food processing industry, one of the largest in the world, is a sunrise sector for the Indian economy and is expected to be worth USD 535 billion by FY 2025-26.⁶⁷ While India ranks 2nd in global agri-food production and allied sector products,⁶⁸ the food processing industry in India has a high potential for growth considering it is still at a nascent stage with processing levels significantly lower than global standards. Studies commissioned by the Ministry of Food Processing Industries (MoFPI), Government of India⁶⁹ indicate processing levels of 4.5% for fruits, 2.7% for vegetables, 21.1% for milk, 34.2% for meat, and 15.4% for fishery.

India's current export scenario

Despite the country's impressive agricultural production capacity, India remains a marginal player in the global market for export of food products. For example, India's share of fruit and vegetable production accounts for ~9% of global fruit and vegetable production. India's share in the world agricultural trade⁷⁰ was a mere 2.4% in 2021, with exports share of processed food even lower. The largest exporting nations include the US, China, the UAE, Saudi Arabia and Bangladesh (Figure 29). The top 20 countries based on the value of processed food exported from India account for more than 65% of the total exports from India.⁷¹

Figure 29: Heatmap of processed food and agriculture-based exports to different countries from India




Source: ITC Trade Map

- 67 Industry Scenario – Food Processing, Invest India
- 68 FAOSTAT 2020
- 69 Study to determine the level of Food Processing in India, MoFPI (2021)
- 70 Agriculture trade policy, promotion, and logistics development division, DoA&FW (2023)
- 71 ITC Trade Map

Trade patterns vary across countries. For example, exports to developed markets like, the US and the UAE are driven by a mix of value and volume whereas exports to developing markets like Indonesia and Bangladesh are largely volume driven (Figure 30).

Figure 30: Trade patterns for developed and developing countries

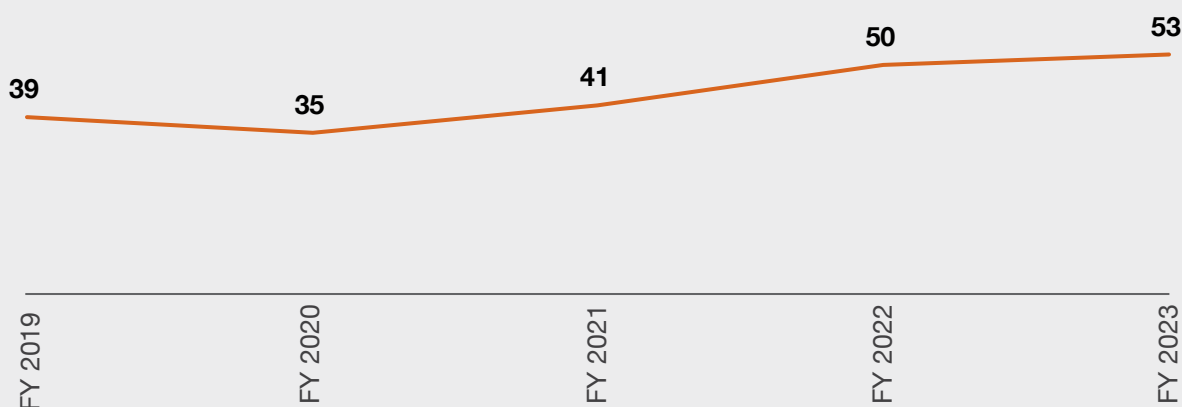
UAE (Trade value: USD 0.75 billion, share: 6.9%) A mix of value and Volume based	Indonesia (Trade value: USD 0.97 billion, share: 8.87%) More volume based	US (Trade value: USD 1.3 billion, share: 12%) A mix of value and volume based	Bangladesh (Trade value: USD 0.62 billion, share: 5.67%) More volume based	Sudan (Trade value: USD 0.5 billion, share: 4.46%) More volume based
Others (192 partners) (Trade value: USD 6.7 billion, share: 62.2%) A mix of value and volume based				



Source: ITC Trade Map

In the last few years, the agri-food processing sector has emerged as a strong growth engine for the Indian economy. In FY23, agricultural exports from India stood at USD 52.50 billion recording a consistent rise from USD 50.2 billion and USD 41.3 billion in FY22 and FY21 respectively. The share of processed food exports in agri-exports has increased substantially from 13.7% in FY15 to 25.6% in FY23 (Figure 31).⁷²

Figure 31: India's agricultural exports from FY 2019 to FY 2023, USD billion



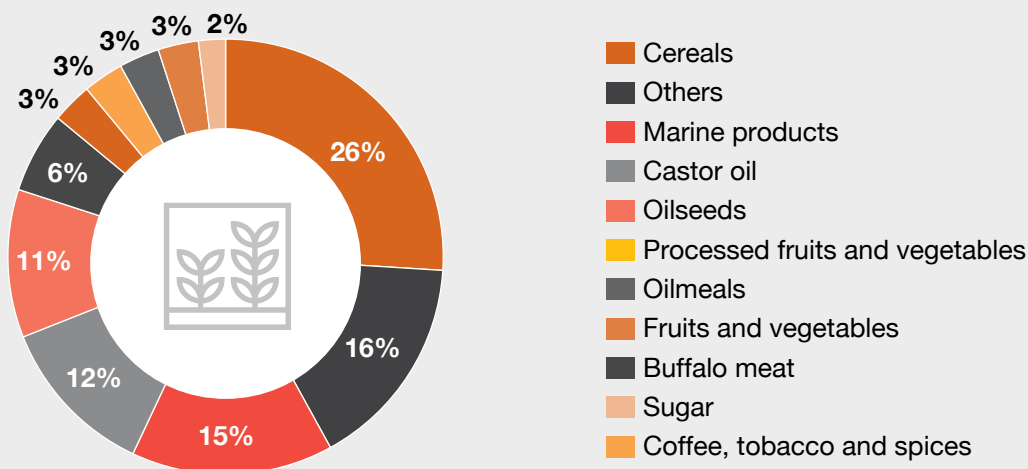
Source: India Brand Equity Foundation

72 [Industry scenario – food processing, Invest India](#)



Figure 32: India's agricultural exports across various categories

What constitutes the USD 52.5 billion agriculture export basket of India?



Source: Department of Commerce, Government of India

Within the agri-export basket of India, processed food exports accounted for around one-fourth of the overall agri-food exports valued at ~7.8 billion USD in FY23 which includes items like bakery products, cereal-based products, mango pulp and processed vegetables (Figure 32). It may be of interest to further understand which growth engines fuel the food processing sector.

Growth enablers in the food processing sector

The recent growth of the food processing sector in India has been fuelled by the following factors:

- **Government's strategic focus:** Since the food processing sector is of strategic focus for the Government of India, multiple government initiatives and policies have been established for the development of the sector. Some of these initiatives are:
 - The Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME), PLIs and the Pradhan Mantri Kisan Sampada Yojana (PMKSY) are three flagship schemes announced by MoFPI to modernise and enhance the food processing sector by reducing wastage, improving the exports of processed food, enhancing the capabilities of existing micro food processing facilities and integrating them into an organised supply chain with improved access to finance.⁷³
 - Approval of agro-processing cluster projects⁷⁴ and mega food park projects⁷⁵ by MoFPI.
 - Relaxation of restrictions in foreign direct investments and allowing 100% foreign ownership in the sector.⁷⁶

73 Industry scenario – food processing, Invest India
 74 Agro Processing Cluster Projects, MoFPI
 75 Mega Food Park Projects, MoFPI
 76 Industry scenario – food processing, Invest India

- **Country's agro-climatic diversity:** India's diverse agro-climatic conditions enable it to produce various food products such as fruits, vegetables, milk, spices, pulses, wheat and rice. This provides a strategic advantage for India since the raw materials for food processing are readily available in the country.
- **Rising consumer awareness:** There have been structural shifts in global consumer behaviour⁷⁷ on account of which there is a rise in demand for convenience foods, healthier alternatives and a rising awareness about sustainable products which have minimal impact on the environment. This is one of the contributing factors for the increase in the global demand for ultra-processed (secondary processed and above) food in comparison to unprocessed and primary processed food categories.

Personalisation is yet another trend that has been observed in both global as well as Indian food processing industry. Consumers are increasingly becoming health-conscious and keeping a close watch on what they are consuming. This necessitates the development of newer technologies which can provide consumers with alternatives which can cater to their personalised nutrition and dietary needs.

These growth engines further fuel various progressive opportunities for enhanced farmer income, improved crop diversification and higher export revenues, and have the potential to play a key role in India's ongoing economic transformation.

Sector value chain

The food processing value chain can be segmented into five critical stakeholder groups:

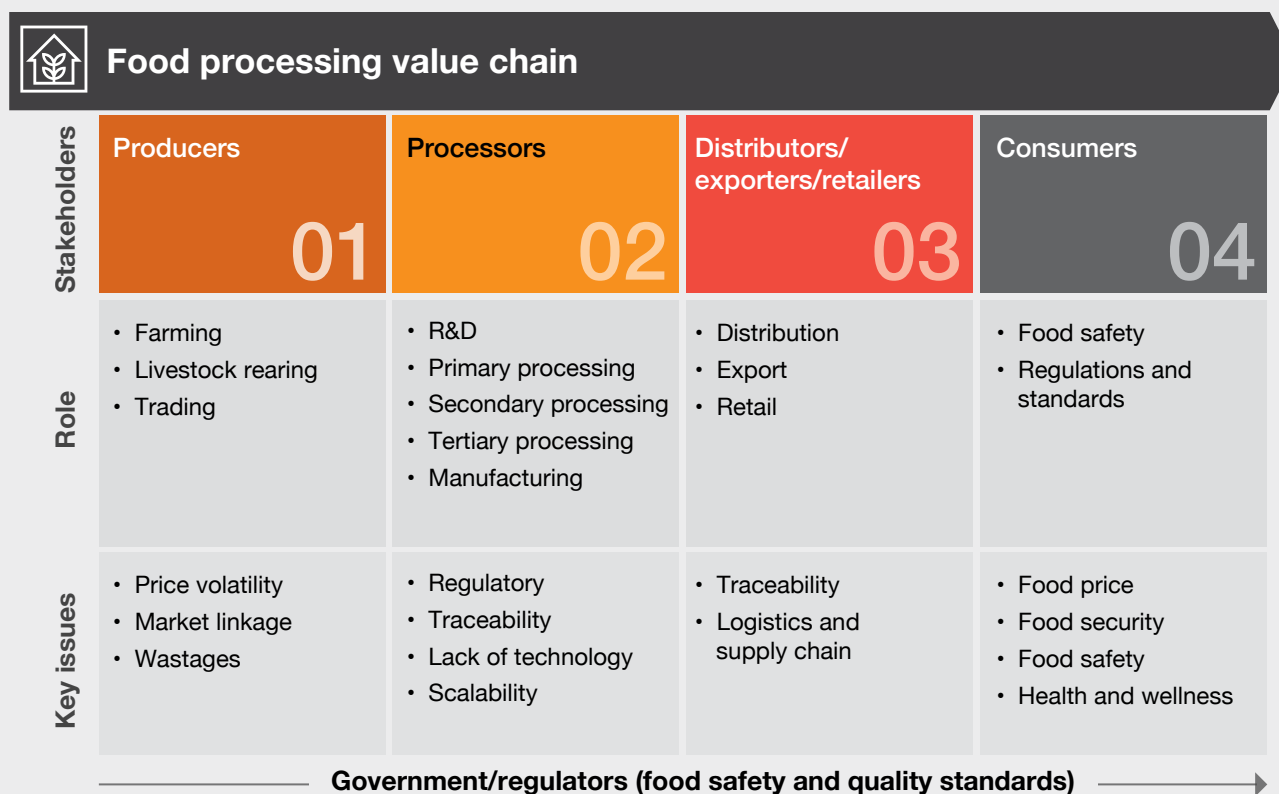
- **Producers:** Producers may constitute individual farmer/producer groups (PGs)/farmer producer organisations (FPOs)/farmer producer companies (FPCs) that are involved in the cultivation of primary food products or rearing of animals for their by-products.
- **Processors:** Typically, food manufacturing companies or micro-scale processors are involved in the primary, secondary, tertiary or further processing of farm produce (perishable and non-perishable).
- **Distributors, exporters and retailers:** The processed food may then reach the distributors, wholesalers, retailers or/and exporters by various distribution and transportation channels to markets, both domestic and international, for consumers to access and consume.
- **Consumers:** These are end consumers who purchase the food products for household/self-consumption.
- **Government/regulators:** The Government along with other regulatory stakeholders enforces policies and regulations to ensure that these food products are produced, packaged and labelled as per the defined standards so that they are safe for human consumption. The Government also plays an additional role in market regulation of domestic and export prices of food commodities, especially primary processed staple food products such as wheat flour and polished rice.

77 Consumer trend report, Agriculture and Agri Food Canada



The illustration below depicts the role of each stakeholder and the key challenges they face:

Figure 33: Food processing value chain mapping with stakeholders, their roles and key issues



Source: PwC analysis

Producers are generally involved in farming, livestock rearing and trading, and the key issues that plague them include price volatility, market linkages and wastages. Similarly, processors conduct R&D, primary, secondary and tertiary processing, and manufacturing. Their key issues revolve around regulations, traceability, lack of technology and scalability. Distributors/exporters/retailers also find challenges in traceability and logistics and supply chain. Consumers’ key issues involve price, security and safety of the food (Figure 33).



4.3.1 Value addition and volume-led growth

Export opportunities for the food processing sector

The food processing sector in India, which has been growing at an average annual growth rate (AAGR) of ~7.26%,⁷⁸ could play a key role in the country's ambitious plans for Viksit Bharat 2047. Based on a weighted average of several parameters like value exported, trade balance, annual growth in value and share in world exports, the following product categories have been shortlisted among the processed food segment for greater focus. The key product segments analysed here are bread and bakery products (HS1905), protein concentrates (HS2106) and cane or beet sugar (HS1701). These product categories along with details on average global imports, respective export clusters in India, key markets and other competing nations for the focus sectors have been briefly discussed below.

- 1. Bread and bakery products (HS1905):** A key segment for Indian food processing, bread and bakery products was valued at USD 11.3 billion in 2022 and is expected to reach USD 21.2 billion by 2028 at a CAGR of 10.8%.⁷⁹ The value chain of bakery products starts with farmers providing wheat or other base cereal and other ingredients for the product, followed by manufacturers/processors, wholesalers, retailers and the consumers.
 - **Value-driven segment:** India's bakery exports primarily cater to developed markets, including the US, the European Union, Australia and Canada. These regions demand high-quality baked goods, emphasising taste, packaging, customisation and branding.
 - **Volume-driven segment:** While local consumption remains substantial, exports to neighbouring countries such as Bangladesh and Sri Lanka also contribute significantly to the total volume of exports. However, these markets prioritise affordability and prefer basic variants over quality.

The bread and bakery segment consists of key products such as bread, cookies, cereals, chocolates and sugar confectionery. The Indian market is driven by the ever-growing demand for cookies and biscuits which takes up 50% of the market share of the bread and bakery segment⁸⁰ making India the second largest producer of biscuits in the world after the US.⁸¹ Bread and rolls, savoury biscuits and cakes, and pastries occupy 21%, 11%, and 6% of the market share respectively. However, given below are some of the challenges which plague the growth of the segment.

- **Meeting diverse consumer demands:** The export demand from the bakery industry is marked by a wide range of consumer tastes and preferences. From sugar-free to honey-infused, from traditional bread and biscuits to specialty cakes and premium chocolates – the wide array warrants a continuous need for innovative product development and customisation to remain competitive.
- **Fluctuating raw material prices:** From wheat flour to millet flour, from sweeteners like sugar to stevia-based products, the raw materials for the bakery industry are also changing as per the consumer's needs to meet the changing demands. The price of the raw material is also volatile in the Indian market due to various factors such as logistics cost, demand and supply, etc., which may pose a potential hindrance to mass production and export.
- **Impact of global culinary influences:** Croissants, Danish pastries and other foreign bakery items have gained popularity due to global influences and culinary trends. Since the origin of these products is in foreign nations, these countries have an innate competitive edge over India.

78 Growth of food processing sector, PIB (2024)

79 Market news – Agriexchange, APEDA (2024)

80 Food processing, Towards sustainable growth opportunities, MoFPI

81 Food processing skill study report, MoFPI

2. Protein concentrates (HS2106): In 2022, protein concentrates, and textured protein substances were the world's 1,172nd most traded product with a total trade of USD 2.93 billion. It is estimated that exports from the Indian market for protein concentrates and textured protein substances were worth over USD 46.3 million and accounted for 1.58% of the global exports.⁸² The simplified value chain of the protein concentrates starts with either animal or plant-based materials like rapeseed, corn, fish and bovine serum albumin. These ingredients go through extensive processing to extract bioactive peptides which are then fed into protein concentrates and textured protein substances. This market opportunity can be broadly categorised into value-driven and volume-driven segments:

- **Value-driven:** Developed economies like the US and the EU seek protein concentrates for sports nutrition, functional foods and supplements. Quality assurance and certifications play a crucial role in the import of these concentrates.
- **Volume-driven:** India's neighbouring countries (Nepal and Bhutan) rely on protein concentrates for their growing population. Price competitiveness is also essential in these markets.

Some of the challenges concerning the export competitiveness of protein concentrates and textured protein substances from India are:

- **Differentiation of product:** Protein concentrates and textured protein substances are facing stiff competition from the wide product array being offered by other competitors like the US, Canada, China and Australia. A primary reason for this is the insufficient product innovation in India. Fortification is one of the techniques which can increase the functionality of protein concentrates and substances while also increasing the variety of the offerings for the consumers. In India in 2021, proteins by fortified/functional (FF) milk formula were the highest in demand (USD 10.3 million), along with proteins by protein/energy bars (USD 4.4 million).⁸³
- **Negligible consumer demand from domestic market and developing countries:** Consumer demand for meat substitutes and plant-based products remains low in domestic and developing markets, therefore, there is a heavy reliance on developed markets like the US and Germany for exports of these products. Developing countries prioritise fresh foods over shelf-stable or frozen options. However, India is witnessing slow growth in plant-based offerings on grocery shelves. Increasingly health-conscious Indian consumers believe that a plant-based diet can reduce disease risk. Notably, plant-based drink launches in the Asia Pacific region emphasise high protein content as a key attribute for healthy alternatives.
- **Palatability:** According to a recent Euromonitor survey, 30% of global consumers cite taste as a reason for not consuming plant-based dairy alternatives.⁸⁴ Historically, soy beverages, often consumed by lactose-intolerant individuals, faced palatability related challenges. However, newer options like oat-based plant milk and almond milk have improved taste and are boosting the sales in the segment. Precision-fermented proteins have developed rapidly with the aim of addressing taste and quality concerns in dairy-free milk and cell-cultivated meat and seafood products.

3. Cane or beet sugar (HS1701): In 2022, cane, beet sugar and other solid products were the world's 135th most traded product with a total trade of USD 34.1 billion. The exports of cane or beet sugar grew the fastest in India by 46.7% from USD 4.11 billion in 2021 to USD 6.03 billion in 2022.⁸⁵

- **Value-driven:** The US, the UAE and Indonesia import sugar from India due to its quality and purity. Contracts often involve refined sugar.
- **Volume-driven:** India's sugar exports to neighbouring countries (Bangladesh and Sri Lanka) prioritise affordability and often include raw sugar.

82 Observatory of Economic Complexity (OEC) data, (2022)

83 Sector trend analysis of plant-based protein food in India, Government of Canada

84 <https://www.euromonitor.com/article/plant-based-foods-face-key-challenges>

85 Observatory of Economic Complexity (OEC) data, (2022)

The beet and cane sugar market can be segmented into three main categories – molasses, beet pulp and white sugar. Some of the challenges for India in this segment are:

- **Logistics challenges:** The logistics network plays a crucial role in the efficient movement of goods. For cane or beet sugar exports, challenges include inadequate transportation infrastructure, delays at ports and suboptimal handling facilities. India's vast geography and varying regional conditions further complicate logistics and increase the time it takes for sugar to travel from sugar mills to export terminals. Efficient logistics and ensuring traceability at each stage of the sugar value chain could reduce the losses due to inefficiencies.
- **Supply chain constraints:** The sugar supply chain involves multiple stages, from cultivation to processing and distribution with challenges at each step. For instance, outdated farming practices, low mechanisation, and weather-related pain points affect sugarcane production. Additionally, storage facilities may not meet international standards and lead to the deterioration of the quality of sugarcane. Addressing these constraints requires investment in modernising the supply chain, promoting sustainable practices and ensuring the timely availability of raw materials.
- **Pricing dynamics:** Global sugar prices are influenced by various factors such as production levels, demand and government policies. India faces tough competition from other major sugar-producing countries like Brazil and Thailand. When global prices are low, Indian exporters struggle to maintain profitability. Conversely, during price spikes, India may not be able to export larger volumes due to high domestic demand. Balancing competitive pricing with sustainable margins is the key.
- **Product innovation and diversification:** The sugar industry must adapt to changing consumer preferences and market demands. Traditional raw sugar exports face stiff competition, but value-added products (e.g. specialty sugars, organic variants or fortified options) offer growth opportunities. Encouraging innovation in product development, diversifying the export portfolio and meeting quality standards is essential. For instance, exploring organic certification for Indian sugar could open up new markets.

Key recommendations

With the world gradually becoming more aware of lifestyle diseases and the importance of staying healthy, the demand for healthy and nutritious processed alternatives can help India drive its exports within the processed food category on to a higher value-added and more inclusive platform. This would need to be done by aligning its offerings to the changing consumer tastes and preferences and adhering to the regulations of the ever-dynamic regulatory landscape.



Suggestions for the private sector

- Understanding the macro-trends in the sector, evaluating the corresponding impact on consumer preferences, and customising new products promptly are imperative to keep up the supply of products in the processed food market. Capturing the data on the end consumer behaviour and its close analysis is paramount for understanding the ever-changing consumer demand, especially in this sector.
- To keep up with the rapid pace of process and product innovation, substantial investments in research and development (R&D) are necessary. Small businesses in the processed food market face greater vulnerability when it comes to adapting to ever-changing consumer preferences. In this context, smaller players may collaborate with R&D labs and academic institutions to maintain a competitive edge and find innovative solutions.

Suggestions for the Government

- Fortified sugar enriched with vitamins and minerals such as Vitamin A, iron, and zinc, is used to combat malnutrition. While helping local sugar manufacturing exporters with financial and technical support to drive sugar fortification, the Government must also use existing FTAs/PTAs to secure preferential market access for these products.
- The Government must view certain products like proteins as strategic products capable of enhancing its goodwill globally. It must recognise that fermentation-derived proteins and cultivated meat can provide affordable, sustainable and delicious protein products across the socioeconomic pyramid. Such products will be pivotal to the global fight against malnutrition and climate change, while vastly reducing the public health risks associated with current models of production of natural protein sources like meat. Therefore, the Government must actively develop export standards and guidelines for plant-based exports and promote plant-based exports in foreign geographies.
- Commercialising alternative and smart protein products is challenging largely because facilities for small-scale experimentation and pilot- and industrial-scale production continue to be non-existent. The government must co-invest with startups and players in the alternative protein sector to build such facilities in food parks. Doing so will allow alternative and smart protein manufacturers to explore opportunities to infuse their products into traditional food items, thereby providing a fillip to market creation.
- The Government must explore opportunities to localise production and develop end-to-end value chains for processed food products. This includes cultivation, manufacturing and distribution of value-added products (e.g. ingredients, isolates, texturised protein) using indigenous crops. This would help crops such as pulses, legumes and millets to become viable raw materials for smart protein foods, thereby increasing crop diversification and helping farmers.

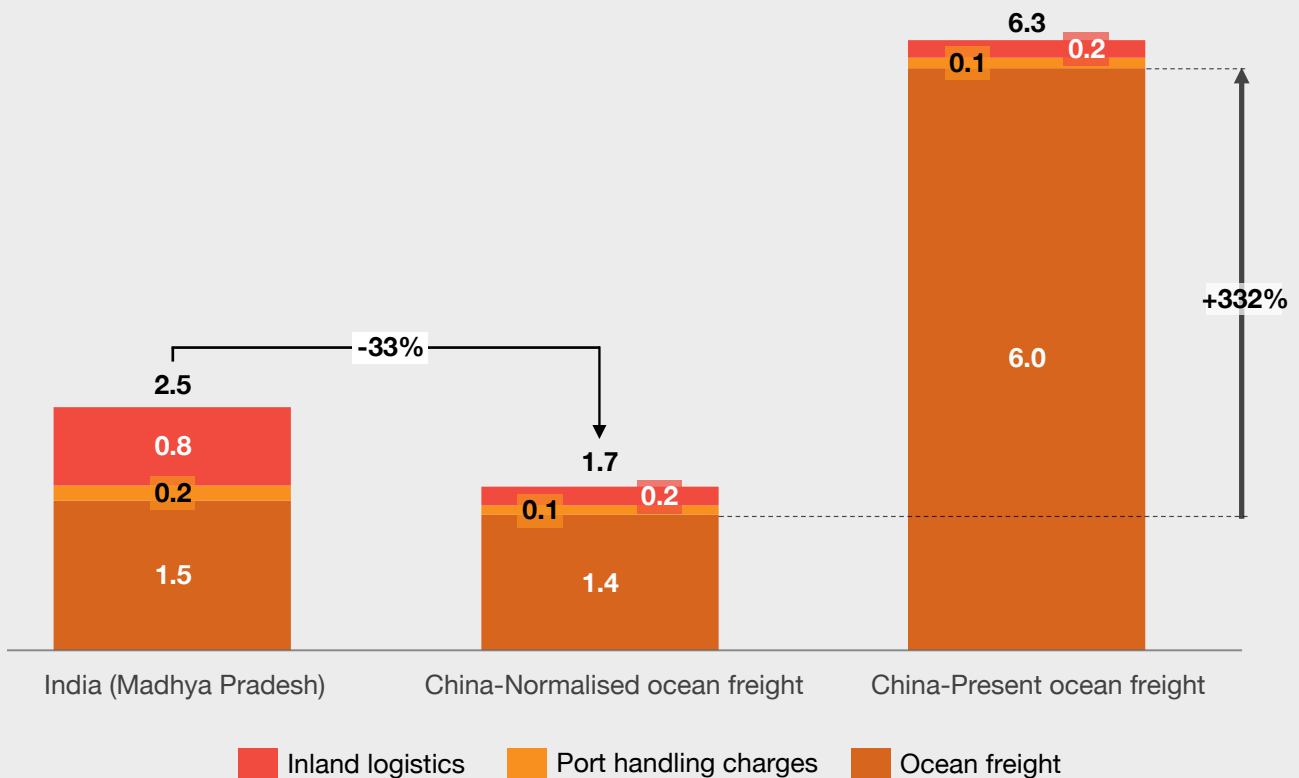
4.3.2 Infrastructure investments

According to a recent report,⁸⁶ the post-harvest food wastage of cereals ranges from approximately 4-6%. This wastage is even higher for the fruits and vegetables category ranging between 5-15%. Milk, meat, poultry, and marine/fisheries sectors also reported a loss of 1-6%. Inadequate cold storage and processing facilities along with inefficient transportation networks hinder efficient operations leading to post-harvest losses and higher transportation costs. Despite significant progress made by India⁸⁷ towards addressing cold storage and warehousing issues, there is still a need for India to upgrade its cold chain facilities with the latest technologies and provide these facilities in Tier-2 and Tier-3 cities to minimise food wastage.

Total logistics cost (TLC) competitiveness

India’s processed food sector encompasses a wide range of products, including beverages, dairy and ready-to-eat foods. India benefits from its vast agriculture base which provides a variety of raw materials. Major centres of production include states like Maharashtra, Punjab, Madhya Pradesh and Karnataka which are well known for their food processing industry due to their access to raw materials and established infrastructure. India is a growing exporter of processed foods and ships products like ready-to-eat meals, frozen foods to markets in North America, the Middle East and Europe. China is also a key competitor and has a well-established processed food sector with significant global market share. Major production centres in China include Shandong and Guangdong provinces. Logistics cost accounts for a significant portion of the overall cost in the processed food export sector in India. The TLC comparison with China is conducted for transportation of 40 feet containers on India (Madhya Pradesh)-US and China (Shandong)-US corridors. Figure 34 shows the TLC difference across both the corridors.

Figure 34: TLC comparison – food processing – container movement



Source: PwC analysis

From a logistics perspective, both cost and time disabilities with respect to China continue to impact India’s competitiveness for food processing exports. While the near-term ocean freight for China has increased by over 300%, long-term freight rate normalisation indicates a cost disability of 33% (Figure 34).

86 Post harvest food loss, PIB (2022)

87 India’s cold chain infrastructure and its future potential, Invest India



Suggestions for the private sector

- **Upgradation and energy transition of existing infrastructure:** Although many states in India have sufficient supporting infrastructure, most of the machinery still in use is now obsolete and the process is still labour-intensive. Upgrading the processing facilities, storage warehouses and transportation networks can streamline the supply chain, reduce wastage, and improve the overall efficiency.

Suggestions for the Government

- **Development of food processing ecosystem in proximity to ports as part of port-led industrialisation:** The export logistics cost for the food processing sector is relatively high, ranging from 10-15% of revenue per metric ton (MT).⁸⁸ A critical component of this cost is the logistics from the hinterland to the port. To reduce such costs, developing food processing industry ecosystems near ports should be prioritised as part of port-led industrialisation. Major port authorities and state maritime boards can focus on promoting food processing industries. This development should include dedicated food processing road and coastal freight corridors that connect production clusters with logistics and packaging facilities like silos, cold storage, and sorting and grading facilities. This approach would provide food processors with a comprehensive export supply chain solution close to port complexes, thereby reducing logistics costs. Some examples of such initiatives include:
 - Veraval and/or Porbandar ports in Gujarat can be evaluated for marine processing hubs with dedicated coastal corridors and RoRo (Roll-on/ Roll-off) facilities to move export containers to Pipavav, Mundra, or JNPA ports.
 - Vishakhapatnam port can be considered for agri-processing given the abundance of agricultural produce and processors in its hinterland.
 - Karwar or Keni or Mangalore port can be considered for establishing a meat processing hub since Belgaum is a significant meat processing centre.
- **Leveraging multiple treaties signed between India and Bangladesh to enhance logistics connectivity for Northeast Region (NER)-based food processors:** In 2008, India and Bangladesh signed the Agreement for the use of Chittagong and Mongla Ports (ACMP), allowing goods to move between India's Northeastern Region (NER) and the rest of India via these ports. Currently, the transit time for cargo from Agartala to Kolkata port via Chittagong is ~5 days, including a three-day sea voyage covering 360 nautical miles and a two-day road journey from Agartala to Chittagong. In contrast, road transport from Agartala to Kolkata via the Siliguri Corridor takes ~8 days and costs INR 6,300-6,700 per metric ton (MT). The cost of transporting cargo through Chittagong is INR 5,000-5,800 per MT, offering savings of INR 500-900 per MT compared to the Siliguri route.⁹⁰ Additionally, the Indo-Bangladesh Protocol (IBP) on inland waterways or using inland waterways of both the countries can be evaluated for exporting cargo from Northeast region movement.
- **Setting up FSSAI testing labs near production clusters:** Currently, many container ports, such as Tuticorin, Karaikal, Paradip, and Hazira lack nearby FSSAI testing laboratories. Samples often need to be sent to centres in cities like Mumbai, Ahmedabad, Chennai or Kolkata for testing and certification, impacting the turnaround time of export containers. The Ministry of Ports, Shipping, and Waterways (MoPSW) can coordinate with various FSSAI centres to establish testing labs at different ports and key ICDs. For instance, FSSAI could consider establishing testing laboratories in Nagpur since Chhindwara, a significant processing hub, is approximately 120 km from the Nagpur ICD.
- **Prioritisation of evacuation from ports/CFSS/ICDs for perishable cargo:** In 2023, the average turnaround time for export containers at Indian ports was ~156 hours, with customs processes taking ~19 hours (~12%).⁹¹ For ICD-bound cargo, the turnaround time was ~128 hours, with customs processes taking ~32 hours (25%).⁹² Ports and customs can evaluate reforms such as prioritising cargo evacuation from ports/CFSS/ICDs for exports of processed foods which are temperature sensitive to ensure cargo integrity as per global standards.

88 PwC analysis

89 PwC analysis

90 Ibid.

91 Customs Time Release Study, 2023

92 Ibid.

4.3.3 Knowledge and capacity building

India's food processing sector predominantly focuses on primary processing. While India is among the top three producers of dairy, fruits, vegetables and cereals, it lags behind when it comes to secondary and above processing of these products. The food processing sector needs to tap into the relatively faster-growing global demand for higher processed foods (secondary, tertiary and above) emerging out of changing consumer behaviour towards convenience foods, ready-to-eat, and ready-to-cook alternatives. This can only be made possible with enhanced skilling of the workforce in the food processing sector while remaining sustainable and compliant with the food safety and export regulations.

Suggestions for the private sector

- **Increased compliance with food safety regulations:** One of the top priorities for both consumers and food processors is food safety. Several factors such as chemical contaminants, food-borne pathogens and physical hazards affect food safety. Although several stringent processes have been put in place by FSSAI in India to ensure food safety and standards, there were several instances when the presence of antibiotic residues was found in chicken meat, milk, and honey products.⁹³ There have also been repeated instances of a lack of adherence to food safety regulations, product categorisations, and alignment of national regulations to the internationally accepted CODEX regulations. The lack of adherence may be further attributed to the constant change in regulations, lack of traceability at different value chain stages and different requirements specific to importing nations. While adherence is a challenge for exporters to follow, it is also difficult for the authorities to monitor the safety compliance of products which may lead to increasing bans on Indian exports.
- **Upskill employees in the unorganised sector:** Processed food products especially large bakery and bread manufacturers can upskill potential employees in the unorganised sector and elevate their product range to include artisanal baking products. There is a possibility that, while doing so, larger players might stumble upon a method or a product that could be scaled and drive value for their export market.
- **Alignment of private sector logistics operators to cater to food processing exports growth:** With an increase in processed food exports, logistics operators also need to augment their capacity and services. For instance, coastal shipping and road transport operators will have to dedicate investment in increasing food processing road and coastal corridors while private container terminal operators can evaluate having green channel access for the industries within its port complex.

Suggestions for the Government

- **Shortage of skilled workers:** According to a study conducted by MoFPI, there is a shortage of skilled, semi-skilled and unskilled workers in the food processing industry.⁹⁴ The Government must recognise the need of the hour and introduce informal/vocational training programmes to mitigate the skill gap via skilling activities.
- **Introduction of curricula related to functional food products:** The Government must also introduce curricula related to functional processed food products like smart proteins at key Indian universities and colleges which deliver courses related to agriculture and food. The Food Processing Sector Skill Council must develop new job roles and eligibility criteria which are relevant to the industry and can be recognised by the National Council for Vocational Education and Training. An effective academia-industry collaboration can be facilitated by the ANRF to nurture young talent in the alternative protein sector through industry-academia collaboration.

93 Presence of antibiotic residue in food products, The Hindu

94 https://www.mofpi.gov.in/sites/default/files/detailed_skill_study_report_-final.pdf

4.3.4 Sustainable supply chains

Export markets for key food processing opportunities

1. Bread and bakery products (HS1905)

India's export of bread and bakery products represents ~1% of the world exports and ranks 21st in terms of world exports. The top ten markets in terms of value exported and share in India's exports are given below.

Table 15: Export destinations for bread and bakery products from India in FY 2022

#	Country	Value exported in 2022 (USD million)	Share in India's exports (%)	Growth in exported value between 2018-2022 (% , per annum)	Average tariff (estimated) faced by India (%)
1	US	92.4	19.2	11	0
2	UAE	27.2	5.7	-2	5
3	UK	24.5	5.1	2	4
4	Canada	23.2	4.8	11	4.9
5	Nepal	18.8	3.9	-1	26.8
6	Angola	16.9	3.5	7	21.2
7	Yemen	14.7	3.1	41	9
8	Australia	14.6	3	8	0
9	South Africa	13.6	2.8	16	19.1
10	Democratic Republic of Congo	11.6	2.4	69	20

Source: ITC Trade Map

India's share of exports to the US is the highest at 19.2%, followed by the UAE with 5.7%. However, while the UAE's growth in imports has increased by 8%, India's exports to the UAE have declined by 2% in the 2018–2022 period. This can provide an opportunity for India to tap into the increase in imports for the UAE. Similarly, Nepal, the UK, South Africa and Qatar present immense potential as future markets where India can channelise its exports in the bread and bakery products segment. The key export clusters for the bread and bakery product segment in Telangana, Punjab and West Bengal with a combined export value of USD 117.4 million are showcased in Table 16 below.

Table 16: Export clusters for bread and bakery products in India (FY 2022)

No.	State	District	Value exported (USD million)
1	Telangana	Rangareddy	59.5
2	Punjab	Jalandhar	29.6
3	West Bengal	Hooghly	14.2
4	Punjab	Patiala	14.1

Source: PwC analysis

Telangana's Rangareddy district exports the highest value of bread and bakery products at USD 59.5 million, followed by Punjab's Jalandhar district at USD 29.6 million. On 3rd and 4th position are West Bengal's Hooghly district and Punjab's Patiala district at USD 14.2 million and USD 14.1 million, respectively (Table 16).

2. Protein concentrates (HS2106)

The Indian exports of protein concentrates and other edible food preparation products represent ~1% of the world exports and rank 29th in terms of world exports. The top ten markets in terms of value exported and share in India's exports are given below.

Table 17: Export destinations for protein concentrate products from India in FY 2022

#	Country	Value exported in 2022 (USD million)	Share in India's exports (%)	Growth in exported value between 2018-2022 (% , p.a.)	Average tariff (estimated) faced by India (%)
1	US	146.3	23.5	16	7.6
2	UAE	91.45	14.7	29	4.7
3	Australia	39.1	6.3	19	1.4
4	Canada	33.6	5.4	22	40.7
5	UK	33.1	5.3	29	2.7
6	Nepal	24.9	4	5	20.1
7	Iran, Islamic Republic of	19.9	3.2	107	13.7
8	Singapore	14.97	2.4	6	0
9	Saudi Arabia	11.4	1.8	11	4.8
10	Bangladesh	10.1	1.6	7	-

Source: ITC Trade Map

As shown in the table above, India's share in exports to the US for the protein concentrates segment is the highest at 23.5%, followed by the UAE at 14.7% and Australia with a share of 6.3%. However, import markets of Nepal, Singapore, Saudi Arabia, Bangladesh and Qatar are growing considerably (5-15%) providing India with an opportunity to grow its export market further for this product segment.⁹⁵ The key export clusters for the protein concentrate products segment in Madhya Pradesh, Gujarat, Rajasthan and West Bengal with a combined export value of USD 86.6 million are showcased in Table 18 below.

Table 18: Export clusters for protein concentrate products in India (FY 2022)

No.	State	District	Value exported (USD million)
1	Madhya Pradesh	Chhindwara	43.6
2	Gujarat	Gandhinagar	33.7
3	Rajasthan	Bikaner	8.8
4	West Bengal	Alipurduar	5.9

Source: District-wise export data, Dashboard, Ministry of Commerce and Industry

Madhya Pradesh's Chhindwara district exports the highest value of protein concentrate products at USD 43.6 million, followed by Gujarat's Gandhinagar district at USD 33.7 million. On 3rd and 4th position are Rajasthan's Bikaner district and West Bengal's Alipurduar district at USD 8.8 million and USD 5.9 million, respectively (Table 18).

3. Cane or beet sugar (HS1701)

India's export of cane and beet sugar products represents 18% of the world exports and ranks 2nd in terms of world exports. The top 10 markets in terms of value exported and share in India's exports are given below.

Table 19: Export destinations for cane or beet sugar products from India in FY 2022

#	Country	Value exported in 2022 (USD million)	Share in India's exports (%)	Growth in exported value between 2018-2022 (% , p.a.)	Average tariff (estimated) faced by India (%)
1	Sudan	782.7	13.6	36	-
2	Indonesia	705.9	12.3	1132	7.1
3	Bangladesh	511.9	8.9	103	-
4	Somalia	377.6	6.6	37	-
5	Saudi Arabia	322.1	5.6	94	0
6	UAE	309.7	5.4	79	0
7	Djibouti	265.5	4.6	36	9.9
8	Iraq	249.2	4.3	1218	-
9	Malaysia	224.1	3.9	129	0
10	Pakistan	219.4	3.8	170	17.7

Source: ITC Trade Map

As shown in the table above, India's share in exports to Sudan for the cane or beet sugar segment is the highest with 13.6% followed by Indonesia and Bangladesh with a share of 12.3% and 8.9% respectively. The key export clusters for the cane and beet sugar segment are in Gujarat, Andhra Pradesh, West Bengal, Karnataka and Uttar Pradesh with a combined export value of USD 2.12 billion (Table 20).

Table 20: Export clusters for cane or beet sugar products in India (FY 2022)

No.	State	District	Value exported (USD million)
1	Gujarat	Kachchh	1,231.8
2	Andhra Pradesh	East Godavari	684.1
3	West Bengal	Medinipur East	85.4
4	Karnataka	Bagalkote	58.5
5	Uttar Pradesh	Kheri	57.2

Source: District-wise export data, Dashboard, Ministry of Commerce and Industry

Gujarat's Kachchh district exports the highest value of cane or beet sugar products at USD 1,231.8 million, followed by Andhra Pradesh's East Godavari district at USD 684.1 million. On 3rd, 4th and 5th position are West Bengal's Medinipur East district, Karnataka's Bagalkote district, and Uttar Pradesh's Kheri district at USD 85.4 million, USD 58.5 million, and USD 57.2 million, respectively (Table 20).

Trade cost competitiveness

For processed food exports from India to be cost competitive in the global market, it is necessary to have a tariff rate in the exporting country which is favourable for competing with other countries. The tariff rate for India for certain priority markets for each product category is given below.

Table 21: Tariff rate analysis for export opportunities identified

HS Code	Description	Value of global imports (in USD million)	Immediate priority (% of global imports)	Tariff rate for India	Tariff favourable to compete	Competitor (tariff, trade agreement)
1905	Bread and bakery products (total imports in 2023 = USD 54.9 million)	54.9	US (19.3%)	0% - 4.5%	In a few cases	Canada (0%, USMCA) Mexico (0%, USMCA)
			UK (7.8%)	4.5%	No	Germany (0%, EU-UK) France (0%, EU-UK)
			Canada (3.9%)	0%-14.5%	In a few cases	US (0%, USMCA) Mexico (0%, USMCA)
			UAE (0.7%)	0%	Yes	Saudi Arabia (0-5%, Unified Customs Tariff, GCC) US (5%, Unified Customs Tariff, GCC)

HS Code	Description	Value of global imports (in USD million)	Immediate priority (% of global imports)	Tariff rate for India	Tariff favourable to compete	Competitor (tariff, trade agreement)
2106	Protein concentrates (total imports in 2023 = USD 66.92 million)	66.9	US (10.9%)	6.4%	No	Singapore (0%, USSFTA) Canada (0%, USMCA)
			UAE (1.1%)	0-5%	In a few cases	US (0-5%, Unified Customs Tariff, GCC)
701	Cane or beet sugar and chemically pure sucrose, in solid form (total imports in 2023 = USD 39.76 million)	39.7	Indonesia (7.2%)	7.5%	In a few cases	Thailand (5%, tariff rate) Brazil (7.5%, no FTA between Brazil and Indonesia)
			Sudan (1.81%)	40%	In a few cases	Egypt (40%, no FTA between Egypt and Sudan) Brazil (40%, no FTA between Brazil and Sudan)

Source: <https://www.macmap.org/>

The food processing sector also faces certain non-tariff barriers designed by export markets that affect exports to these countries. One such barrier is maximum residue level (MRL)-related barriers in the EU market. The EU's MRL specifications and their modifications have persistently posed a challenge to market access for Indian exports. Recent instances of such a barrier are the rejection of turmeric consignments at Poland port due to the presence of Salmonella Weltevreden in turmeric powder from India (the permissible level is zero), border rejection by Germany on finding thiamethoxam and tricyclazole in rice from India (the permissible level is 0.01 mg/kg - ppm which is default level and the level found in Indian exports was 0.03 mg/kg – ppm) and the official detention of Indian groundnuts by the Netherlands on finding aflatoxins (maximum permissible limit is 20 µg/kg – ppb and the analytical results depicted 56 µg/kg – ppb).

Though, often the scientific basis of specifying the maximum permissible threshold is questioned, the overall specification of default values in cases where specific maximum thresholds is not defined is found to be highly questionable. This is because the threshold of default value i.e. usually 0.01 mg/kg is a significantly low level and is applied on a standard basis when the MRLs are not specifically defined. Such an approach puts every product under a scrutiny that might not even be warranted in some cases.

It is also noteworthy that disparate policies or procedures across EU Member States including around customs, labelling, agricultural biotechnology, packaging and packaging waste, government procurement, investment and intellectual property protection and enforcement are persistent challenges noted by various jurisdictions including India.

Table 22: Non-tariff measures with the potential to serve as non-tariff barriers

Product	HS Code	Target country	Non-tariff measures with the potential to serve as non-tariff barriers
Bread and bakery products	1905	US, UAE, UK, Canada	<p>China: Exporter registration with the government, which seeks detailed information, has been made mandatory; food packaging related challenges have been faced in the past.</p> <p>The EU: Indian products are often challenged in testing with EU citing maximum residual limit (MRL) related breaches, with EU's MRL thresholds often set at default value, which might not be scientifically justified; across EU dispersed labelling systems for packaging.</p>
Protein concentrates	2106	US, UAE	<p>China: Exporter registration with the government has been made mandatory seeking very detailed information; food packaging related challenges have been faced in the past.</p> <p>The EU: Indian products are often challenged in testing with EU citing MRL-related breaches, with the EU's MRL thresholds often set at default value which might not be scientifically justified.</p>
Cane or beet sugar	1701	Sudan, Indonesia	<p>China: Exporter registration with the government has been made mandatory seeking very detailed information; food-packaging-related challenges have been faced in the past.</p> <p>Indonesia: Standards on refined crystal sugar, raw crystal sugar and white crystal sugar have been made mandatory; in the context of some other products, India has questioned the mandatory application of Indonesian National Standard (SNI) standards.</p> <p>The EU: Indian products are often challenged in testing with the EU citing MRL-related breaches, with the EU's MRL thresholds often set at default value, which might not be scientifically justified.</p>

Source: <https://www.macmap.org/>

The consumers in key food export markets like the UAE, the US and the EU are now fast emerging as active sustainable customers. They are keen to know more about the associated carbon and water footprints derived from the life-cycle assessments of these products. Therefore, the corresponding standards that regulate this segment are also transitioning and new caveats are being institutionalised within export markets to ensure that the products which the consumers consume are safe, healthy and nutritious.

Suggestions for the private sector

- Keeping in view the challenges that might arise due to non-tariff barriers levied on packaging materials, exporters of processed products must explore the use of biodegradable plastics. Some of these alternatives like starch-based plastic, polymers synthesised by microorganisms and chemically degradable photodegradable plastics have recently been developed by the Central Food Technological Research Institute (CFTRI) for packaging and labelling products like bakery and bread items.
- Large manufacturing exporters of beet and cane sugar can ensure that their CSR spends are dedicated to helping farmers adopt more climate-friendly, technology-driven production methods which can preserve the long-term productivity of their farms and families.

Suggestions for the Government

- Plant-based processed food products, especially plant-based protein sources, plant-based fat substitutes (e.g. plant-based eggs, butter) remain relatively underexplored in India despite the growing markets in the US and the EU. Domestic players within our key export markets are actively driving conversations with domestic regulators to build standards for such products as per their requirements. The Government, in collaboration with food processors, must actively influence the standards and standard-setting processes now, so that they don't become non-tariff barriers for our exports in future.
- **Mitigate the impact of climate change on food processing:** As an agrarian economy, India is heavily dependent on agriculture, which is vulnerable to the impact of climate change. Climate change can alter plant pollinator interactions, increased insect/pest resilience, decreasing yields, low soil moisture retention and weakening of disease resilience of the crops. This impacts the entire processed food value chain as the supply side of the raw material is disrupted for a long time.



4.3.5 Inclusive industrial development

The processed food industries are responsible for generating direct and indirect employment for more than five crore people in India today. This contribution is further subdivided into organised and unorganised sectors. While organised industries generate most export revenues, the smaller unorganised players and individuals (e.g. farmers and raw material suppliers) are responsible for building volumes across the value chain required to generate the desired value. Therefore, it is important to ensure that the interests of the volume drivers are preserved along with those of the value generators as the share of the food processing industry grows in India's export revenue basket.

Suggestions for the private sector

- Processors can help create employment for the farmers who provide them with raw materials. Startups, key food industry players and equipment manufacturers must collaboratively support training initiatives at their production facilities and train young talent from rural communities who wish to pursue a career in this field.

Suggestions for the Government

- Sensitising small and medium players about sub-terranean changes in their demand landscape such as consumer trends around nutrition, sustainable sourcing and environment-friendly packaging must be taken up by the Government actively. To overcome the language barrier, the Government can harness the power of GenAI and provide multilingual support to the small and medium players.



4.3.6 Technology enablement

In the dynamic landscape of process and product innovation, technology plays a pivotal role in sustaining and expanding processed food exports. Small businesses, often more vulnerable to market shifts, can leverage collaboration with R&D labs and academic institutions to harness technological advancements. These innovations empower them to adapt swiftly to consumer preferences, maintain quality and stay competitive.

Suggestions for the private sector

- **Blockchain for traceability:** Private players have increasingly started adopting blockchain technology to enhance transparency and traceability throughout the supply chain. It allows consumers and importers to verify the origin, quality and safety of processed foods.
- **The Internet of things (IoT)-enabled smart warehousing and cold chain management:** IoT sensors monitor temperature, humidity and storage conditions in warehouses while allowing the option of control it on the move. This real-time data ensures optimal preservation of perishable goods. Additionally, IoT-enabled devices track temperature during transportation, reducing spoilage and ensuring compliance with export standards.
- **Development of newer technologies for consumers:** Increased personalisation has been observed in both the global as well as Indian food processing industry. Consumers are increasingly becoming health conscious and keeping a close watch on what they are consuming. This necessitates the development of a technology which can provide consumers with alternatives that can cater to their personalised nutrition and dietary needs.
- **Automation technology adoption:** Automation technologies such as smart sensors, robotics and data analytics enhance production accuracy, minimise human errors and optimise resource utilisation. For instance, automated sorting systems can enhance product quality by ensuring consistent grading and minimising defects. By embracing technology-driven infrastructure enhancements, businesses can position themselves competitively in the global processed food market.
- **Collaborate with R&D labs and academic institutions:** In the ever-evolving landscape of process and product innovation, private players can benefit significantly from partnerships with R&D labs and academic institutions. By collaborating with these institutions, businesses gain access to cutting-edge technologies, scientific knowledge and market insights. For instance, joint research projects can lead to the development of novel processing techniques, packaging solutions and quality control methods. These collaborations empower small businesses to stay abreast of industry trends, adapt swiftly to changing consumer preferences and maintain high-quality standards.

Suggestions for the Government

- **AI and machine learning in assessing regulatory compliance:** AI algorithms can assess food quality, detect defects and sort products. For instance, identifying blemishes on fruits or grading rice based on visual cues. Governments could actively collaborate with startups to bring in the required AI and ML capability into this sector, which could further benefit the large unorganised supply chain players in the value chain.
- **Encouraging collaborative research and adoption of technologies with the industry, government and research institutions:** By embracing innovation, India can elevate its processed food exports and meet global demand.

05 Other export ecosystem enablers



Other key export ecosystem enablers

Following are recommendations for adopting the VIKSIT approach for enabling the wider export ecosystem:

Table 23: Summary of key recommendations

Pillar	Sub-area	For Government	For private sector
V - Value addition and volume-led growth	Product basket	<ul style="list-style-type: none"> Undertake initiatives for improving value addition such as supply chain localisation for key sectors like furniture, electrical equipment, fabricated metal products, machinery and equipment, rubber and plastic, and automobiles. Encourage new investments in sectors having high value addition ratio for sectors such as pharmaceuticals, non-metallic minerals, wearing apparels, machinery and equipment, and leather. 	<ul style="list-style-type: none"> MSME players may evaluate forming private sector led export consortiums to aggregate their supply which could enable enhanced negotiation terms. Private companies operating in high value-add sectors (e.g. pharma, non-metallic minerals) may evaluate how they can access new markets or scale up within the existing markets. Diversification into high value add products may be evaluated by Indian exporters.
I - Infrastructure investments	Transport and logistics	<p>Ports and logistics</p> <ul style="list-style-type: none"> Both major and non-major ports, including those in the private sector, are undertaking various port capacity augmentation projects which are also critical and in line with the capacity required to achieve USD 1 trillion merchandise exports. Timely execution and close monitoring of these projects, especially the VadHAVAN port, is crucial. Any delays could bottleneck India's container handling capacity, leading to port congestion and higher logistics costs. Deploy non-intrusive inspection systems at seaports, CFSs and ICDs for exports to reduce cargo release time of export containers and achieve the target set under the National Trade Facilitation Action Plan (NTFAP). Develop partner government authorities (PGAs) infrastructure near key manufacturing hubs and ICDs. For instance, textile committee laboratories could be set up at ICD Coimbatore, as Tirupur, a textile hub, is just 70 km away. 	<p>Ports and logistics</p> <ul style="list-style-type: none"> Private sector logistics operators could augment their capacity and services to align with the envisaged growth. For instance, investments in port terminal equipment could increase cargo handling productivity and facilitate the development of rail siding within terminals to cater to future cargo growth.

Pillar	Sub-area	For Government	For private sector
		<ul style="list-style-type: none"> • Maintain competitiveness and attract investors to set up export-led facilities adjacent to ports by rationalisation of lease rentals of port-led industrial parks. • Augment DFC connectivity to key ports especially on the western coast which has major cargo traffic, i.e. Mundra, Hazira and JNPA, for faster cargo evacuation. • Develop coastal berths near production centres and use them as feeder ports to major ports for exports. For instance, coastal berth at Navlakhi, Gujarat can be evaluated to move containers from Morbi and Rajkot districts to Kandla and Mundra ports instead of using road transport for reducing road congestion and carbon emissions. <p>Airports</p> <ul style="list-style-type: none"> • Establish air cargo villages in collaboration with private sector for faster clearance of cargo. • Revive the GST exemption scheme for supply of transportation services of goods or implement similar incentives to reduce overall costs and enhance the competitiveness of air cargo exports, making them more attractive compared to those from other countries. 	<p>Airports</p> <ul style="list-style-type: none"> • Terminal capacity enhancement at airports and terminal operations in line with the vision of the Ministry of Civil Aviation (MoCA) can help achieve the target of 10 MT of air cargo trade by 2030. • Airlines could increase the proportion of widebody aircraft in their fleet to capitalise on economies of scale.
	Industrial infrastructure	<ul style="list-style-type: none"> • Formulate and notify a new SEZ policy and attract anchor investors, especially from hi-tech sectors to replicate the success of current SEZs. • Create economic zones which cater to priority products manufacturing near major gateways/ ports (under the Districts as Export Hubs Initiative to provide higher focus on districts contributing to export of priority products from India). • Set up EU-recognised testing labs and subsidise the cost of testing. Simultaneously, expedite recognition of existing Indian labs with the EU. • Offer land in export zones (near port) at subsidised rates. • Equip such zones with environment infrastructure to enable industries/exporters to comply with net-zero/ decarbonisation targets. 	<ul style="list-style-type: none"> • Private developers can evaluate developing economic zones, industrial townships, and common facilities such as testing and certification labs near major ports of India based either on PPP or private sector development models.

Pillar	Sub-area	For Government	For private sector
		<ul style="list-style-type: none"> • Mobilise land offtake at port-led industrial parks, estates and economic zones to enable competitive exports (by reducing the in-land logistics cost). • Frontload common infrastructure at key nodes along the industrial corridors to enhance competitiveness and improve level of service for tenants. • Leverage alternative financing instruments to develop eco-industrial parks, sustainability-related infrastructure. • Evaluate the modification of the pricing model of industrial parks to move towards pay-as-you-use model, i.e. payment of land lease on a recurring basis (monthly/ quarterly/ annual basis). • Enhance the role of ULBs in financing the infrastructure upgradation of industrial parks which can enable the inclusion of ULBs' revenue streams from property tax, transportation services and select utilities into the financing structure and improve its viability. 	
K - Knowledge and capacity building	Access to business intelligence and market insights	<ul style="list-style-type: none"> • Create a centralised platform for business intelligence and market insights into priority products, including a repository of non-tariff barriers faced by those priority products. • Develop knowledge repositories and collaterals on product and market opportunities. • Conduct knowledge sharing and awareness sessions on the knowledge repositories. 	
	Transport and logistics: Research and innovation	<p>Ports and logistics</p> <ul style="list-style-type: none"> • Set up a facility for innovations in greening ports and logistics sector in collaboration with academicians and the private sector. <p>Airports</p> <ul style="list-style-type: none"> • Develop PGAs infrastructure with a focus on IT infrastructure and staffing requirements in the specific PGAs (WCCB and AQ). • Initiate policy reforms like introduction of known consigner concept, provisions for cargo movement of buildup ULDs via airports, circulars for standardisation in processes across airports like acceptance of weight variation by airlines for a seamless EXIM cargo movement. 	

Pillar	Sub-area	For Government	For private sector
S - Sustainable supply chains	Trade tariff and regulations	<ul style="list-style-type: none"> • Adjust the customs duties on inputs, parts, sub-parts, and raw materials for products covered/ to be covered under the PLI scheme (two-year period). • Ensure faster customs clearance for product sample export. • Conclude FTAs with major global importing countries where India currently doesn't have any active trade agreements (e.g. the US, the EU, the UK, GCC, African Free Trade Area). • Extend Drawback and RODTEP to all uncovered sectors and schemes (for e.g. bonded warehouse manufacturing scheme) and reconsider increase in rates. • Implement complete rationalisation and inversion correction for customs duty structure. 	
	Net-zero and decarbonisation	<ul style="list-style-type: none"> • Encourage and incentivise private sector initiatives which enable net-zero/decarbonisation transition which focus on: <ul style="list-style-type: none"> – circular economy – energy efficiency – renewable energy – carbon capture and storage – supply chain decarbonisation – green tech procurement. • Standardise carbon accounting process for all sectors and share SOP for assessment of carbon emissions across the value chain. 	<ul style="list-style-type: none"> • Assess carbon footprint. • Develop carbon reduction strategy. • Source sustainable raw materials. • Adopt green energy sources. • Procure green technology. • Invest in carbon capture, storage technologies and infrastructure. • Optimise supply chain for sustainability. • Continuously bring in green manufacturing processes. • Invest in training and capacity building.

Pillar	Sub-area	For Government	For private sector
	Transport and logistics: Net-zero and decarbonisation	<p>Ports and logistics</p> <ul style="list-style-type: none"> • Develop sustainability monitoring tools for port ecosystem to assess the impact of climate adaptation and mitigation measures, create green shipping corridors and consider implementing a carbon trading platform, aligned with global platforms, to make Indian exporters competitive at the global level. • Establish a green fund which is focused on greening initiatives for ports, terminals and shipping operators which includes sustainability-linked lending with targets or KPIs attached to loan instruments. <p>Airports</p> <ul style="list-style-type: none"> • Issue green credits to MNCs for transporting cargo via airlines which run on sustainable aviation fuel. These green credits may further be used as a proxy for sustainability compliance targets. 	<p>Ports and logistics</p> <ul style="list-style-type: none"> • Private terminal operators and logistics companies can consider setting their net-zero goals to align with India's net-zero goals. • Invest in electrification of port handling equipment and renewable sources of power for electrifying the port operations. • Set goals to use rail and coastal shipping for export and cargo movement as opposed to road transport, to reduce carbon emissions.
	Transport and logistics reforms	<p>Ports and logistics</p> <ul style="list-style-type: none"> • Establish institutional frameworks for port-led industrialisation and define clear roles for land ownership, master development, subcontracting among port authority, and state and central government. • Port authorities can have the flexibility to fix land rates which are competitive with state industrial development corporations to promote port-led industrialisation. 	
	Supply chain	<ul style="list-style-type: none"> • Create apex body for raw material supply. • Procure raw material from a centralised agency at cheaper rates. 	

Pillar	Sub-area	For Government	For private sector
I - Inclusive industrial development	Market access	<ul style="list-style-type: none"> • Create apex body for export promotion in India (e.g. JETRO, KOTRA). • Evaluate opening foreign retail spaces for promoting Indian products in select priority target markets. • Make all the existing state export promotion councils (SEPC) fully functional (currently only some of the SEPCs are functional). • Establish SEPCs in states where they do not exist. • Organise global export promotion summits at both state and national levels in alignment with investment promotion summits like the Dubai Expo. • Organise onboarding workshops for MSMEs in partnership with global e-commerce/cross border trade platforms. • Evaluate creation of aggregator institutions (export consortium) for select priority products. • ONDC may explore tie-ups with more global e-commerce platforms (e.g. Proxtera) for enabling cross border e-commerce exports from India. • Evaluate export-linked incentives (ELIs) for merchant exporters. 	<ul style="list-style-type: none"> • SME internationalisation centres may be established in key export clusters. Such centres may provide end-to-end support to organisations for conducting exports. Support services may include logistics, trade compliance, order and lead management, finance and insurance. • Collaborate with cross-border e-commerce platforms to enable cross-border exports from India.
		<ul style="list-style-type: none"> • A detailed study to improve ease of exporting may be undertaken. A thorough review of all the trade and custom compliance processes involved may be undertaken and accordingly interventions/solutions to reduce the number of processes and time may be proposed. A common portal for managing the exporter's end-to-end compliance process for exporting merchandise goods may be developed. 	
	Access to finance	<ul style="list-style-type: none"> • Encourage banks to offer loans at attractive rates for exporters. • Extend the Credit Guarantee scheme support to also offer working capital finance for conducting exports to MSME units. 	<ul style="list-style-type: none"> • Add the products which have been identified as high priority export products in the priority lending basket of banks for providing finance. • Simplify compliance requirements for availing export finance and insurance.

Pillar	Sub-area	For Government	For private sector
	Capacity development for MSMEs	<ul style="list-style-type: none"> SEPCs may institutionalise and organise (especially first time) training programmes for exporters in select priority export clusters in their states at regular intervals (monthly/ quarterly). Training programmes may have coverage of all the key topics related to exports such as identifying key markets, understanding tariff and trade barriers and its related compliances, trade agreements and its benefits, export-related incentive schemes, trade finance and trade insurance. 	
T - Technology enablement	EoDB	<ul style="list-style-type: none"> Reduce SCOMET application's approval time. Have a single integrated portal for providing end-to-end approvals required for conducting exports (state and Central government approvals) to improve ease of exporting. 	
	eCommerce	<ul style="list-style-type: none"> Expedite proposed FY2024 budget initiative for formulating eCommerce export guidelines/ framework. 	
	Transport and logistics - EoDB	<p>Ports and logistics</p> <ul style="list-style-type: none"> Integrate NLP-Marine with PGAs, the Indian Railways and other organisations which are not part of NLP-Marine. Equip Government stakeholders including port authorities, customs, PGAs in the port ecosystem with handheld devices and conduct capability building sessions for paperless transactions. Integrate ICEGATE, SEZ Online and express customs clearance systems to provide a single sign-on, a unified repository, a single application and a single dashboard for traders. With the announcement of the India Middle-East Europe Economic Corridor (IMEC), customs can consider transitioning to digital information exchange via blockchain-based platforms that enable pre-arrival, post-clearance, mutually recognised agreement-authorised economic operator information exchange with major trading partners, allowing trade to become more competitive and be integrated into existing global value chains. 	<p>Ports and logistics</p> <ul style="list-style-type: none"> Adopt NLP-Marine to facilitate paperless transaction across the port ecosystem.

Pillar	Sub-area	For Government	For private sector
	Digitisation	<ul style="list-style-type: none"> Integrate database of DGFT, customs, banks and other stakeholders to reduce compliance burden. 	<p>Airports</p> <ul style="list-style-type: none"> Enable advanced technologies for high dwell time processes like cargo weighment, segregation and screening by terminal operators at ports and airports to increase process throughput and reduce overall process dwell time. Enhance internet connectivity to facilitate smooth operations and reduce manual intervention which will decrease the dwell time at cargo terminals.
	Transport and logistics - digitisation	<p>Ports and logistics</p> <ul style="list-style-type: none"> Implement gate automation systems as a part of the 'Smart Ports' initiative to reduce manual touchpoints and interventions in collaboration with customs to improve the overall container turnaround time. <p>Airports</p> <ul style="list-style-type: none"> End-to-end digitalisation of customs clearance processes at airports can enable faceless transactions and reduce the overall dwell time for exports and trans-shipment processes. 	<p>Ports and logistics</p> <ul style="list-style-type: none"> Port terminal operators should identify technology interventions to improve operational efficiency and reduce the bottlenecks in port operations.

About PwC

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 151 countries with over 360,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com.

PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details.

© 2024 PwC. All rights reserved.

Contact us

Sanjeev Krishan

Chairperson
sanjeev.krishan@pwc.com

Vivek Prasad

Markets Leader
vivek.prasad@pwc.com

Kunj Vaidya

India Clients and
Industries Leader
kunj.vaidya@pwc.com

Ranen Banerjee

Partner and Leader – Responsible
Development Services (RDS)
ranen.banerjee@pwc.com

Mohammad Athar

Partner and Leader, Industrial
Development and Investment
Promotion platform
mohammad.athar@pwc.com

Anurag Srivastava

Partner, Industrial Development
& Investment Promotion platform
anurag.srivastav@pwc.com

Manoranjan Pattanayak

Managing Director
RDS Growth Business
manoranjan.pattanayak@pwc.com

Dhruv Gadh

Partner, Ports and Logistics
Infrastructure
dhruv.gadh@pwc.com

Sonal Mishra

Partner
Aviation Infrastructure
sonal.mishra@pwc.com

Kavan Mukhtyar

Partner and Sector Leader
Automobile
kavan.mukhtyar@pwc.com

Sujay Shetty

Managing Director
Electronics sector advisory
s.shetty@pwc.com

Shashi Singh

Partner
Food Processing
shashi.k.singh@pwc.com

Anurag Sehgal

Managing Director, Tax & Customs
anurag.sehgal@pwc.com

Raghav Narsalay

Partner, Research and Insights,
raghav.manohar.narsalay@pwc.com

Rohan Shah

Director
rohan.shah@pwc.com

Key contributors

Nishant Shah, Dr. Debdeep De, Shrikant Sharma, Souma Shekhar Gangopadhyay, Faisal Khan, Vatan Agrawal, Yogesh Thakar, Sindhu Bharathi Mandharachalam, Avantika Sharma, Nirvanjyoti Bhattacharjee, Stuti Toshi, Dhiraj Das, Bhumika Pandit

Editorial support

Sreedhar Pothukuchi, Vishnupriya Sengupta,
Dion D'Souza, Ruchika Uniyal, Megha Adhikari

Design

Gulam Ansari, Gurpreet Singh, G Gnanaraj,
Kirtika Saxena, Akshay Wadhawan, Shipra Gupta,
Praveen Pr, Harshpal Singh



pwc.in

Data Classification: DC0 (Public)

In this document, PwC refers to PricewaterhouseCoopers Private Limited (a limited liability company in India having Corporate Identity Number or CIN : U74140WB1983PTC036093), which is a member firm of PricewaterhouseCoopers International Limited (PwCIL), each member firm of which is a separate legal entity.

This document does not constitute professional advice. The information in this document has been obtained or derived from sources believed by PricewaterhouseCoopers Private Limited (PwCPL) to be reliable but PwCPL does not represent that this information is accurate or complete. Any opinions or estimates contained in this document represent the judgment of PwCPL at this time and are subject to change without notice. Readers of this publication are advised to seek their own professional advice before taking any course of action or decision, for which they are entirely responsible, based on the contents of this publication. PwCPL neither accepts or assumes any responsibility or liability to any reader of this publication in respect of the information contained within it or for any decisions readers may take or decide not to or fail to take.

© 2024 PricewaterhouseCoopers Private Limited. All rights reserved.

July 2024 - M&C