Expanding tech horizons

Unlocking India's digital potential

Shri Ashwini Vaishnaw

Union Cabinet Minister of Railways, Communications, Electronics and Information Technology, Government of India

India today is at the centrestage of the global ICT industry. The unique achievements by the country including the fastest 5G deployment and implementation of Digital Public Infrastructure (DPI), has made India a reckoning force in the global ICT ecosystem. Already the fifth largest economy in the world, laying the foundation for 6G by co-creating the standards for the world, India has its sight set on becoming a global technology powerhouse and the Indian Government is determined to create an enabling environment that attracts investment in the sector. We believe that with all the foundational pillars in place, the time is opportune for industry stakeholders in India to enhance their core capabilities and contribute to the government's trillion-dollar vision. I cordially invite all of you to this year's India Mobile Congress (IMC) event so we can engage in a holistic, inclusive, and futuristic discussion about India's place in this era of Global Digital Innovation.

Shri Devusinh Chauhan

Minister of State for Communications, Government of India

I would like to take this opportunity to thank the Government, MeitY, DoT, telecom players, organising bodies, KPMG, and all participants contributing to the revolution of India's ICT sector. These are exciting times for India and the ICT sector, and we are certain that cross-sector collaborative effort, research and development, and the government's support for the sector will take India to new heights. Heartiest congratulations to IMC and associated members for making this event a tremendous success.

Shri Neeraj Mittal

Secretary, Department of Telecommunications, Government of India

As we initiate our strides towards a digital future and prioritise adoption of new technologies, we also see ourselves uniquely positioned to be global suppliers of repute in the telecom sector. I thank the IMC team for creating an inclusive platform where the public and private sectors can meet to strategise way forward for the Indian telecom ecosystem.

IMC foreword

As we enter the seventh edition of the Indian Mobile Congress (IMC), I extend a warm welcome to all the participants who have made this event a success. Your contribution has helped elevate the stature of the IMC to an unparalleled platform for bringing together key players from the Information and Communication Technology (ICT) industry to identify, discuss and align upon the present and future of the industry. Our collective deliberations have and will continue to contribute to setting India's ICT agenda.

Underlining the 2023 IMC theme of 'Global Digital Innovation', we seek to explore India's position and capability as the next major player in the future of ICT. We will focus on the Indian growth story, the nation's recent digital leaps, and the ever-improving nationwide connectivity that is paving the way for a large Indian customer base.

The sector's robust growth trajectory indicates, major industry players looking to address the needs of this customer base have also found the opportunity to be global suppliers, supported by the government's thrust on conducive policy and enabling infrastructure. Their success underlines the government-industry synergy that is driving India's emergence as a global force in the ICT sector.

This report seeks to highlight and interpret the favourable headwinds capable of propelling India into the global limelight of technological development. I would like to thank the IMC and KPMG in India teams for drafting this report and defining the narrative that will pave the sector's way forward.

P Ramakrishna
CEO
India Mobile Congress

KPMG in India foreword

India, a nation with a rich tapestry of technological progress, has made significant strides in the ICT sector. These advancements have been driven by ubiquitous connectivity, the evolution of smart cities, enhanced digital governance, and the nurturing of a robust startup ecosystem. Some of the recent feats of the country including delivering on world's fastest 5G deployment and becoming the second largest manufacturer of mobile phones are testimonial to India's digital prowess and have successfully placed India as a reckoning force in global ICT industry.

5G technology has emerged as a pivotal force reshaping both enterprise and consumer markets. Enterprises are harnessing the high-speed, low-latency capabilities of 5G to streamline operations and introduce innovative applications. Simultaneously, consumers are experiencing a new era of connectivity characterised by high-definition streaming and the IoT (Internet of Things) experiences.

India's 6G vision document has positioned its digital capabilities on the global tech stage and reaffirmed its commitment to technological advancement. Looking ahead, India is set to play a significant role in 6G development by offering its research and development capabilities, in collaboration with global stakeholders.

In tandem, India's satellite communication sector is opening up to private players, thus fostering competition and innovation. Concurrently, the semiconductor market in India is expanding, bolstered by government incentives aimed at reducing import dependence and strengthening the country's position in the global semiconductor supply chain. These developments collectively underscore India's evolving and increasingly influential role in the global technology landscape.

India's digital economy is experiencing exponential growth, including the advancements in the ICT manufacturing sector. Government initiatives such as Production Linked Incentive (PLI) schemes in India, specifically targeting the smartphone, IT hardware, and semiconductor industries are

fostering investment, enhancing competitiveness, and driving innovation.

Inclusivity remains a core focus, with initiatives like the National Broadband Mission extending fibre connectivity to rural areas. The government's steadfast promotion of entrepreneurship and startups through programs like Startup India, Make in India, and Digital India is not confined to domestic endeavours; it now extends to the global stage.

With a resolute dedication to innovation, research and development, India is poised to become a global manufacturing hub. Ongoing developments, strategic schemes, and youth upskilling efforts are paving the way for a self-reliant digital future, further solidifying India's prominent role in the global arena of digital innovation. This thought leadership serves as a guidepost in this transformative journey, offering insights and visionary perspectives that will shape our collective digital destiny.

Yezdi Nagporewalla
CEO
KPMG in India

Akhilesh Tuteja
National Leader – Technology
Media and Telecom
KPMG in India

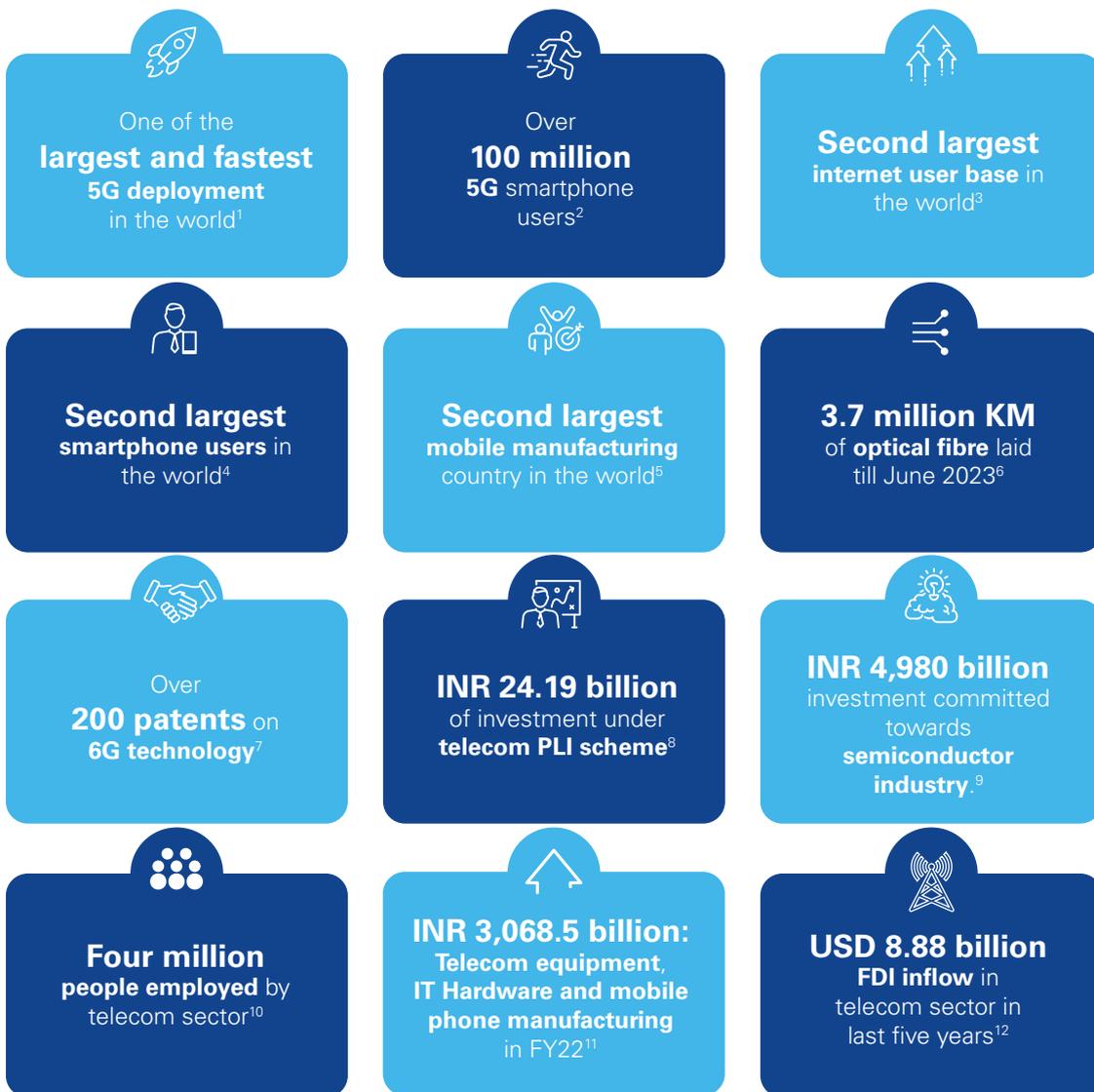## Purushothaman K G
Telecommunications
Industry Leader,
Head – Digital Solutions
KPMG in India

Executive summary

India is today at the threshold of an extraordinary decade of technological advancement and innovation, well positioned to become a global leader in ICT. We are witnessing continuous improvements in nationwide connectivity, driven by a strong government push to position India as an emerging technology leader. Some of the achievements of the Indian ICT sector include:

One of the
largest and fastest
5G deployment
in the world[1]

Over
100 million
5G smartphone
users[2]

Second largest
internet user base in
the world[3]

Second largest
smartphone users in
the world[4]

Second largest
mobile manufacturing
country in the world[5]

3.7 million KM
of **optical fibre** laid
till June 2023[6]

Over
200 patents on
6G technology[7]

INR 24.19 billion
of investment under
telecom PLI scheme[8]

INR 4,980 billion
investment committed
towards
semiconductor
industry.[9]

Four million
people employed by
telecom sector[10]

INR 3,068.5 billion:
Telecom equipment,
IT Hardware and mobile
phone manufacturing
in FY22[11]

USD 8.88 billion
FDI inflow in
telecom sector in
last five years[12]

1. India among top 3 nations with highest 5G base roll out remarkable, The Economic Times, October 2023

2. India's 5G smartphone user base crosses 100 million mark, The Economic Times, July 2023

3. Countries with the largest digital populations in the world as of January 2023, Statista, January 2023

4. India overtakes US to become 2nd largest smartphone market in Q3, Hindustan Times Tech, August 2022,

5. India ranks second in mobile production with 'Make in India' driving 2 billion devices, CNBCTV18, August 2023

6. Last mile fibre: Government initiatives to connect all villages with OFC, Tele.net, August 2023

7. Telecom Minister Ashwini Vaishnaw inaugurates 6G lab in India, Business Today, October 2023,

8. Telecom companies invest Rs 2,419 Cr under PLI scheme till date, Business Today, October 2023

9. India never disappoints: PM Narendra Modi to global chip companies, Business Standard, July 2023

10. Telecos to see 45 per cent rise in hiring, add 6mn jobs by FY 26, Live Mint, January 2023

11. MEITY FY24 annual report and KPMG analysis

12. Amount of foreign direct investment inflows in India's telecommunications sector from financial year 2012 to 2023, Statista, August 2023 has context menu

These achievements have been a result of the government's vision to drive an ICT centric growth, enabled by some of the policy changes included below:

The new Telecom bill that seeks to replace archaic laws and enable the pathway to make India a digitally connected nation

With cybersecurity and e-governance joining the list of top national priorities, measures such as the Digital Personal Data Protection Act (DPDPA), aimed at protecting users and countering cyber frauds, reinforce India's commitment to digital safety

National Broadband mission that has enabled broadband connectivity to 93.21 per cent of villages[13]

Development of indigenised 4G stack for India and for the world

Multiple reforms aiming to enhance ease of doing business like simplification of Right of Way (RoW rules), launching of Gati Shakti portal among others

The Pradhan Mantri Gramin Digital Saksharta Abhiyan that aims to train 600 million rural Indians in digital literacy

PLI scheme to boost Indian manufacturing ecosystem in telecom, IT hardware, semiconductor value chains with a target to increase electronics manufacturing capacity to INR 24,000 billion and which will also help create over a million jobs by 2025-26[14]

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13. Broadband Connectivity Reaches 93.21% Villages of India, TelecomTalk , July 2022

14. MEITY Report, Ministry of Electronics & Information Technology, April 2023

Leveraging the key strengths of the nation namely economy, technology, demography and demand, India is readying itself for an epochal shift to make it a global digital powerhouse. It is focussing on development and adoption of pioneering cutting-edge technologies across 5G/6G, Satellite Communication (SatCom) and Semiconductors. KPMG estimates these three technologies to collectively contribute approximately USD 240 billion to the nation's economy in the next five years and estimates it to contribute ~1.6 per cent to the national GDP by FY2028.

Areas	Value addition in next 5 years (USD billion)	Contribution to GDP in FY2028
5G	170	1.25%
Satellite Communication	20	0.12%
Semiconductor manufacturing	50	0.24%
	240	1.60%

Source: KPMG Analysis

India has a great opportunity to chart a new course for the ICT industry and usher in a wave of technological advancement and manufacturing excellence. India can lead the way for other developing nations by aligning business goals with government policies. India's journey, as it strives for leadership in technology development and manufacturing, is being closely observed and has global significance. To ensure that the country delivers on the world's expectation to be the 'bright spot' in the world economy, and garners lions share in world's ICT manufacturing supply chain, below are some directional recommendations:

Progressive policies and regulations that enable growth

Balancing spectrum auction objectives with policies that enable faster deployment of technologies

Ensuring financial stability of the sector

Making the sector **lucrative for private players** both domestic and global

Development of **strong digital infrastructure** and enhancing high capacity **backhaul spectrum**

Expedite creation of electronics and telecom manufacturing clusters that deliver world class, **sustainable infrastructure** with large quantity of **pure water, uninterrupted electricity, communication, pollutant free environment** and a **secure social environment**

India needs to transition from an assembly-only approach in electronics **to a holistic, integrated, end-to-end manufacturing-led approach**

Through backward integration, Indian companies need to develop niches that will help the country move beyond assembly operations. Until such capabilities are built, the government should focus on **getting lowest-cost component manufacturers to set up operations in India**

Invest in skill development for the workforce, with **special focus on 5G/ 6G, semiconductors and satellite communication**.

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Chapter 1

India's Digital Leap

Recent achievements of India's ICT Sector

India has made tremendous strides in developing its ICT capabilities and infrastructure. Today, India is rapidly emerging as a global innovation hub, driven by strengths across 5G networks, the fintech revolution, smart city implementations, enterprise digital transformation, robust cybersecurity and data governance policies, and a vibrant startup ecosystem supported by government policies.[1]

2nd	**USD 8.88 billion**	**3rd**	**700+**
Largest telecommunication market of world is India[1.1]	FDI inflow in the Indian telecom sector in the last 5 years (2019-2023)[1.2]	Largest startup ecosystem of the world is India[1.3]	Districts covered by 5G[1.4]

Digital infrastructure

3,726,577 kilometers of optical fiber cable deployed as of June 23[1.9]

750,000 Towers with 36% fiberisations[1.10]

1st country to develop 3 foundational DPI[1.11]

138 data centers World's 13th largest market[1.12]

2.5 million BTS have been deployed[1.13]

India expected to have

USD 1 trillion

Digital Economy by 2025[1.1]

500 million New smartphones added over the last decade[1.5]

881.25 million Internet subscribers[1.6]

3000+ deep-tech start-ups[1.7]

1.1 billion Telecom subscribers[1.8]

19.5 GB Average wireless usage per subscriber per month[1.8]

5G and Beyond

10 million 5G subscriptions achieved within 3 months of launch[1.14]

6th position globally With average 5G download speed of 301.6 Mbps[1.15]

1 site/min One of the fastest rollout of 5G in the world[1.16]

100 5G labs And 5G test beds[1.17]

200+ 6G related patents[1.18]

India has #1 adoption rate in the world for Digital Payments[1.19]	India has world's second largest internet users	2nd largest mobile manufacturer in the world
2nd largest market by app downloads globally	India ranks 40th in world competitive index	India is one of top 10 countries in terms of FDI receipt in 2022[1.20]
INR 3,068.5 billion: Telecom equipment, IT Hardware and mobile phone manufacturing	4 million people employed by telecom sector	

1. For sources of these facts and figures, refer to the Appendix section

Growth in Telecom sector

The telecommunications sector is currently valued at INR 3,000 billion and is anticipated to grow at a CAGR of nearly 7 - 9 per cent by FY 24[2].

There will be nearly 45 per cent rise in hiring in the telecom and allied industries during the next few years. The rollout of 5G/6G will increase job prospects in the telecom industry. Currently, the telecommunications industry employs approximately four million people, of which 2.2 million people work directly and 1.8 million indirectly in the sector. By FY 2026, employment is expected to cross the six million mark owing to the continued use of cutting-edge technologies like IoT, 5G/6G, and virtual network operations[3,4].

India's focus has shifted from being an import intensive economy to self-reliance in manufacturing specifically for telecom equipment. This aim is supported by the government's Production Linked Incentive (PLI) scheme worth INR 121.95 billion (for years FY 2021-22 and 2025-27) which will promote the industry and encourage the production of networking and telecom equipment. The key focus areas of manufacturing in telecom industry are – core transmission equipment, next generation RAN and wireless equipment, and enterprise switches and routers.[5]

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2. Telecom services industry revenue to see 7-9% growth in FY24, The Hindu, August 2023

3. Telecos to see 45 per cent rise in hiring, add 6mn jobs by FY 26, Live Mint, January 2023

4. Telecom Industry In India Crosses A Milestone, Invest India, September 2022

5. Production Linked Incentive Scheme (pli) For Promoting Telecom & Networking Products Manufacturing In India, MyScheme, February 2021

Transforming India

Bridging the Digital Divide through Nationwide Connectivity and Security

One of the enabling factors that has led India to achieve the above digital triumph is the enabling and responsive policies and regulations institutionalised by the government. To propel the ICT industry into a state that is future-ready, the Indian government has launched a number of key initiatives. These programs aim to accomplish a variety of things, such as closing the digital divide, fostering local manufacturing and innovation, getting ready for 5G Advance/6G technology, supporting start-ups, streamlining laws, improving skill development, and boosting cybersecurity. Together, these initiatives seek to establish India as an ICT leader globally by promoting investment, innovation, and digital transformation in the industry. Some of the recent interventions brought in by the government include:

Telecom bill 2022

The draft bill is a progressive bill that seeks to replace archaic laws like the Indian Telegraph Act, 1885, the Indian Wireless Telegraphy Act, 1933, and the Telegraph Wires (Unlawful Possession) Act, 1950. The draft bill offers better clarity and explanation to terminologies and provisions that address the technological advancements and clarify past ambiguous and litigious matters. With the evolution of technology and advent of 5G services in India, the new bill has the potential to augment the initiatives of the government for ease of doing business. As this bill gets legalised, it is recommended that the supporting rules support the four objectives of the bill:

- Efficient utilisation of spectrum
- Bringing in efficiency on policy making
- Supporting innovation and
- Bringing in security for end users

While the bill provides for assignment of the spectrum primarily through auction, it does provide for administrative process of allocation of certain prescribed usages and also leaves the option for 'allocation in any other manner as prescribed'.

To ensure regulation augments growth and does not stifle innovation, it will be important for the government and industry to work together to identify innovative methods for spectrum allocation through this provision. Some international examples of allowing spectrum usage without auctioning include Germany where certain bands of frequencies are assigned as 'general assignments' for use by the general public or by group of persons. The decision to assign administratively or by way of an auction is taken on a case-to-case basis and is linked to the policy goals of the government. For 5G, Germany has decided to open 5G spectrum to telecom providers on a rolling basis, prioritising quick roll-out of services over short-term revenue maximisation.

Further, as the contours of the licensing regime will be finalised through separate rules, it is important that the licensing conditions that will be mandated through subordinate legislation should follow extensive consultations to ensure that the stakeholders can provide holistic comments on the framework.

Bridging the digital divide

One of the key pillars of achieving digital India's vision is to build a digitally connected nation. On this front the government has undertaken a slew of initiatives that have led to the uptake in rural connectivity.

A significant increase in rural internet users and mobile devices in rural India can be attributed to the efforts of the government and the private sector, which include:

- **Government initiatives:** The Indian government has initiated a variety of programmes to encourage the use of mobile devices in rural regions, including the BharatNet project and Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA).

- **Affordable mobile devices:** Mobile phone prices have dramatically decreased in recent

years, making them more accessible

- **Fierce competition between Mobile Network Operators (MNOs)**: Extreme competition between telecom operators has resulted in cheaper mobile tariffs and improved rural network coverage.

- **Low data cost:** India's mobile data cost per GB is amongst the lowest in the world.[6]

The effectiveness of these factors is exemplified by a remarkable 400 per cent surge in rural data consumption over the past few years.[7] The government's sustained policy and infrastructural emphasis on universal internet access and digital literacy are, therefore, expected to reduce the digital divide in the coming years.

As of March 2023, the number of **active internet users[8] in rural India** were

358 million

India expected to have

900 million

active Internet users by **2025[9]**

Average data consumption and cost per GB

- Average Data Consumption per Month Per User (GB)
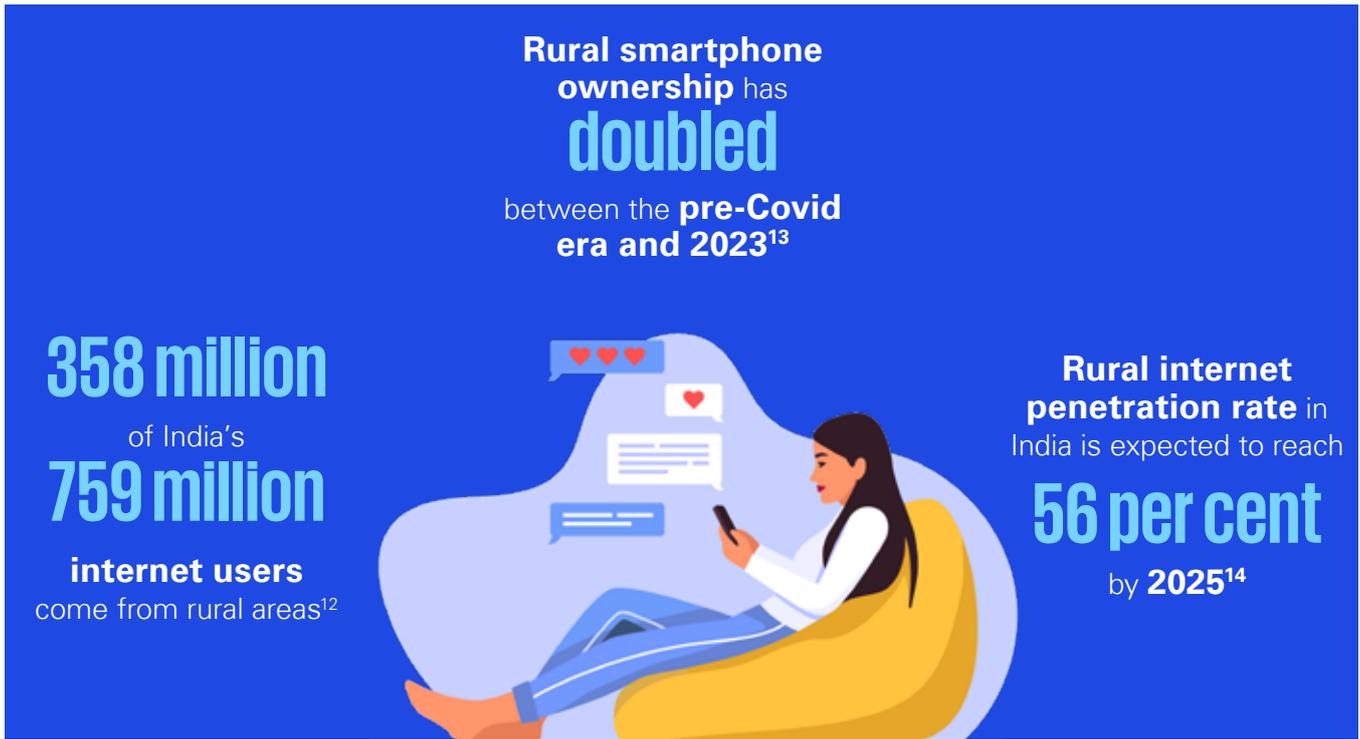- Cost Per GB (Rs)
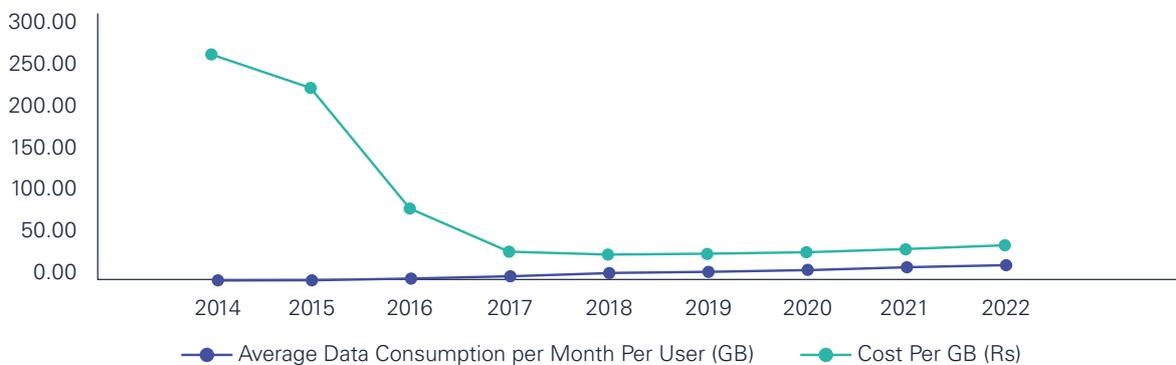
Source: Statista 2023, Ericsson Mobile Data Traffic Outlook, Zee Business[6]

6. Mobile data in India is the third cheapest in the world, Firstpost, May 2023
7. 400per cent surge in rural data consumption over the past few years, The Economic Times, August 2021
8. Press Information Release, Telecom Regulatory Authority of India, March 2023
9. Internet penetration in India has increased from 15.09 per cent in 2015 to 57.69 per cent in 2023, India Brand Equity Foundation, May 2023
10. India's journey from 1GB to 62GB per month data: A look at telecom sector's growth so far, Zee Business, June 2022

Indian internet users consumed an average of 19.5 GB of data each month with 4G contributing to 99 per cent of total data traffic[11]. An Increase in OTT content viewership, a sharp decline in data cost over the years, and a rise in remote work opportunities and online education have led to the rise in data traffic. Indians are likely to consume 62 GB of data per month by 2028.

Notably, the rural digital divide is being closed by rising mobile penetration. Mobile phones offer rural India accessible and affordable means of connecting to the internet, as evidenced by the following statistics:

Rural smartphone ownership has

doubled

between the **pre-Covid era and 2023**[13]

358 million

of India's

759 million

internet users come from rural areas[12]

Rural internet penetration rate in India is expected to reach

56 per cent

by **2025**[14]

Some of the recent initiatives for bridging the digital divide include:

National Broadband Mission

The Government of India initiated the National Broadband Mission to expedite the development of digital communications infrastructure, bridge the digital gap for inclusion and empowerment, and provide affordable broadband access for all. The mission's current phase aims to establish a state-of-the-art resilient network that includes fiber connectivity, designed with a ring topology for enhanced redundancy in all districts and blocks.

The use of a combination of implementation models like state-led model, private sector model and Central Public Sector Undertaking Unit (CPSU) Model, along with last mile connectivity in Gram Panchayats (GP) has resulted in significant outreach of BharatNet project.

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11. Average data consumption per user per month in India from 2015 to 2022, Statista, May 2023

12. Internet in India, Kantar, April 2023

13. Number of smartphones doubled in rural India from pre-covid era, New Indian Express, January 2023

14. Internet in India, Kantar, April 2023

Progress of BharatNet project as of 02 October 2023[15]

- 202,646 gram panchayats connected through BharatNet project

- 661,984 km of OFC has been laid

- 663,827 FTTH connections have been commissioned

- 104,675 Wi-fi hotspots have been installed to ensure widespread connectivity.

Pradhan Mantri Gramin Digital Saksharta Abhiyan

The PMGDISHA program aims to train 600 million rural Indians in digital literacy. As of March 2023, PMGDISHA has covered nearly 60 million people, who include women, youth, and other neglected communities.[16]

15. BharatNet project, Universal Service Obligation Fund, October 2023
16. Overview of PMGDISHA, PMGDISHA Website, September 2023

Inching towards 4G Saturation

India had 812 million 4G subscribers as of March 2023. 4G subscriptions have been fast increasing, with over 102 million new users joining in the last year alone. However, 4G penetration in rural areas remains low in comparison to urban regions, and internet speeds and consistency remain issues.[17]

India still has around 250 million 2G subscribers as of July 2023. While this figure is constantly falling, the digital divide between rural and urban areas remains[18]. India's state-owned telecom company has unveiled ambitious plans to bring its 4G services to the entire country by the end of 2025, to help achieve the Indian Government's target of '4G saturation'.[19]

The telecom giant is considering building more than 100,000 4G towers over the next 18 months to transition its networks to 4G technology. It is also identifying priority locations with an expenditure outlay of over INR 120 billion. India's state owned telecom company's approach seeks to establish Indian entrepreneurs and businesses as partners in the project build-out to completely cover the nation with 4G services.

17. Building an Inclusive Digital Society for Rural India, Broadband India Forum, November 2021
18. Democratising the Internet, Tele.net, August 2023
19. Cabinet approves a project for saturation of 4G mobile services, Press Information Bureau, July 2022

Reforms aiming to enhance ease of doing business

- The Gati Shakti Sanchar Portal launched by the Government in May 2022 has paved the way for efficient deployment of network infrastructure by bringing in a mechanism between state and central governments to facilitate Right of Way (RoW) applications and permissions[20]

- The process for obtaining an import license has also moved online and self-declaration-based clearance has replaced the erstwhile scrutiny-based clearance, facilitating quicker equipment deployment across the country

- Simplification of RoW application procedures for telecom licensees will help them to use street infrastructure to deploy small cells at a nominal cost

- The Ministry of Defence (MoD) introduced new progressive RoW rules for rolling out mobile towers, optical fiber and other telecom infrastructure in Military Stations/ Cantonments

- The Wireless Licensing Reforms of 2022 have also helped simplify and enable faster infrastructure deployment in the country. Reduction in processing fee and expedited process for obtaining Standing Advisory Committee on Radio Frequency Allocations (SACFA) certificate clearance have also added to the ease of doing business.

Interventions aiding 5G deployment

The Union Budget 2023 (the 'Amrit Kaal' budget) has provided a clear view of the government's vision of transforming India into a highly digitised, technology-driven, knowledge-based economy. Keeping up the tech momentum created by the 5G auctions, India will now set up 100 5G labs within various engineering institutes to facilitate the development of 5G applications and services to bolster smart transport, precision farming, and smart learning, among other opportunities. Three Centres of Excellence (CoEs) for Artificial Intelligence (AI), focused on developing cutting-edge AI solutions, will also be provisioned at leading academic institutions in line with the 'Make AI in India and Make AI Work for India' initiatives.[21] These telecom interventions are further supported by the anticipated growth in local manufacturing of telecom equipment, projected to reach a value of INR 33.45 billion by 2026.[22]

Making Data protection a priority - Introduction of DPDPA

With India's increasing digitisation and data creation, the government is intensifying its commitment to cybersecurity and placing a significant emphasis on data protection and privacy.

India's DPDPA has established standards for the processing of personal data by public and private institutions, in order to secure individuals' data and support the expansion of the digital economy.

The DPDPA represents an all-encompassing legal framework that aims to establish meticulous protocols for the lawful handling of personal data and thereby empowers and protects the rights of Indian citizens. Passed by Parliament on 4 August 2023, the Act received a presidential assent on August 11, 2023[23]. The DPDPA rules, along with their accompanying implementation specifications, are poised for imminent release within the forthcoming months.

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20. Department of Telecommunication Launches "GatiShakti Sanchar" Portal for Centralised Right of Way (RoW) approvals, Ministry of Communications, May 2022
21. India will set up 100 5G labs to develop new apps, services, Times of India, February 2023

22. India a new destination for telecom equipment manufacturing; what more can be done, The Economic Times, May 2022
23. Decoding the Digital Personal Data Protection Act 2023, KPMG in India, August 2023

Given India's demographic size and its speed of digitisation, DPDPA is a positive step forward for balancing governance with innovation. The Act has the potential to fuel India's digital innovation journey by providing a comprehensive framework to regulate the security and governance of personal data and thereby the privacy of Indian citizens.

Lawmakers have kept the Act simple, easily comprehensible, and compliance friendly. The DPDPA's pragmatic approach makes it easy to implement at scale, avoiding undue compliance burdens on organisations that process data at scale, thus preserving India's affordability advantage.

Key takeaways

- Boosts growth and innovation: Implementation of the DPDPA could boost consumer trust, cross-border trade, and lawful processing, and therefore may enhance India's economy and digital innovation

- The DPDPA empowers individuals to have extensive control over their personal data. It specifically provides individuals the right to access, correct, delete, and transfer their personal information. They also have the right to object to the processing of their personal data at any time and to withdraw permission

- Enhanced data security and privacy: The DPDPA requires data controllers to establish suitable security measures to prevent unauthorised access, disclosure, alteration, or destruction of personal data. In addition, for some forms of data processing, the Act compels data fiduciaries to undertake data privacy impact assessments

- Greater accountability and transparency: The DPDPA compels data controllers to be transparent about how they collect, use, and disclose personal data. The Act also creates a Data Protection Authority (DPA) to oversee the law's implementation and examine complaints of data privacy violations

- The DPDPA places stringent requirements on data controllers to safeguard personal data. For specific forms of data processing, data controllers must adopt suitable security measures and complete data privacy impact assessments

- The DPDPA proposes a phased implementation approach, giving organisations a strategic window of time to prepare for full compliance with all parts of the Act, reducing the resources required for compliance.

Challenges

- Compliance issues: The DPDPA sets a number of standards on data controllers, which may be difficult to meet for some organisations, particularly small and medium-sized businesses. It is critical to provide organisations with direction and support to enable their compliance

- Balancing privacy and other interests: The DPDPA must balance between privacy protection and data driven innovations. The legislation must not impose undue restrictions on the handling of personal data for legitimate purposes

- The DPDPA is silent on the categorisation of personal data and sensitive personal data. This can be concerning since sensitive personal data attributes such as biometric details are used for authentication and may require an enhanced layer of protection.

Chapter 2

Unleashing possibilities
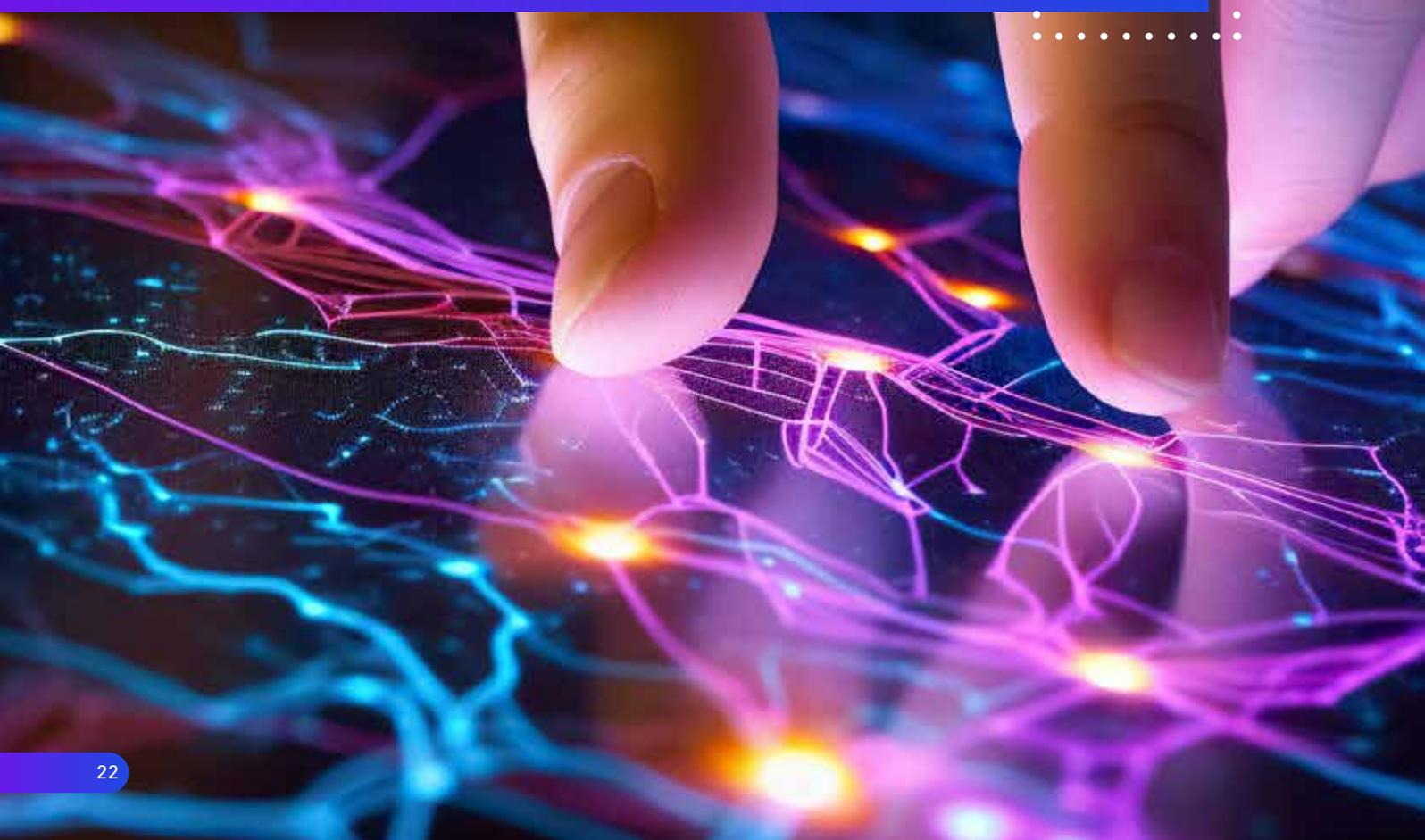
With the maturation of 4G technology and the rapid growth of 5G networks, we are witnessing the evolution of India's connectivity. Its aspiration to take the lead in 6G technology is setting a bold course for global innovation.

Additionally, India is set to become a potent market from increased use of satellite communications through government initiatives aimed at privatization. Massive demand generation is also taking place with the rise in Work from Home (WFH), Over-the-top (OTT) media services, mobile banking, online education, etc.

As India seeks to navigate this complex terrain, we outline the steps required to overcome obstacles in the subsequent sections and focus on how India can unlock the full potential of satellite connectivity.

India is moreover charting a path towards becoming a global manufacturing hub, and government's conducive financial incentives have attracted foreign players to set up establishments in India, sparking a transformation in the country's semiconductor industry.

These narratives together weave a compelling story of India's relentless pursuit of technological advancement, and innovation, and its quest to shape the future of telecommunications on a global stage. KPMG in India estimates 5G, Satellite Communication and Semiconductor manufacturing are expected to collectively contribute approximately USD 240 billion in the next five years to the nation's economy which is estimated to contribute ~1.6 per cent to the national GDP in FY2028:

Areas	Value addition in next 5 years (USD billion)	Contribution to GDP in FY2028
5G	170	1.25%
Satellite Communication	20	0.12%
Semiconductor manufacturing	50	0.24%
	240	**1.60%**

India followed the world in 4G, marched with the world in 5G and now has set a vision to lead the world in 6G
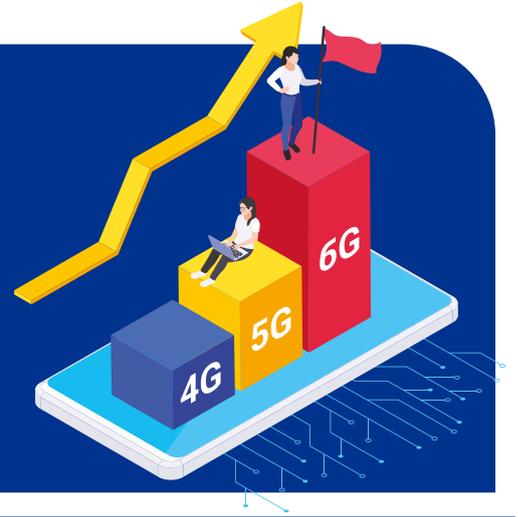
India has solid digital infrastructure in place and has exhibited rapid digital transformation in recent years, to boast a digitally active population. Around 75 per cent of India's mobile connections are already on 4G networks and 5G subscriptions are increasing consistently[1]. The country's commitment to adopting new technology is demonstrated by the recent unveiling of the Bharat 6G vision document, a starting point for policymakers and industry to design, develop and deploy 6G network technologies.

Current adoption of 5G by consumers

Within six months of its launch, India achieved 20 million 5G connections and is steadily progressing towards 40 million connections by the end of 2023[1]. Operators in India have successfully launched their 5G Fixed Wireless Access (FWA) service through AirFiber. The most recent data from Ookla indicates that average 5G speeds have shown consistent improvement over time and are promising across all circles[1]. Given the wide range of consumer and enterprise use cases, it is estimated that 5G subscriptions in India will reach around 57 per cent of mobile subscriptions in the country by the end of 2028.

Current adoption of 5G by enterprises

5G adoption in India will be far more diverse than that of 4G. According to an Omdia report[2], over half (52 per cent) of the 300 Indian enterprises that were interviewed expressed a desire to start using 5G this year, while another 31 per cent expect to adopt 5G in 2024.

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1. Laying the foundations for success in 5G in India, Mobile World Live, April 2023
2. Indian enterprises plan to start using 5G services in 2022/23, Omdia, April 2022

India's journey in the evolution of 5G technology has been remarkable. To ensure adequate monetisation of 5G investments, it is worth considering some of the lessons learnt globally:

1. Collaborations and partnerships

Many of the 5G enterprise use cases revolve around the ability of Communication Service Providers (CSPs) to collaborate and co-innovate with the partner ecosystem. An effective partner ecosystem can help CSPs better support their customers' growing needs with more comprehensive solutions, utilising 5G and other advanced technologies.

2. Infrastructure development

There is a need to formulate regulations and administrative processes in the context of Digital Connectivity Infrastructure Development (DCIP). In addition, the plan to set up a digital communication readiness index for mapping and tracking the states performance on digital initiatives under the Department of Telecommunications (DoT) could be instrumental in expediting 5G implementation. The role of infrastructure providers must evolve in accordance with the future needs of 5G. This includes aspects such as lit fiber capacity and optical transport bandwidth, number of towers, 5G repeaters, edge sites, small cells, and Distributed Antenna Systems (DAS) for inbuilding and outdoor solutions.

3. Availability of high capacity backhaul spectrum

The current allocation of backhaul spectrum may not be sufficient to support all 5G use cases and increased data traffic. The government should plan for additional backhaul spectrum allocation which is enabled by clear policy guidelines.

4. Regulatory reforms

The draft Indian Telecommunication bill, crafted after extensive deliberations with experts and incorporating global best practices, needs to be brought to fruition. This bill has the potential to bolster the government's initiative for improving the ease of doing business in the country.

5. Other Government Initiatives

Decreasing taxation and government levies could help to financially strengthen the sector. A clear policy framework could enable Original Equipment Manufacturers (OEMs) to invest in the future roadmaps for 5G products while maintaining a focused approach on 3GPP (global standard) or 5Gi (Indian-specific) standards across each band, and geographical circle. Further, the government should consider providing incentives to invest in 5G use cases that will help in increasing the enterprise adoption of 5G.

6. Skill development

The deployment of 5G technology requires a highly skilled workforce capable of managing and maintaining the complex network infrastructure.

The 6G revolution – Accelerating the era of digital convergence in India

As India embarks upon its own unique 5G journey, the global telecom sector has already initiated strides towards creating 6G technology as the next big thing on the communication horizon. Despite being a concept, 6G promises seamless human-machine and machine-machine connectivity with speeds 100 times faster than 5G[3], offering a glimpse into the next decade. India is actively participating in 6G deployment, leveraging its tech-savvy population and the need for high-speed and low-latency connectivity across industries. Hon'ble Prime Minister Shri Narendra Modi's Bharat 6G vision, emphasising on affordability, sustainability, and ubiquity, aligns with the Atmanirbhar Bharat vision, aiming to empower every Indian towards self-reliance. India's potential in driving the 6G revolution positions it as a global leader in advanced and affordable telecom solutions. Here are certain ways in which India can contribute to the development and deployment of 6G technology:

- **Research and development:** India can invest in research and development activities to contribute to the advancement of 6G technology. It can strengthen the global knowledge base and help shape the future of this technology. Demonstrating its prowess, India has already secured over 200 patents through industrial and academia collaboration. The recently signed pact with the U.S. to drive high end research will further help India to establish a robust 6G IP framework[4]

- **Standardisation:** India can play a role in establishing global standards for 6G technology. Currently, different countries are conducting research and development on 6G, and it is important to have standardised protocols and specifications to ensure interoperability and seamless connectivity across different networks and devices. The recent recognition of India's 6G vision by International Telecommunication Union (ITU)[5] is a testimonial of the world's confidence in India contributing to global technology development

- **Collaboration and partnerships:** India can collaborate with other countries and industry partners to share knowledge, resources, and expertise in the development and deployment of 6G technology

- **Infrastructure development:** 6G will require 100 per cent fiberisation of towers, however, given that the current state of fiberisation of towers stands at 38 per cent,[6] the country will have to develop an expedited plan to meet the above targets. Despite progressive amendments to the Right of Way (RoW) Rules by the Government, on ground implementation remains to be slow. The use of street furniture is critical to augment the current infrastructure deployment

- **Skill development:** India can focus on skill development initiatives to build a talent pool of experts in 6G technology. This can involve training programmes, workshops, and educational initiatives to equip professionals with the necessary skills and knowledge to work on 6G-related projects. Tie ups between academia, industry experts and policy makers to create centre of excellences in tier II and III cities will help tap talent in these cities and help build expertise across the country

- **Manufacturing and export:** India can leverage its manufacturing capabilities to produce and export 6G equipment to other countries. The "Make in India" initiative, which aims to promote domestic manufacturing, can be extended to the telecom sector to encourage the production of 6G equipment in the country. This will ensure a mature device ecosystem to be ready before the 6G launch date and will also allow India to have a synchronous launch as the global launch of 6G.

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3. Bharat 6G Vision Statement, Department of Telecommunications, March 2023

4. How India is preparing for 6G revolution which will transform connectivity as we know it, The Economic Times, October 2023

5. India plays key role in shaping ITU 6G Vision Framework, Press Information Bureau, June 2023

6. Fibre rollout pace jumps 6-fold since 5G launch; still trails target, global mkt, The Economic Times, September 2023

Initiatives undertaken by the government to stimulate the 6G ecosystem

- The Department of Telecom has set up six academia driven task forces under the Technology Innovation Group on 6G technology

- Investment of INR 2,240 million in a new 6G Test Bed co-developed by a consortium of IITs. It provides a Research and Development (R&D) platform[7] to start-ups, researchers, industry, and other broadband wireless applications

- Launch of Bharat 6G alliance to enable India to:

    – Become a leading global supplier of IP, products, and solutions of affordable 5G and 6G and other future telecom solutions

    – Support and energise Indian participation in standard development organisations

    – Build coalitions with similar 6G global alliances and other global technology alliances and associations

    – Promote the ecosystem for research, design, prototyping, development, proof of concept testing, IPR creation, field testing, security, certification and manufacturing of telecom products, end-to-end solutions, use-cases, pilots, among other objectives.

- India has recently signed a pact with the U.S. to promote 6G technology. As a part of this pact, Bharat 6G Alliance and Next G alliance will come together to forge research and development in 6G, to work towards creating secure and trusted technology and to build a resilient supply chain.

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7. Bharat 6G Vision: India's Push for the Next Generation of Telecom Technology, Invest India, April 2023

SatCom

India on the launchpad

In India, the satellite communication landscape facilitates 5 billion ATM transactions annually through 125,000 Very Small Aperture Terminal (VSAT)-enabled ATMs. Additionally, it plays a crucial role in networking the USD 2 trillion equity markets and provides support for cellular backhaul, enterprise networking, rural connectivity, as well as in-flight, rail, and maritime communications. Furthermore, 50,000 gas stations are automated via SatCom which offer a reliable link to access information on a real time basis, while 65,000 trains are fitted with GAGAN devices, which has improved efficiency in train operations to a significant extent.[8]

There is a massive scope in India for space-based solutions that need to be harnessed owing to the tremendous demand generation taking place with the rise in WFH, OTT, mobile banking, online education, and so on.

The recent surge in space sector reforms, with as many as seven policy documents coming forward in last two to three years and a few more in the pipeline, all point towards India's foundational space strategy and the country's firm vision to promote space as the nation's newest horizon. The country is set to become a potent market for increased use of satellite applications, with the capacity to attract billions of dollars as Foreign Direct Investment (FDI), as per the Finance Minister of India's statement last year in Parliament. This is expected to further stimulate local manufacturing, create millions of jobs, make a substantial contribution to the GDP, and secure a significant share in the global space ecosystem.

Indian satellite communication market is valued at

USD 2.23 billion

in **2023**[9]

The market is expected to grow to

USD 25 billion

by **2028**[10]

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8. A Balanced Approach for Spectrum Allocation, Satcom Industry Association, March 2022

9. Indian satellite communication market is valued at USD 2.23 billion in 2023, Indian Infrastructure, September 2023
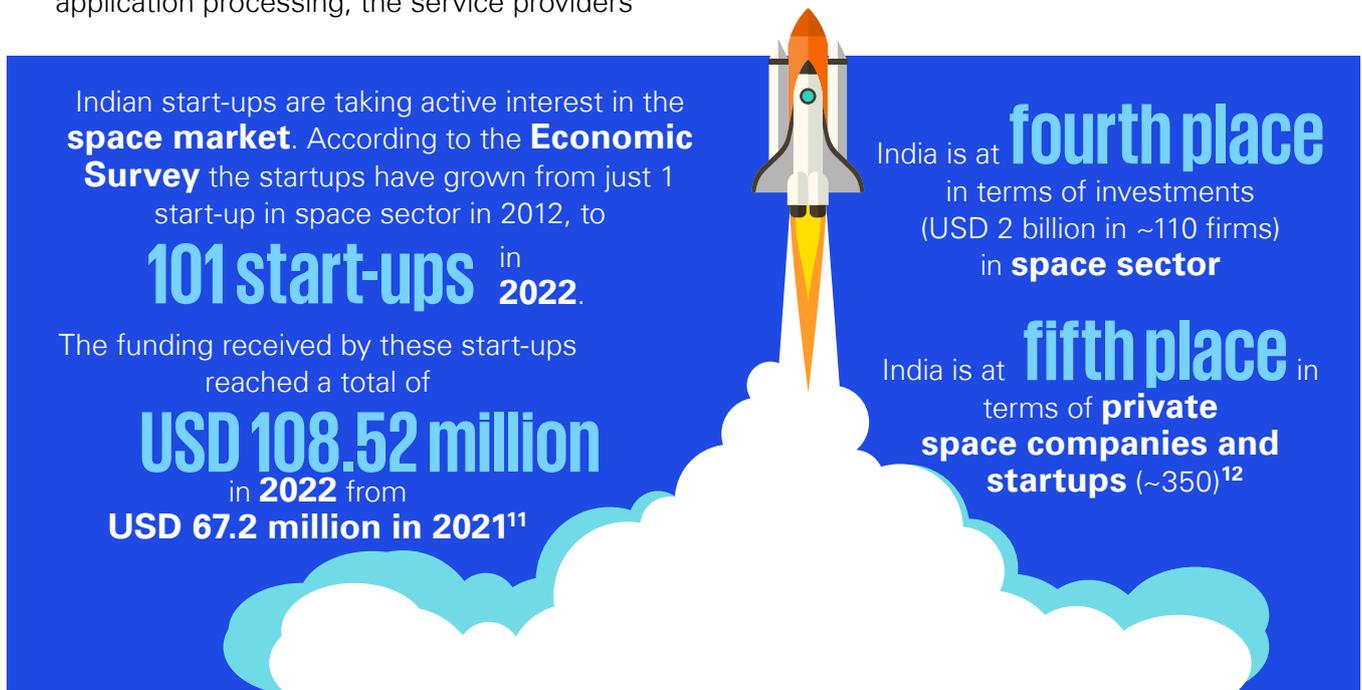
10. India Satellite Communication Market Size & Share Analysis - Growth Trends & Forecasts (2023 - 2028), Mordor Intelligence, September 2023

As the Indian government eases regulations in the space sector to include private players not only as vendors but also as partners in the space economy, a multitude of private entities, bolstered by new-age investors with an appetite for projects with extended gestation periods, are venturing into various domains in the sector. These range from establishing launch facilities and developing satellite thrusters to creating mmWave and optical communication links, engaging in satellite manufacturing, and delving into Earth Observation (EO) applications, amongst others. The following factors are further propelling growth in the sector:

- **Satellite reforms by DoT:** With the proposed simplified procedures and time bound online application processing; the service providers will be able to roll out satellite-based communication networks in a relatively shorter time. Removing multiple charges will help in the ease of doing business and will lower the compliance burden on the service providers. This is likely to enable additional investment in the network capacity and the introduction of state-of-the-art technologies

- **Indian Space Policy 2023:** Indian start-ups are taking an active interest in the space market. According to the Economic Survey the startups have grown from just one start-up in space sector in 2012, to 101 start-ups in 2022.

Indian start-ups are taking active interest in the **space market**. According to the **Economic Survey** the startups have grown from just 1 start-up in space sector in 2012, to

101 start-ups in **2022**.

The funding received by these start-ups reached a total of

USD 108.52 million in **2022** from **USD 67.2 million in 2021**[11]

India is at **fourth place** in terms of investments (USD 2 billion in ~110 firms) in **space sector**

India is at **fifth place** in terms of **private space companies and startups** (~350)[12]

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11. Explore opportunities in Indian Space Sector, Invest India, September 2023

12. With over 350 private space companies, India in fifth place globally, The Times of India, June 2021

Considerations for expanding Satellite communication in India

Aatmanirbhar Bharat's vision calls for a significant revamp of government-led space activities to make it a reality. India needs a space law to support the thriving domestic space industry and the country's vision of expanding participation in the global space economy. It is therefore imperative to establish a favorable policy environment that encourages private sector investment. These regulations should aim to foster an environment that supports and empowers entrepreneurs and Small and Medium Enterprises (SMEs) to develop internationally scalable end-to-end products and services. Additionally, there is a need to focus on developing competency in space technologies.

Considerations for improvement

1. Investment:

Government agencies and a select few private players currently make up the majority of investors in India's SatCom industry. The government must allocate additional funding to the space sector, encourage academic R&D initiatives, and make it easier for people to access financing through grants, sovereign funds, and other sources in order to increase the participation of other companies.

The regulations governing FDI should be liberalised, as well as the ability to transfer technologies with few restrictions and with less onerous tax obligations

2. Legal and regulatory:

There is a dire need for comprehensive space legislation in India in addition to boosting capacities in space exploration and scientific research.

Moreover, beyond space-related regulations, considerations such as the ease of contract enforcement, freedom of commerce, and the translation of international trade and investment obligations into domestic laws are crucial benchmarks. These factors collectively contribute to an environment that is conducive to attracting international investments. The goal of tax policy should be to encourage, support, and promote enterprises by bringing in investment and capital expenditure flow. It should comprehend the peculiarities of the space business and be concise, consistent, and agile.

3. Infrastructure and resource:

- India requires a national strategy for space technologies and manufacturing to address the challenges of unpredictability, high costs, and excessive spending on non-mission engineering

- A PLI scheme, similar to successful policies implemented in the electronics and telecom industries, is required. This could improve output and draw investment to the space industry

- State governments can assist the sector by building technological parks or encouraging a cluster-based strategy, in which a number of auxiliary businesses develop around key players in industry hubs. To cut costs and benefit consumers, space tech parks will bring together the whole space ecosystem, including manufacturers, application developers, vendors, suppliers, and service providers.

4. Improvement in policy:

The current spectrum policy in India needs to align with the international standards identified for radio frequency spectrum use to support global harmonization of the spectrum for space activities and protect existing satellite investments from interference. The current orbital slot allocation limits India's capacity if only Indian spectrum is used. Thus, cooperation and coordination are necessary when more spacecrafts use the same orbital slots. To support the expansion of satellite services, regulators must make the necessary bandwidth and the appropriate spectrum band available. Furthermore, the choice between spectrum assignment and auction should be carefully considered while keeping in mind the long-term goal of using spectrum communication to reduce social disparities.

5. Data security:

There is a rise in the potential of cyber hazards with the modernisation of the traditional data processing system in the space industry. India must concentrate on putting strong cyber security measures in place to safeguard the upcoming Low Earth Orbit (LEO) constellations and commercial space industry participants. To do this, we must adopt global best practices and involve important parties including the government, business community, legal professionals, and academics in order to assure the adoption of a comprehensive strategy to cyber security. Setting up a strong cyber security system will require sufficient funding and resources, which will ultimately secure the durability of space assets.

6. Skilled Workforce:

The space sector also requires investment in training and skilling of local resources which will aid in manufacturing of SatCom equipment, thereby creating a large pool of talent and more jobs.

7. Protection of Intellectual Property (IP):

To encourage the expansion of the space industry in India, it is essential to include the issue of intellectual property (IP) in space in the national space legislation and to establish clear guidelines for patent and Intellectual Property Rights (IPR) registration. In order to safeguard intellectual property rights, India must implement IPR protection policies in the space industry. It is necessary to streamline and hasten the IPR registration process to create a fast-track route for patent approvals and make it both quicker and more accessible in India.

8. Support by startups:

While there is significant traction being built up in space startup ecosystem, the following recommendations need to be taken into consideration to spur further growth:

- The permissible scope and related approvals for the space sector need to be clear. Implementing a temporary experimental license and low fees for approval standards will bring about this clarity

- The nationwide implementation of policies for start-ups, including but not limited to rationalisation of the tax system for commercial start-ups by offering tax breaks, holidays to both MSMEs and start-ups

- There has to be a formalised system in place to finance and support pilot innovation projects. Creating a platform for collaboration with academia, businesses, investors, and the government can help with this. The government can allocate financing for start-ups in the space industry from the stage of ideation to monetization

- Support startups with market access, funding, subsidised access to hardware businesses, local certification facilities, skilled labor, enabling legislation, and space clusters

- Establishing clear procurement standards with flexible payment terms will ease the requirements for Indian start-ups to participate in government and Public Sector Undertaking (PSU) procurements

- Ensuring the availability of space frequencies for trials and data operations and easing the experimental frequency allocation procedures and payload testing/tech demonstration procedures

India is poised to become one of the largest markets for space production and technology. It is also emerging as an attractive outsourcing option worldwide, as well as the next space hub. The telecom and manufacturing industries stand to gain tremendously from advancements in India's satellite communication capabilities.

Connected circuits

India's semiconductor industry in the years ahead
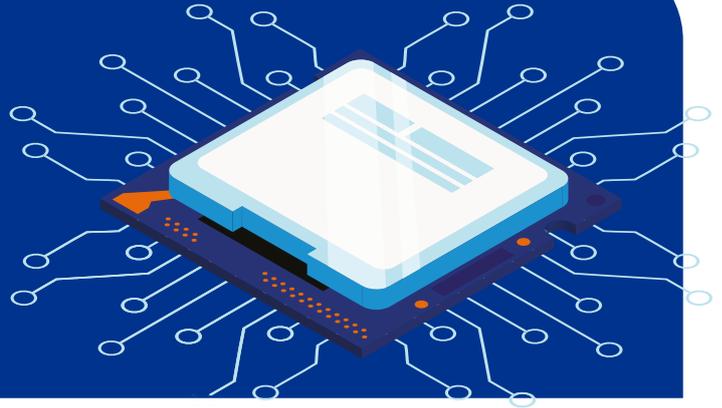
The evolving landscape of Indian semiconductor industry

India is poised to be the second largest market in the world from the perspective of scale and growing demand for semiconductor components across several industries and applications.[13] This demand is being pushed by the increasing pace of digital transformation among the country's consumers, enterprises, and public sector through the adoption of new technologies, ranging from advanced connectivity to content consumption to the cloud. These cover smartphones, PCs, wearables, cloud data centers, Industry 4.0 applications, IoT, smart mobility, and advanced telecom and public utility infrastructure. While the country is becoming one of the largest consumers of electronic and semiconductor components, most components are imported, offering limited economic opportunities for the country. Currently, only 9 per cent of this semiconductor requirement is met locally.[14]

India has become a hub for semiconductor design services. Many multinational semiconductor companies have established design centers in India to take advantage of the country's engineering talent. India designs nearly 2,000 chips every year, with more than 20,000 engineers working in various aspects of chip design and verification.[15]

India's strength in design engineering presents a unique advantage. Rather than simply pursuing manufacturing capabilities, the country should aim to create a synergy between its design prowess and manufacturing aspirations. This approach allows India to offer a comprehensive suite of services, combining design, engineering, and manufacturing. By maintaining a stronghold in design engineering, while venturing into manufacturing, India can establish a competitive edge that sets it apart in the global semiconductor landscape.

India has successfully demonstrated its capabilities to assume a much larger role in global electronics and Information and Communications Technology (ICT) manufacturing supply chains. India's electronics production, valued at USD 76 billion in 2021, is expected to grow four-fold to USD 300 billion by 2026, including a tripling of mobile phone production, and an increase in production of other ICT hardware to USD 40 billion[16]. India's semiconductor market, valued at USD 21.6 billion in 2020, is expected to grow to over USD 64 billion by 2026.

13. Consumption of Indian Semiconductor Components to Climb to USD 300-Billion Cumulative Revenue During 2021-2026, Counterpoint Research, August 2022
14. Currently, only 9 per cent of this semiconductor requirement is met locally, The Economic Times, August 2022
15. India readying for bigger role in semiconductor market, The Sunday Guardian, December 2022
16. India Semiconductor Readiness Assessment Report: Initial Findings, Information Technology & Innovation Foundation, June 2023

Indian Semi Conductor Market Size (USD Bn), 2019 - 2026


Legend:
- Aerospace & Defence
- Automotive
- Consumer Electronics
- Industrial
- Telecom
- Information Technology
- Mobiles & Wearables
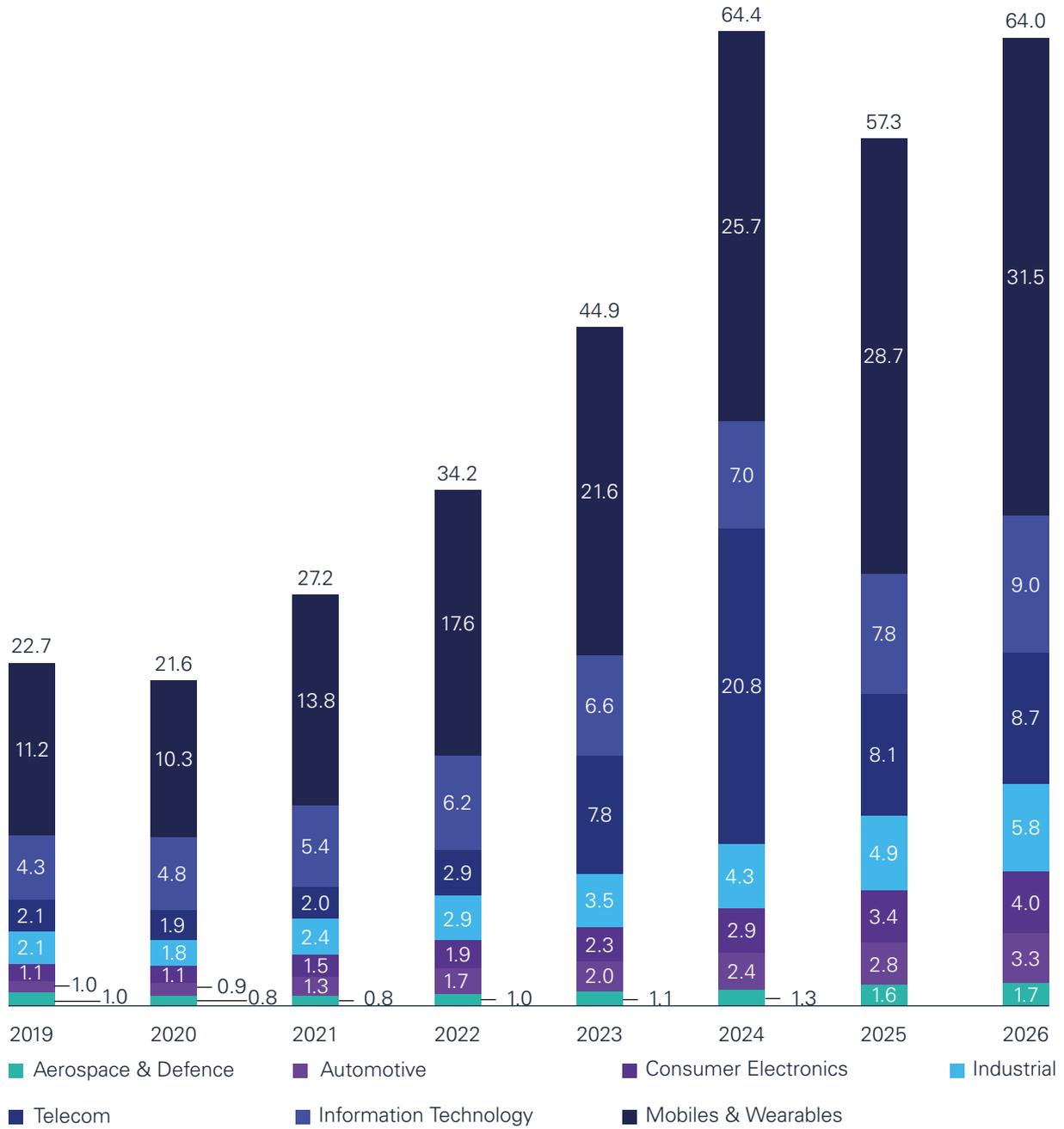
Source: Counterpoint & IESA Report

Recognising the potential, the government is working aggressively to enable India to be at the centre stage of global semiconductor supply chain. One such enabling program is the Semicon India programme with a total outlay of INR 760 billion crore for the development of semiconductor and display manufacturing ecosystem in the country[17]. The following schemes have been introduced under the programme.

Modified scheme for setting up of Semiconductor Fabs in India	Modified scheme for setting up of Compound Semiconductors/Silicon Photonics/Sensors Fab/Discrete Semiconductors Fab and Semiconductor ATMP/OSAT facilities in India	Design Linked Incentive (DLI) Scheme
Fiscal support of **50 per cent** **of the project cost** on an equal footing basis for setting up of **silicon complementary metal-oxide semiconductor (CMOS)** based semiconductor fabrication in India	Fiscal support of **50 per cent** **of the Capital Expenditure** on an equal footing basis for setting up of **production facilities** in India (Other than CMOS)	**Financial incentives, design infrastructure support** across various stages of development and deployment of semiconductor design
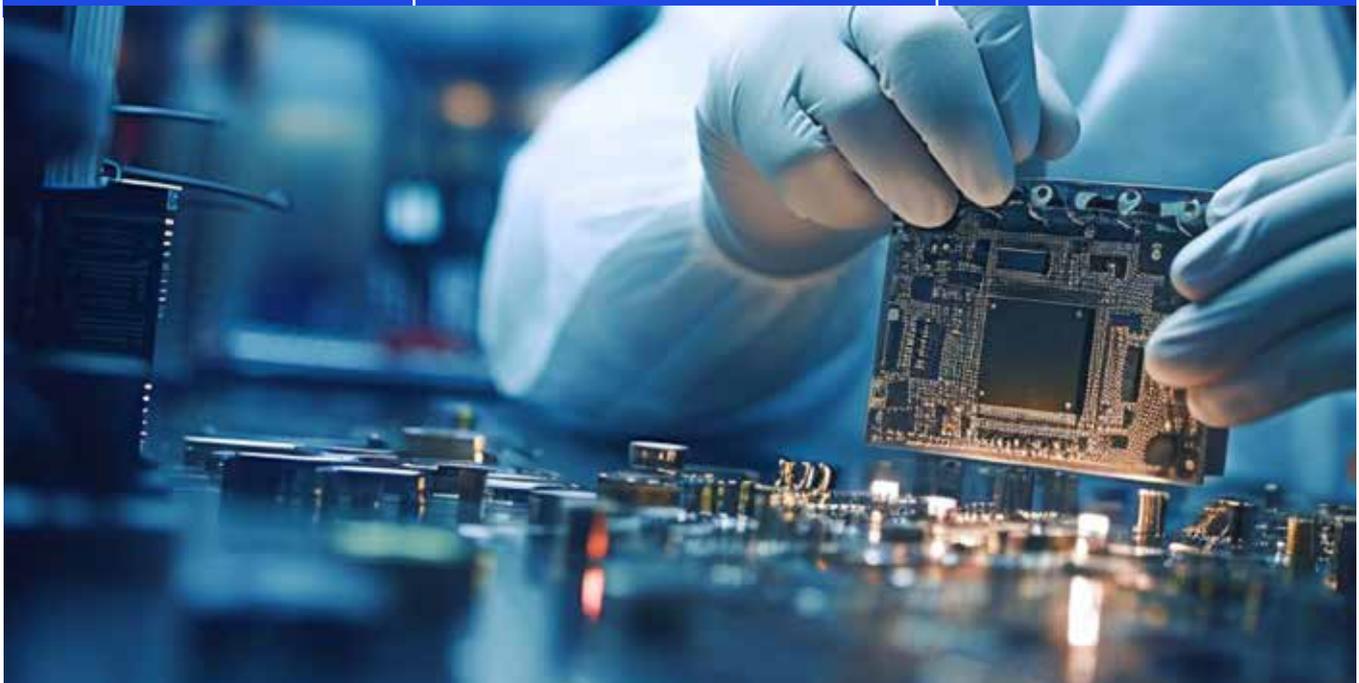
17. Government invites applications for setting up Semiconductor and Display Fabs as per Modified Semicon India Programme, Press Information Bureau, May 2023

These initiatives have led to several investments by Indian and foreign entities through partnerships and other developments such as

US chipmaking giant starts construction of USD 2.75 billion semiconductor factory in Gujarat[18]	Indian government is planning for a Graphics Processing Unit (GPU) cluster as part of the India AI programme to support the growth of startups focused on training artificial intelligence models within India[19]	Industry stakeholder predicts that the semiconductor industry in India will generate a demand for 1.2 million jobs encompassing a wide range of roles, including engineers, operators, technicians, and more[20]
The government has earmarked INR 11-12 billion (approx. USD 133.83 million-USD 146 million) to support the country's semiconductor design startups[20]	The Semiconductor Design-Linked incentive scheme has so far onboarded 27 start-ups[20]	Rajasthan-based Semiconductor company, which is part of (SPECS), has stated that it will begin the commercial production of the first made-in-India memory chips[21]
Major US semiconductor chip design company has plans to invest up to USD 400 million in India over the next five years[22]	Odisha Semiconductor Manufacturing & Fabless Policy aims to attract investors and facilitate their entry into the manufacturing of semiconductor/electronic chips in the eastern state of Odisha[23]	India and Japan have formally agreed to establish a joint mechanism aimed at facilitating collaboration between their respective governments and industries in the field of semiconductors[24]
US Semiconductor Industry Association (SIA) and the India Electronics and Semiconductor Association (IESA) have decided to form a private sector task force to strengthen bilateral collaboration in the global semiconductor ecosystem[25]	C-DAC has approved five applicants to the Design-Linked Incentive (DLI) Scheme, which is a part of the INR 760 billion-budget Programme for development of semiconductors and display manufacturing ecosystem in India[26]	India's leading IT company is on the verge of presenting a proposal to the Centre for the establishment of an assembly, testing, marking, and packaging (ATMP) unit for semiconductors at an estimated project cost between USD 200-300 million[27]

18. US chipmaking giant starts construction of USD 2.75 billion semiconductor factory in Gujarat, Forbes India, September 2023

19. India is planning GPU cluster to boost AI startups, India AI, September 2023

20. India's Semiconductor Sector: Tracking Government Support and Investment Trends, India Briefing, September 2023

21. Sahasra Semiconductor to start chip production from September '23, Indian Express, August 2023

22. India wants to be a trusted partner in chipmaking, Modi tells investors, The Straits Times, July 2023

23. Odisha Semiconductor Manufacturing and Fabless Policy, Invest Odisha, September 2023

24. A 'fab' way to conduct India-Japan tech diplomacy, The Hindu, August 2023

25. U.S. and India Semiconductor Groups Announce Initiative to Strengthen Public-Private Collaboration in Chip Ecosystem, Semiconductor Industry Association, January 2023

26. India accelerates semiconductor push: 5 applicants approved under Design Linked Incentive Scheme, CNBC, July 2023

27. HCL Group planning USD 300 million semicon foray, The Economic Times, July 2023

India's potential

Many nations have recently introduced strategies and incentive packages to attract semiconductor manufacturing activity - these include the CHIPS and Science Act in the United States, the EU Chips Act in Europe, and the K-Belt Strategy in Korea - yet India offers some of the most attractive incentives globally. In total, India is offering USD 30 billion in support for semiconductors and related industries. This includes:

- USD 10 billion for the semiconductor/display sector

- USD 7 billion for electronics manufacturing

- USD 13 billion for related sectors such as solar photovoltaic cells, electric and other automotive vehicles, and white goods[28]

This support is significant because these sectors, alongside ICTs and electronics, are expected to be key drivers of the Indian economy. They will require increased consumption to accommodate the anticipated growth in Indian semiconductor output.

Recommendations

The past few decades in India were strongly driven by the software and services industries. While the growth potential in those industries will continue to accelerate, India has the opportunity to take a strong position in semiconductor design and manufacturing. There is a need for the government, industry, academia, startups, and investors to come together to develop a skilled workforce and building the necessary infrastructure. The government should also work to reduce the dependence on imports and increase the share of domestic production in the market. Additionally, the industry needs to focus on research and development along with IP protection to improve technology and manufacturing processes and form partnerships with global companies to access their expertise and resources. Supportive and stable national taxation policies coupled with competitive state policies can also aid the long-term nurturing of the sector.

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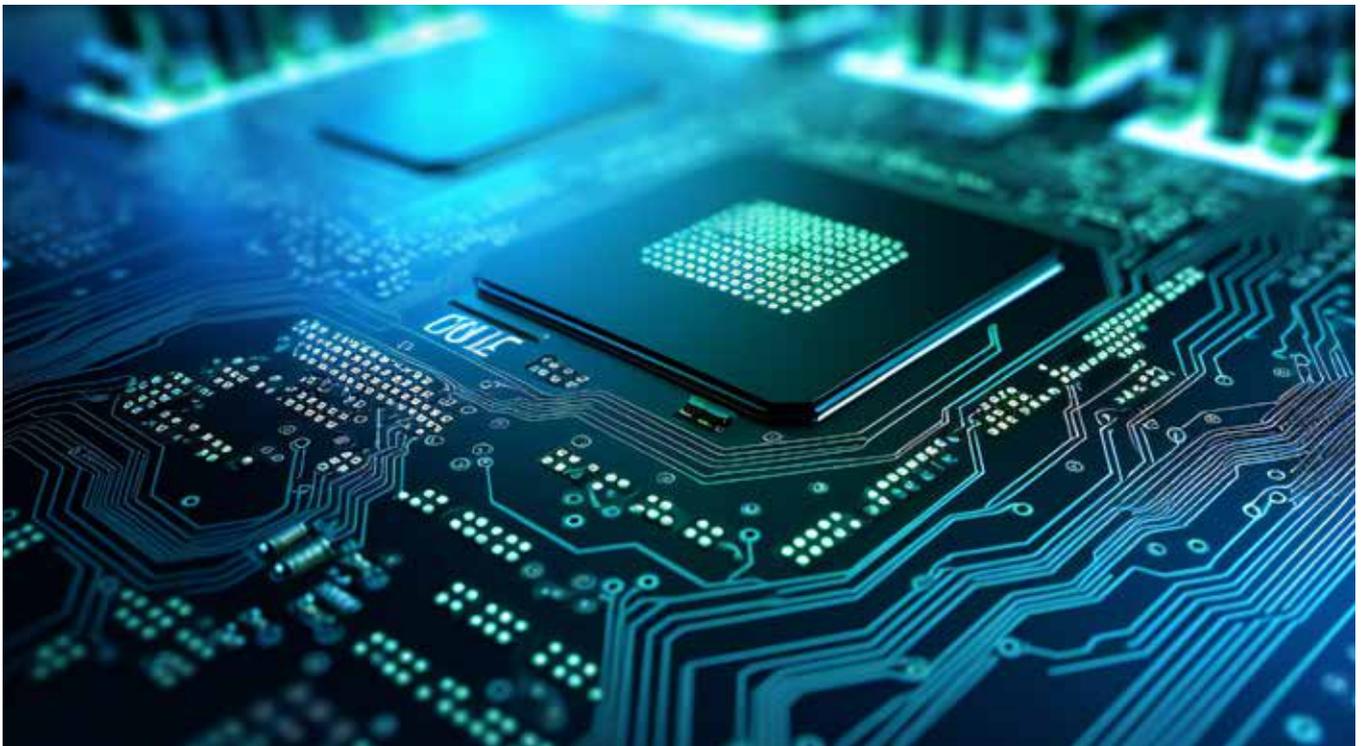
28. India Semiconductor Readiness Assessment Report: Initial Findings, Information Technology & Innovation Foundation, June 2023

Recommendations to attract global majors

Provide more incentives	Leverage India's USP
While government has provided various fiscal incentives, there is a lot more that can be done to lure investments in India, one such thing can be incentivising cost technology transfer. In addition, the government could offer tax breaks and other incentives to international investors	India's strength is the huge domestic consumption market when it comes to semiconductors, being the second-largest populous economy in the world, also India has been ranked as the nation with the cheapest manufacturing cost ahead of China and Vietnam[29], and Indian engineers account for around 20 per cent of the world's semiconductor design workforce[30]
Providing infrastructure	**Providing an ecosystem to operate**
World class, sustainable infrastructure, as required by a modern semiconductor fabrication plant be provided, with swift transportation, large quantity of pure water, uninterrupted electricity, communication, pollutant free environment etc.	It takes a network of various types of manufacturers for end-to-end manufacturing of a semiconductor. Therefore, there is a need to build an ecosystem like technology parks so that there is easy access to raw materials and logistics

Recommendations to bolster Indian investment in the sector

Selection of product mix	Securing technology and partnerships
Product mix would include Microprocessors, Memory chips, Integrated circuit (IC), Sensors, Optoelectronic devices, Micro Electromechanical Systems (MEMS), Transistors. We need to ensure that we have the right product mix for the Indian market, considering the availability of manufacturers capable of producing these products	Indian companies should focus on areas where India already has a better expertise and can offer better prices such as assembly, testing, marking, and packaging (ATMP), due to some factors in our favour such as cost of labour. While ATMP is just one step in the overall value chain, silicon chip manufacturing is the key building block.
Team and talent	**Social infrastructure**
India has an advantage in semiconductor manufacturing as a large portion of semiconductor design engineers globally are either Indian or Indian origin. There is a need to develop a skilled workforce through government initiatives or providing incentives to private players on education	Along with the infrastructure for manufacturing, there is a need to provide social security to attract a skilled workforce. Therefore, there is a need to focus on providing hospitals, schools, residential spaces nearby the manufacturing units

29. India has cheapest manufacturing cost globally, The Economic Times, November 2022   30. India's Emerging Prominence as a Semiconductor Superpower, Invest India, July 2023
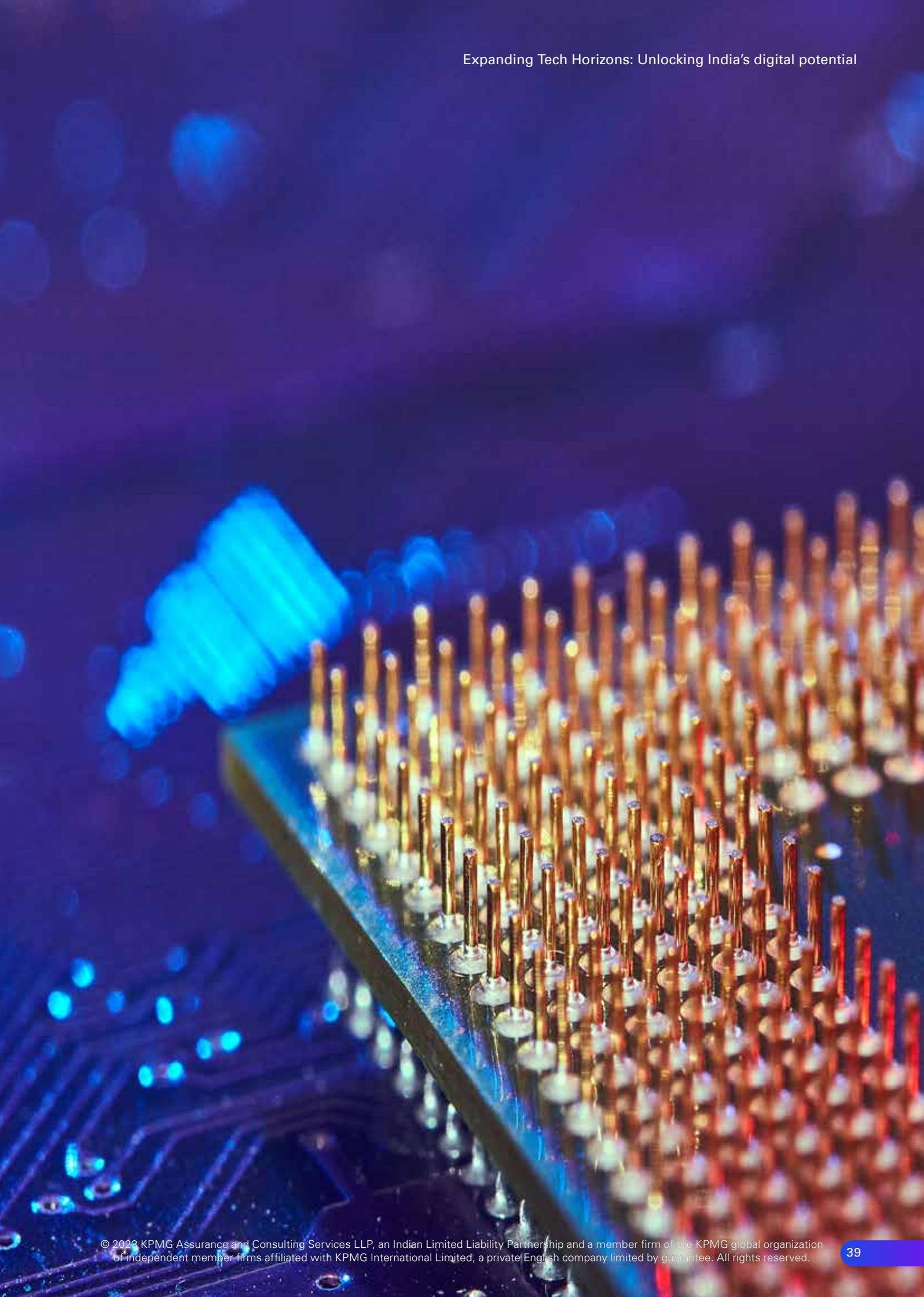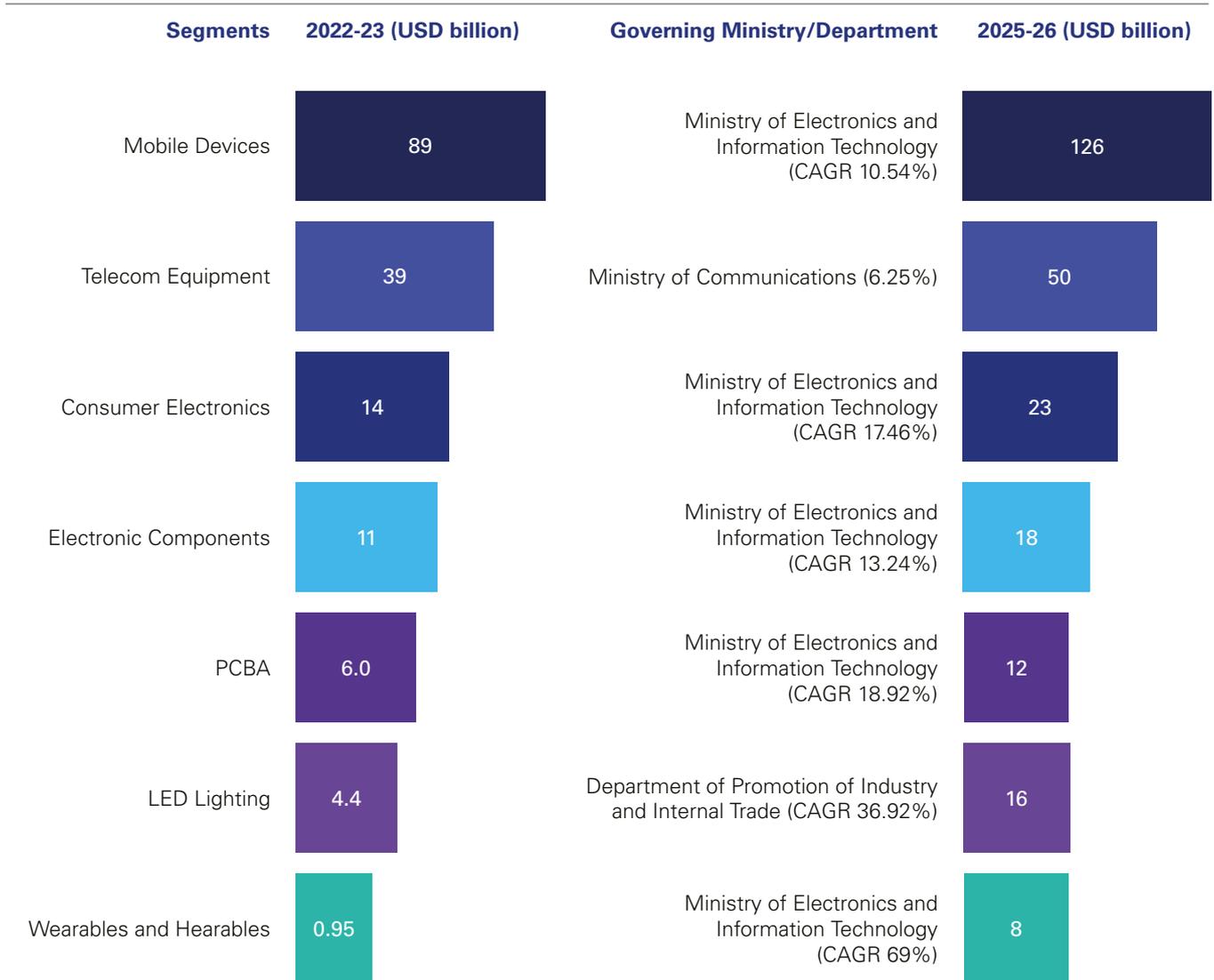
Chapter 3

India as a Global Force

India is today the second largest online market in the world[1]. Its digital prowess is underlined by the huge strides in 5G; the adoption of emerging technologies; the successful implementation of DPI such as Aadhar and UPI; and various other initiatives. However, despite this progress, India continues to be a net importer of ICT products and contributes only 3.75 per cent to the global electronics manufacturing[2]. Recognising the potential of the ICT sector to contribute to the GDP, the Government of India is focusing on an ambitious plan to give impetus to electronics manufacturing in the country.

A snapshot of electronic manufacturing in India by segment and their respective ministries [3,4,5]

Segments	2022-23 (USD billion)	Governing Ministry/Department	2025-26 (USD billion)
Mobile Devices	89	Ministry of Electronics and Information Technology (CAGR 10.54%)	126
Telecom Equipment	39	Ministry of Communications (6.25%)	50
Consumer Electronics	14	Ministry of Electronics and Information Technology (CAGR 17.46%)	23
Electronic Components	11	Ministry of Electronics and Information Technology (CAGR 13.24%)	18
PCBA	6.0	Ministry of Electronics and Information Technology (CAGR 18.92%)	12
LED Lighting	4.4	Department of Promotion of Industry and Internal Trade (CAGR 36.92%)	16
Wearables and Hearables	0.95	Ministry of Electronics and Information Technology (CAGR 69%)	8

This vision is supported by favourable trends – supply chain diversification by global majors; government-led initiatives; increased capital expenditure; higher buying power of consumers; inherent strength of the electronics sector; and the inflow of FDI into the electronics sector. Of the USD 1 trillion export economy that India is projected to become by FY2026, USD 120 billion is expected to come from the electronics exports[6]. Rapid growth in supplier base, supported by policy incentives, will help India emerge as a global champion in this segment

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1. Unravelling the digital video consumer, KPMG in India, September 2019.

2. Atmanirbhar Bharat: Becoming an electronics manufacturing hub, PIB Chennai, April 2023.

3. Economic survey 2023, Business Today, Arnab Dutta, January 2023

4. India exported telecom gear worth Rs 6911 crore till May 31, The Economic Times, July 2023
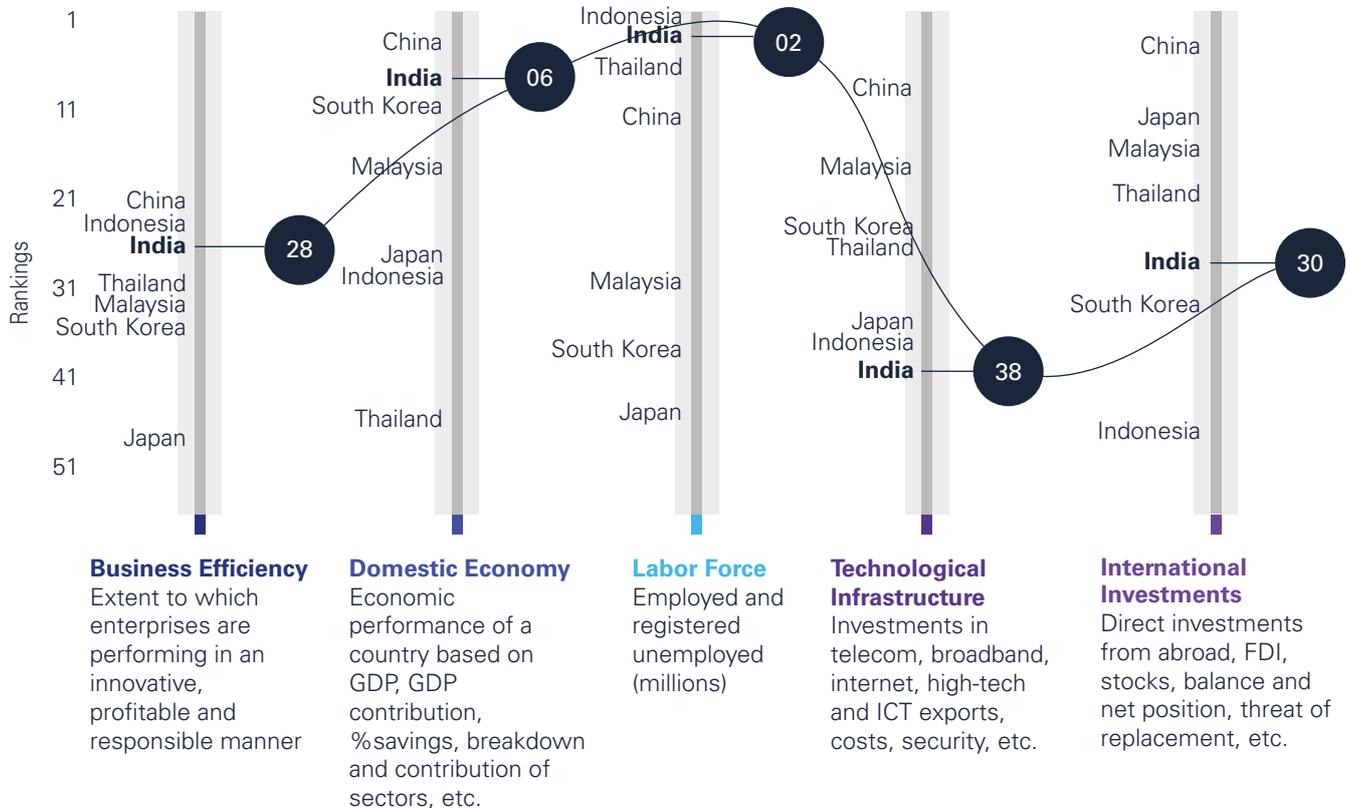
5. Electronic wearables production in India reaches Rs 8000 crore in FY23, ET Telecom, May 2023

6. India – A 1 trillion manufacturing export by 2030, Livemint.com, November 2023
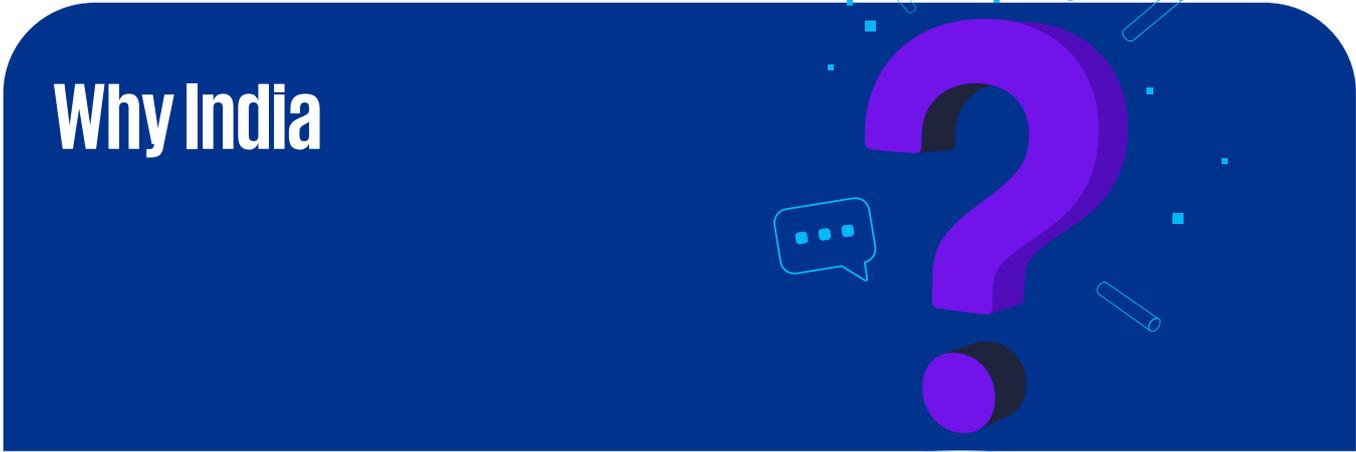
Why India ?

India's competitive ranking

The focus on hardware manufacturing is bolstered by India's growing strength in technological infrastructure, business efficiency, labour force, and the health of the domestic economy and investments. Figure 2 below shows how India is improving, in comparison to its Asian peers, on these fronts.

India's competitiveness ranking is improving with improvements in technological infrastructure[7]

Rankings					
	Business Efficiency Extent to which enterprises are performing in an innovative, profitable and responsible manner	**Domestic Economy** Economic performance of a country based on GDP, GDP contribution, %savings, breakdown and contribution of sectors, etc.	**Labor Force** Employed and registered unemployed (millions)	**Technological Infrastructure** Investments in telecom, broadband, internet, high-tech and ICT exports, costs, security, etc.	**International Investments** Direct investments from abroad, FDI, stocks, balance and net position, threat of replacement, etc.

Source: IMD Competitiveness Report, 2023

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7. IMD World Competitiveness Booklet 2023, IMD, June 2023

A robust policy framework and the launch of Bharatmala Pariyojana and Gati Shakti programmes are eliminating infrastructure bottlenecks and improving efficiency across various modes of transport. The fast-improving road and transport network in the country (with a possible move away from tolls soon) is complemented by a vast coastline that can support new mega-ports and mega-container ships with greater handling capacities. This bodes well for India's goal of blending tightly into global value chains.

Table 2: India's infrastructure is supporting agile supply chains[8]

Country	Number of Airports	Annual Freight Traffic (Million mt-km)	Number of Sea Ports	Coastline in Kms	Railroad Density (Km/ 1,000 Km^2)	Population (million)	GDP (USD billion)	Key highlight
India	137	2,704	212	7,000	22.7	1,400	2,641	42 FTAs, 40 million employed in manufacturing
Vietnam	22	481.4	44	3,444	7.6	97.3	340.6	Electronics manufacturing
Thailand	38	2,666.3	27	3,219	8.7	69.8	501.7	27 seaports; 38 airports
China	248	25,256	150+ major; 1,800+ minor ports[1]	14,500	9.5[2]	1,412	18,321	High level of expertise, well built supply chains; catering to scope and scale of activities
Malaysia	67	1,404.4	9	4,675	6.8	32.7	336.3	2.3 million workforce; 14 FTAs; semiconductor exports
Hong Kong	3	11,739	1	456	102.2	7.5	347	2nd busiest cargo airport
Taiwan	17	1,072.7	7	1,566.3	45	23.5	668.5	Semiconductor manufacturing
Singapore	1	5,194.9	1	193	281.5	5.69	337.5	25 FTAs, busiest port (shipping tonnage); semiconductor exports

Source: KPMG report, Rethinking supply chains in Asia Pacific, Statista, CEIC, World Bank; 1Freightos; 2WorldStatInfo

Note: Port capacities are being ramped up under the Sagarmala project, and the addition of mega ports will boost the tonnage further over time.

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8. Rethinking supply chains in Asia Pacific, KPMG Global, October 2022

Enabling government policies

Aligned with the Hon'ble Prime Minister's vision of elevating India from a consumer of technology to a developer and implementer of it, the Government of India has taken measures to build a business and regulatory environment conducive to promoting India as a manufacturing hub. Some of the key initiatives in this direction include:

- PLI Scheme for large-scale electronics manufacturing

- PLI Scheme for IT hardware

- Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS)

- Modified Electronics Manufacturing Clusters (EMC 2.0) under the National Policy on

Electronics, 2019, which envisages positioning India as a global hub for Electronics, System Design and Manufacturing (ESDM)

- FDI up to 100 per cent under the automatic route is permitted for electronics manufacturing, subject to applicable laws.

The PLI 2.0 scheme is helping India strengthen its presence in the global market by attracting investments, promoting exports, enhancing competitiveness, and fostering innovation. It aligns with India's goal of becoming a global manufacturing hub and positioning Indian manufacturers as key players in both domestic and global markets. Some of the schemes relevant to the ICT sector include:

Segment	Production commitment	Investment attracted and value addition till March 2023
LSEM	INR 8.13 trillion	Investment of INR 59.98 billion leading to total production of INR 2769 billion and employment generation for 58,276 people
IT hardware	INR 4.65 trillion	Investment of INR 1.95 billion leading to a total production worth INR 57.15 billion and employment generation for 1,089 people
Semicon-ductor	---	INR 1.9 trillion as per KPMG in India[9] .

Source: KPMG in India's estimates 2023 based on secondary research and industry interactions

9. KPMG Analysis, 2023

Flourishing startup ecosystem

India's startup ecosystem has undergone a significant transformation. Startups are now a part of the broader business landscape, creating impactful solutions, and serving as centres of innovation and vehicles for socioeconomic development. We are seeing the emergence of startups that develop IR4 (Fourth Industry Revolution) technologies such as 3D printing, which help in addressing manufacturing needs such as customisability, error reduction, zero waste, cost-time efficiency, and precision fabrication, and find application in sectors such as defense, aerospace, and drone manufacturing. The other technologies that manufacturing-focused startups employ include IoT, Advanced Manufacturing, Artificial Intelligence (AI), and Machine Learning (ML).

IR4 startups in the manufacturing industry[10]

Start-ups	Location	Technologies	Activities	Impact
Fabheads	Chennai, Tamil Nadu	AM	Composite manufacturing and manufacturing carbon fibre 3D printers	Customizability, reduction in errors, zero material waste, low development cost and time
BlinkIn	Bengaluru, Karnataka	AR, AI	Customer support and after-sale services	Cost-efficiency
Udyog Yantra	New Delhi, Delhi	AI, ML, IoT	Real-time monitoring of quality, quantity and traceability of food	Ensuring right quality and quantity of food
RDL	Mangalore, Karnataka	IoT	Shop floor and operations management, and predictive maintenance	Optimised resource utilisation and higher productivity
Gordian	Bengaluru, Karnataka	IoT	Supply chain and logistics management	Fast, secure and affordable delivery
TagBox	Bengaluru, Karnataka	IoT, ML, AI	Supply chain, and logistics management	Ensuring product quality and compliance, end-to-end traceability and operational efficiency
Skyislimit	Mumbai, Maharashtra	AI, ML, Blockchain, IoT	Sales and operation management	Increased operational efficiency

Source: Rethinking supply chains in Asia Pacific, KPMG Global report, 2022

Note: Port capacities are being ramped up under the Sagarmala project, and the addition of mega ports will boost the tonnage further over time.

The fact that companies like G42, which conduct fundamental research on technologies such as Big Data, AI, and ML, are setting up base in India augurs well for technological advancements and the creation of job opportunities for the skilled workforce.

10. Adoption of Industry 4.0 Technologies in India's Start-up ecosystem, ISID, February 2023

Availability of labour and talent

India ranks second on labour availability. It boasts of a large pool of skilled and semi-skilled workers, particularly in engineering, information technology, and science-related fields. As India is looking at playing a dominant role in global manufacturing supply chain, it is ramping up its pool of skilled labour. For example, the government is planning to train 85,000 engineers and skilled worker to support the semiconductor ecosystem. Similarly, Telecom Sector Skill Council (TSSC) is planning to train 100,000 youth in 5G and allied technologies over the next three years with support from DoT.[11] TSSC is partnering with academia and private industries to build centres of excellences to train manpower on 5G, IoT, cloud, AI/ML and other emerging technologies.

Further, amid rising employment needs in India's manufacturing, Tier-2 cities are becoming competitive hubs, fueled by 60 per cent of the nation's graduates.[12] These cities are witnessing a surge in enrolment for digital and vocational training. To fulfil this requirement, Indian Government is actively expanding upskilling programs in tier 2 cities.

The Government schemes such as the Pradhan Mantri Gramin Digital Saksharta Abhiyan, have enabled Internet access in remote parts of the country. As a result, multiple corporates, non-profits, and educational startups are reaching small towns with skill training programs.

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11. 2 tier cities scaling up to be India's new technology hubs, September 2023

12. TSSC to place over 1.25 lakh youth, set up 50 labs across India as 5G roll out gains pace, ET Telecom, January 2023

India as a R&D hub

Research & development in India has been steadily growing in importance and scale, with the country strengthening its 'Make in India' story to become an integral part of the global value chain. India has become a global hub for R&D in various sectors. Here are some highlights of the vital role that R&D is playing in ICT manufacturing:
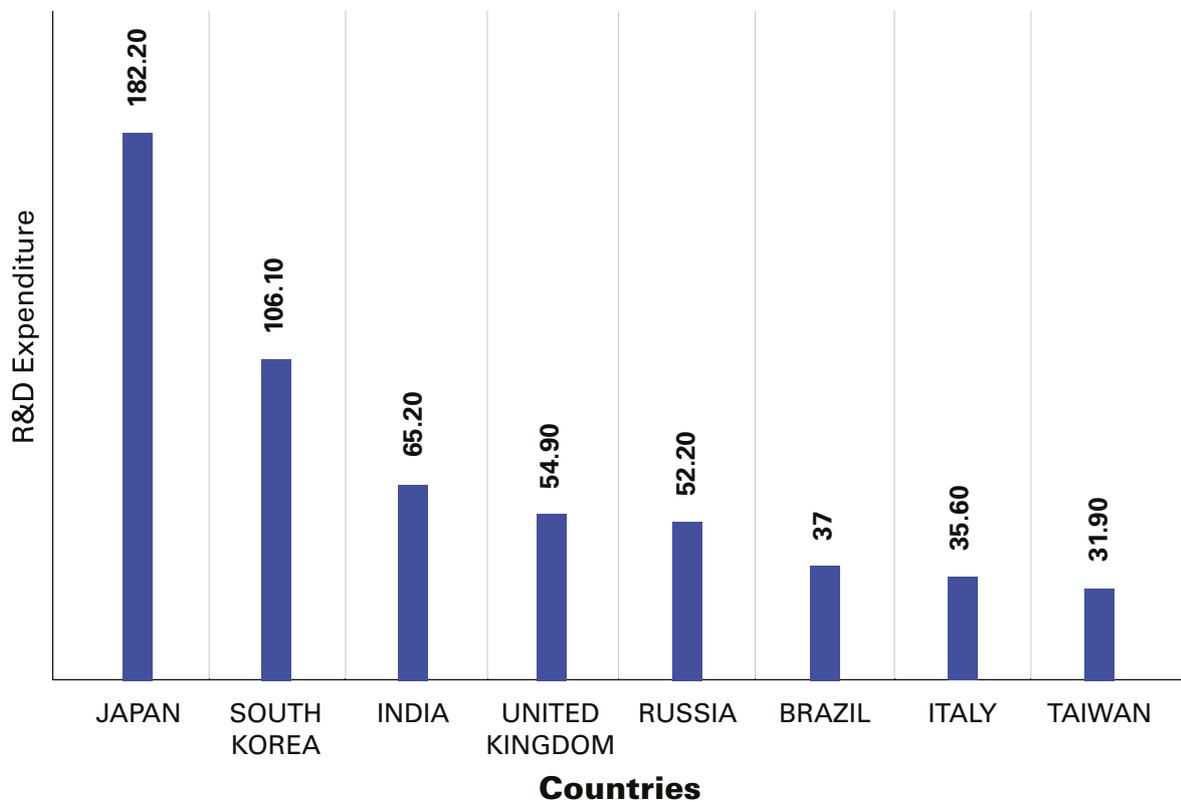
- The gross expenditure on R&D has increased significantly over the years, more than doubling from INR 601.96 billion in FY 2010-11 to INR 1273.80 billion in FY 2020-21

- In terms of industrial R&D expenditure, drug and pharmaceuticals occupy the first place followed by IT with a share of 9.9 per cent[13]

- During 2010-2022, India filed around 584,000 patents, of which 266,000 were from the technology domain, 90,000 from telecommunication, and 56,000 from semiconductors

- FY22 witnessed a 13.6 per cent Y-o-Y increase in patent filings[14].

In 2022, India's R&D spends were USD 65.2 billion, while Japan was the leading country in terms of R&D spends, with expenditure exceeding USD 182 billion[15].

Leading countries by gross research and development (R&D) expenditure worldwide in 2022 (in billion U.S. dollars)[15]

Country	R&D Expenditure
JAPAN	182.20
SOUTH KOREA	106.10
INDIA	65.20
UNITED KINGDOM	54.90
RUSSIA	52.20
BRAZIL	37
ITALY	35.60
TAIWAN	31.90

13. R&D statistics at a glance, DST, March 2023

14. India's Patents filings soar 13.6 per cent in FY22, The Hindu, April 2023

15. Leading countries by gross R&D expenditure worldwide, Statista, September 2023

Circular Economy in ICT

The transition to a circular economy could result in an additional USD 4.5 trillion in global economic output by 2030. Moreover, in contrast to the current growth environment, India's circular economy development route might generate an annual value of USD 218 billion (INR 1400 billion) by 2030[16].

Towards this there is a concentrated effort by both government and industry to leverage the Electrical and Electronic Equipment (EEE) waste produced in the country by integrating circularity principles in design, manufacturing, consumption and finally end of life management of products wherein it can ensure recovery and utilisation of secondary raw materials, circular products with longer use-life, quality assurance for repair and refurbished products, investment in its labor force and advanced recycling technology to mine secondary materials from e-waste, enabling circular growth in electronic production. Recognising the manufacturing potential, government has formulated E-waste management rules by the Central Pollution Control Board, promoting recycling and proper disposal. These will apply to every manufacturer, refurbishing business, and recycler of e-waste. Authorised recyclers will source waste in bulk, recycle it, and issue electronic certificates for companies to meet their yearly target. This government initiative of recycling E-waste will support the manufacturing companies to set up their units in India and achieve their ecological necessity and circular objectives.

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16. Circular economy for sustainable development in India, IBEF, January 2023

14

The Way Forward

Aiming to establish itself as a trusted partner in the ICT product and services value chain, India should continue to build on the momentum generated by various government-led initiatives and move up the production value chain. A preliminary analysis of India's role in mobile and laptop manufacturing indicates that a large proportion of the manufacturing value chain for laptops is accounted for by China and other countries.

Bill of material break up for a sub USD 1000 laptop and the corresponding value chain
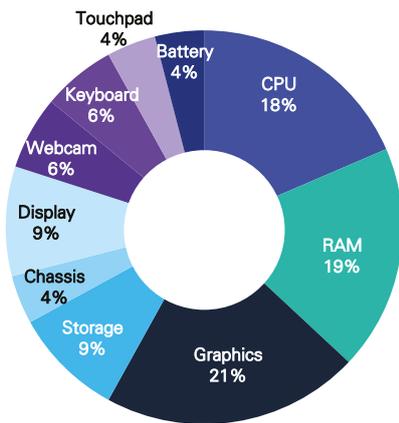
Contribution of sub-assemblies to the BoM of a sub USD 1000 laptop	% BoM sourced from India
CPU	0-10
RAM	0-10
Graphics	0-10
Storage HDD	20-40
Chassis	50-80
Display	0-5
Webcam	0-10
Keyboard	0-10
Touchpad	0-10
Battery	20-30

Pie chart: Touchpad 4%, Battery 4%, CPU 18%, Keyboard 6%, Webcam 6%, Display 9%, Chassis 4%, Storage 9%, Graphics 21%, RAM 19%

Phase 1 Equipment Design
A team of engineers works on the product's specifications, design, and appearance. **Country – China, U.S.**

Phase 2 Raw Material Procurement
All raw materials necessary to construct the product are gathered from various vendors and transported to the assembly chain. **Country – China, South Korea, Japan, Myanmar**

Phase 3 Component Manufacturing and Front-end Development
The raw components are then assembled to create the desired product according to the design. **Country – India, China, Myanmar, South Korea**

Phase 4 Back-End assembly and testing and packaging
Once the product is finished, the backend work such as software licensing and testing to guarantee that the product operates properly begins. **Country – India, Myanmar, China**

Phase 5 Supply to manufacturer/ OEM
The completed product is delivered to the corporation for sale to the final user. **Country – India, China**

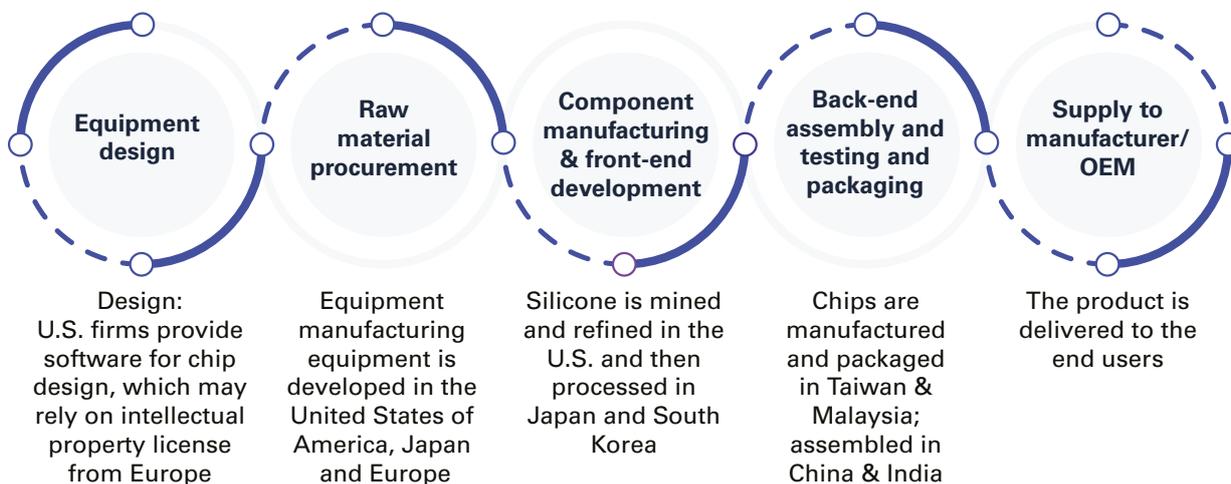Source: Industry reporting, KPMG in India analysis, December 2020

India is largely involved in the packaging and assembly of electronic devices and equipment, including mobile phones. Design and research activities are primarily concentrated in the U.S. and Europe; manufacturing equipment is developed primarily in the U.S., the EU, and Japan; and chip manufacturing takes place primarily in Taiwan, the U.S., and South Korea[17].

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17. Powering up: Electronics manufacturing in India, KPMG in India, December 2020

Bill of material break up for a sub USD 1000 smartphone and the corresponding value chain
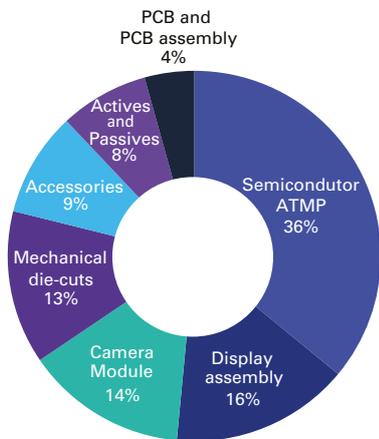
Contribution of sub-assemblies to the BoM of a sub USD 200 smartphone	% BoM sourced from India
Gift box	100
ATMP	100
Battery & charger	90-95
PCBA	100
Mechanics	10-20
Display assembly	10-20
Mic, receiver, connectors, vibrator motor	0-5
Camera module	20-30

Equipment design

Design: U.S. firms provide software for chip design, which may rely on intellectual property license from Europe

Raw material procurement

Equipment manufacturing equipment is developed in the United States of America, Japan and Europe

Component manufacturing & front-end development

Silicone is mined and refined in the U.S. and then processed in Japan and South Korea

Back-end assembly and testing and packaging

Chips are manufactured and packaged in Taiwan & Malaysia; assembled in China & India

Supply to manufacturer/ OEM

The product is delivered to the end users

Source: Powering up Electronics manufacturing in India, KPMG report, December 2020; KPMG analysis

India needs to transition from an assembly-only approach in electronics to a holistic, integrated, end-to-end manufacturing-led approach. Through backward integration, Indian companies need to develop niches that will help the country move beyond assembly operations. Until such capabilities are built, the government should focus on getting lowest-cost component manufacturers to set up operations in India.

Conclusion

India has made great strides in digital inclusion; manufacturing and technology excellence; innovation leadership; and global impact. The ICT industry in India is poised for significant growth over the next few years. The government has outlined a clear vision for the industry and has launched several initiatives to support its growth. To drive this growth further, the government should encourage innovation and create a workforce equipped with the necessary skills. Government support and public-private collaborations are essential to fully realise the potential of the digital economy. Below are some key recommendations for the industry and for the government in this regard.

- Encourage the use of cutting-edge technologies, including 5G and 6G, satellite communications, and semiconductors

- Provide financial inducements and regulatory assistance and encourage public-private partnerships towards this end

- Make sustained investments in digital infrastructure, particularly in broadband and data centers, to provide nationwide access to the internet

- Create an environment conducive to ICT R&D and production. Offer more incentives such as tax rebates, land subsidies, and other rewards, to domestic and international businesses

- Invest in skill development for the workforce, with special focus on 5G, semiconductors and satellite communication, to ensure that India has the talent required to support the expansion and sustain the growth of these sectors

- Work with the public sector to promote inclusivity and digital literacy.

The Indian population dividend, in conjunction with the country's technological surge, give the country an enormous advantage and can help the country achieve its goal of becoming one of the world's most dependable digital leaders. Governments, businesses, and academia need to continue to engage in conversations and explore collaborations so that we are able to create a sustainable future for Digital India that is inclusive, safe, and technologically advanced.

Investing in the Indian ICT sector can represent a significant opportunity for other developing nations interested in shaping the future of the ICT industry through policies and programmes.

Glossary

3D	Three-dimensional	IoT	Internet of Things
3GPP	Third Generation Partnership Project	IP	Intellectual property
5Gi	5G Radio Interface Technology	IPR	Intellectual Property Rights
AI/ML	Artificial Intelligence/Machine Learning	IR4	Fourth Industry Revolution
AM	Advanced Manufacturing	ISMC	Indian Standard Medium Council
AR/VR	Augmented Reality/Virtual Reality	ITU	International Telecommunication Union
ATM	Automated Teller Machine	LEO	Low Earth Orbit
ATMP	Assembly, Testing, Marking, and Packaging	LSEM	Large-Scale Electronics Manufacturing
BPO	Business Process Outsourcing	MEITy	The Ministry of Electronics and Information Technology
BTS	Base Transceiver Station		
CAGR	Compound Annual Growth Rate	MEMS	Micro Electromechanical Systems
C-DAC	Centre for Development of Advanced Computing	MNO	Mobile Network Operator
		MoD	Ministry of Defence
CHIPS	Creating Helpful Incentives to Produce Semiconductors	M-SIPS	Modified Special Incentive Package Scheme
		MSMEs	Micro, Small and Medium Enterprises
CMOS	Complementary Metal-Oxide Semiconductor	NPE	National Policy on Electronics
CoE	Centre of Excellence		
CPSU	Central Public Sector Undertaking	OEM	Original Equipment Manufacturers
CSP	Communication Service Providers	OFC	Optical Fibre Cable
DAS	Distributed Antenna Systems	OSAT	Outsourced Semiconductor Assembly and Test
DCIP	Digital Connectivity Infrastructure Development	OTT	Over-The-Top
DLI	Design Linked Incentive	PCB	Printed Circuit Board
DoT	Department of Telecommunications	PLI	Production-Linked Incentive
DPDPA	Digital Personal Data Protection Act	PMGDISHA	Pradhan Mantri Gramin Digital Saksharta Abhiyan
DPI	Digital Public Infrastructure		
EEE	Electrical and Electronic Equipment	PSU	Public Sector Undertaking
EMC	Electromagnetic Compatibility	R&D	Research and Development
EMS	Electronics Manufacturing Services	RAN	Radio Access Network
EO	Earth Observation	RoW	Right of Way
ESDM	Electronics System Design and Manufacturing	SACFA	Standing Advisory Committee on Radio Frequency Allocations
EU	European Union		
FDI	Foreign Direct Investment	SatCom	Satellite Communication
FTTH	Fiber To The Home	Semicon	Semi-Conductor
FWA	Fixed Wireless Access	SIA	Semiconductor Industry Association
FY	Fiscal Year	SME	Small and Medium Enterprises
GAGAN	GPS Aided GEO Augmented Navigation	SPECS	Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors
GB	Giga-byte		
GDP	Gross Domestic product	TMT	Technology, Media, and Telecom
GoI	Government of India	TRAI	Telecom Regulatory Authority of India
GP	Gram Panchayat	TSSC	Telecom Sector Skill Council
GPU	Graphics Processing Unit	UPI	Unified Payment Interface
HCL	Hindustan Computers Limited	US	United States of America
IC	Integrated circuit	USD	US Dollar
ICT	Information and Communication Technology	USP	Unique Selling Proposition
IESA	India Electronics and Semiconductor Association	VSAT	Very Small Aperture Terminal
INR	Indian Rupees	WFH	Work From Home

Appendix

| Ref	Source title	Source
1.1	Largest telecommunication market of world is India USD 1 Tn Digital Economy by FY2025	New India Factbook, Invest India, September 2023
1.2	FDI equity inflow amount for telecommunications sector in India FY 2012-2023	Amount of foreign direct investment inflows in India's telecommunications sector from financial year 2012 to 2023, Statista, August 2023
1.3	India is world's 3rd Largest Startup ecosystem	New India Factbook, Invest India, September 2023
1.4	700 + Districts covered by 5G	India's 5G Juggernaut: the country launched 3 lakh sites in 714 districts in 10 months, ET Government, August 2023
1.5	500 Million New smartphones added over the last decade	Telecom Industry in India: Sector Overview and Opportunities, Invest India, October 2023
1.6	881.25 million internet subscribers	TRAI PIR October 2023
1.7	3000 deep-tech start-ups	India's DeepTech Start-Ups - Poised For Impact, NASSCOM, August 2022
1.8	1.1 Bn Telecom subscribers 19.5 GB Average wireless usage per subscriber per month	TRAI PIR October 2023
1.9	3,726,577 kilometers of optical fiber cable deployed of June 23	3,726,577 kilometers of optical fiber cable deployed of June 23, Times of India Business, September 2023
1.10	7.5 lacs Towers with 36% fiberisations	65% telecom towers need fiberisation; 12L towers to be deployed to make India 5G-ready, The Economic Times, March 2023
1.11	1st country to develop 3 foundational DPI	Digital Public Infrastructure – lessons from India, Observer Research Foundation, February 2023
1.12	138 data centers World's 13th largest market	138 data centers World's 13th largest market, India Briefing, September 2023
1.13	25 lac+ BTS have been deployed	State-Wise Breakdown of 5G BTS Deployments in India as of July, Telecom Talk, July 2023
1.14	10 Million, 5G subscriptions achieved within 3 months of launch	Ericsson Mobility Report, Ericsson, June 2023
1.15	6th position globally With average 5G download speed of 301.6 Mbps	Global 5G Experience Report, Telecom Talk, July 2023
1.16	1 Site/min One of the fastest rollout of 5G in the world	Fastest 5G Rollout, Press Information Bureau, May 2023
1.17	100 5G labs And 5G test beds	Centre to set up 100 labs for developing 5G applications, The Economic Times, February 2023
1.18	200+ 6G related patents	India acquires over 200 patents for 6G Technology, All India Radio News, July 2023
1.19	India has #1 adoption rate in the world for Digital Payments	New India Factbook, Invest India, September 2023
1.20	India is one of top 10 countries in terms of FDI receipt in 2022	India received the highest-ever FDI inflows of $ 84.8 bn in services in FY22, Times of India, January 2023

Acknowledgements

We are extremely grateful to senior leaders from the industry, subject matter experts, and KPMG in India team members for sharing their knowledge and insights to help us develop this report.

Authors

- Akanksha Jain
- Akanksha Saxena
- Akhilesh Tuteja
- Amit Bhargava
- Amrita Kumar
- Arjun Iyer
- Arjun Malhotra
- Avinash Ramachandran
- Chaitanya Karmarkar
- Deepak Hotwani
- Madhur Malhotra

- Manika Saxena
- Purushothaman K G
- Raghavan Viswanathan
- Rahul Hakeem
- Rohan Rao
- Sambhavi Marwah
- Shubham Shishodia
- Sonica Bajaj
- Vinny Sharma
- Yatin Gaind

Design and Compliance

- Avanti Premkumar
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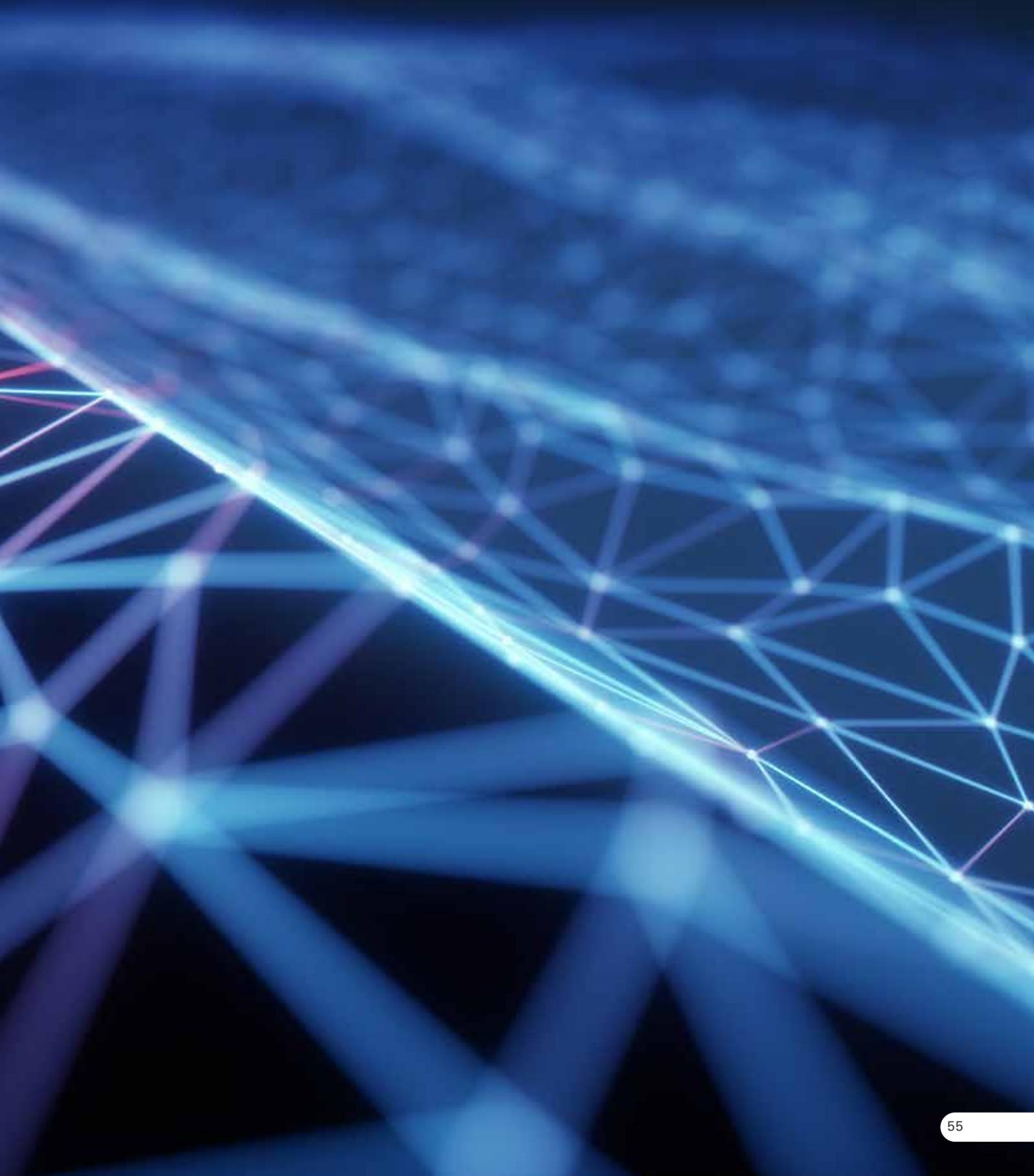
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