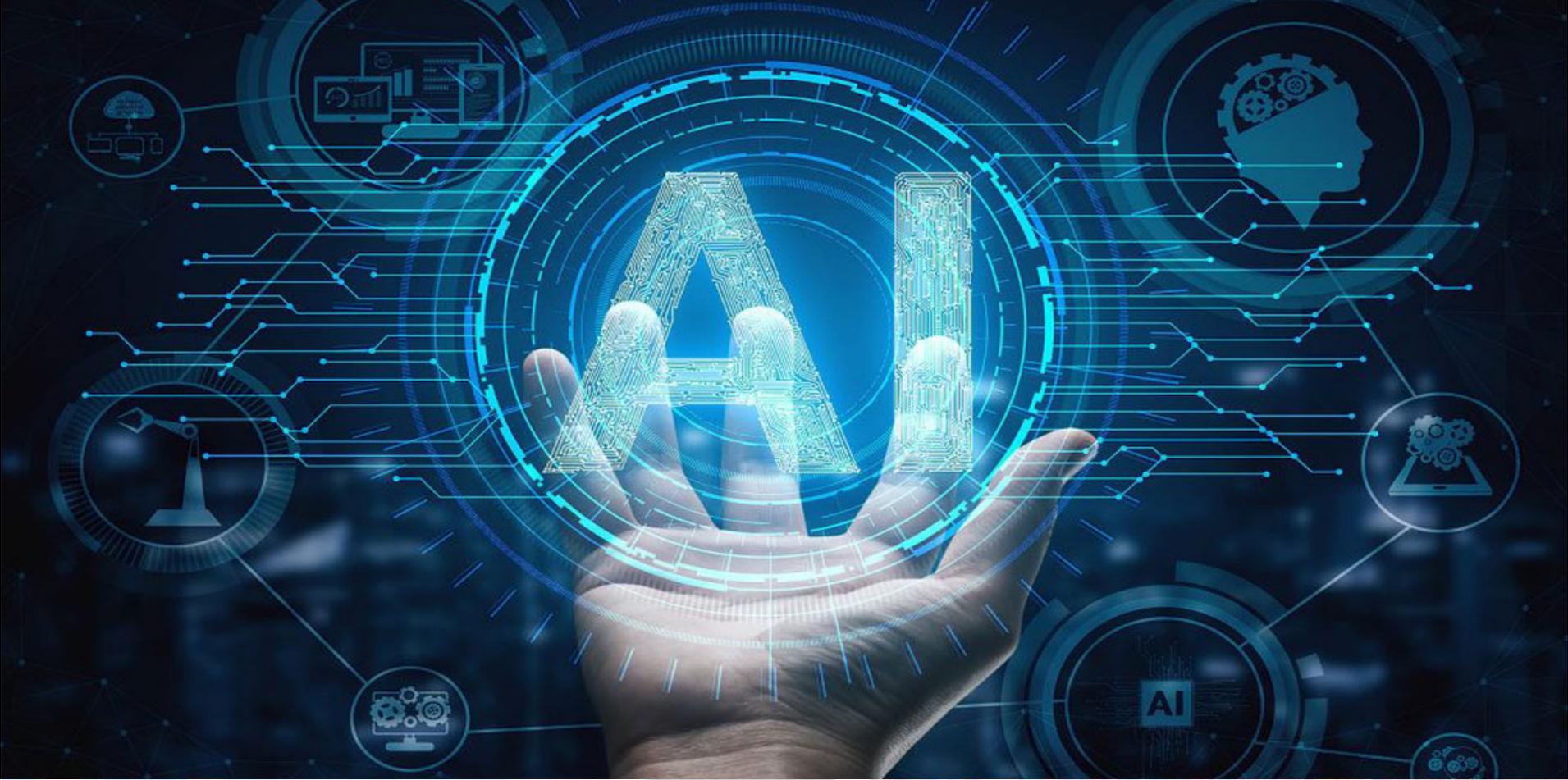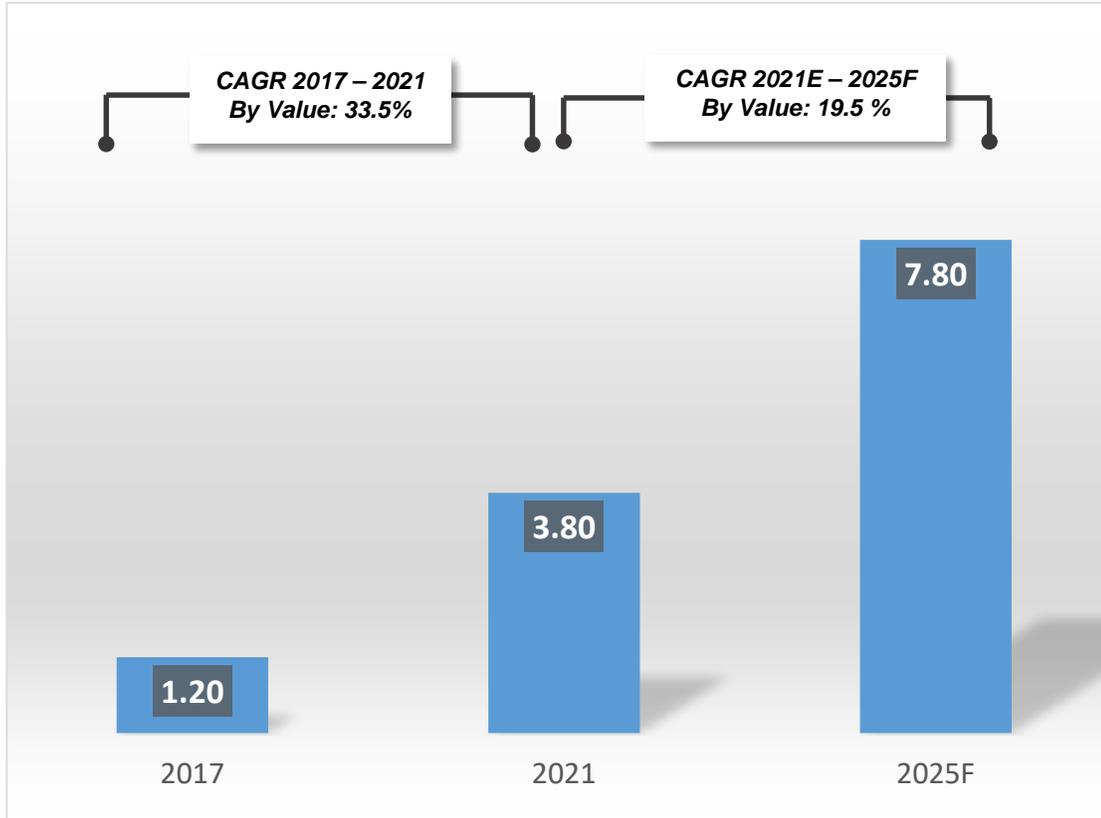# INDUSTRIAL TECHNOLOGY TREND SURVEY - AI, ROBOTICS, QUANTUM TECHNOLOGY, SEMICONDUCTOR and SPACE

INDUSTRIAL TECHNOLOGY TREND SURVEY- ARTIFICIAL INTELLIGENCE

Executive Summary

India Artificial Intelligence Market Size, By Value (USD Billion), 2017-2025F

CAGR 2017 – 2021 By Value: 33.5%

CAGR 2021E – 2025F By Value: 19.5 %

- 2017: 1.20
- 2021: 3.80
- 2025F: 7.80

Source: TechSci Research

Key Growth Drivers:

- Rapid adoption of artificial intelligence and automation by the end use industries. The end-use industries include automotive, healthcare, banking and financials services etc.
- Government initiatives such as responsible AI for youth, Telangana AI Mission, Tamil Nadu Safe & Ethical Artificial Intelligence Policy 2020, U.S. - India Artificial Intelligence (USIAI) Initiative etc.
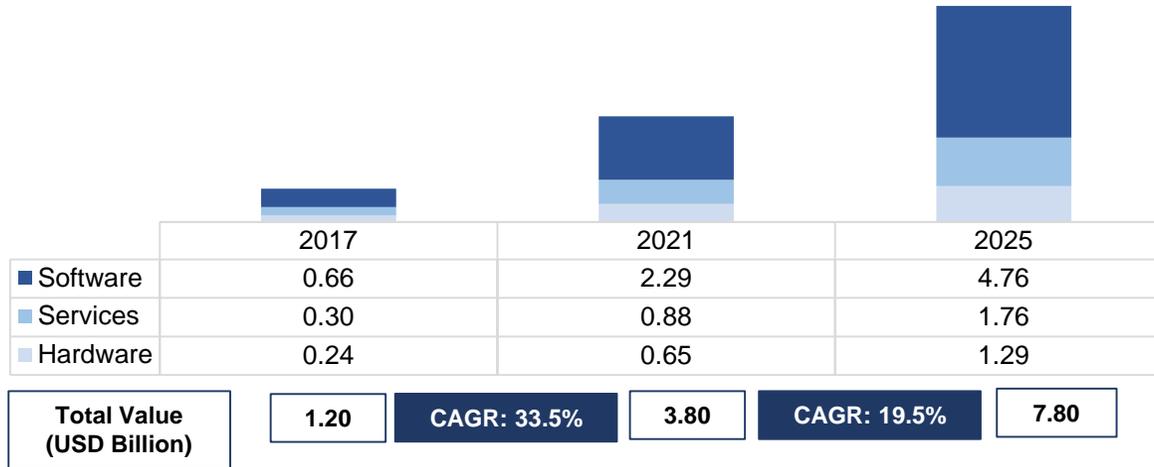
Key Challenges

- Integration of AI into existing systems.
- Data quality and availability are necessities for AI capabilities.
- Complex Algorithms and Training of AI Models.
- Data Security and Storage

The Indian artificial intelligence market stood at USD 3.8 billion in 2021 and is expected to grow at a CAGR of 19.5% to reach USD 7.8 billion by 2025.
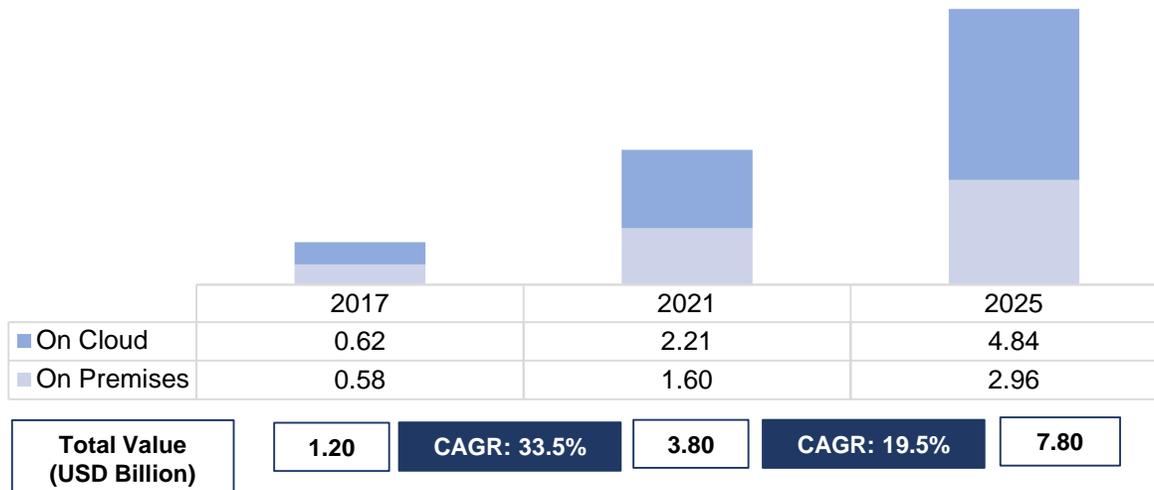
Executive Summary

India Artificial Intelligence Market Size, By Component, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ Software	0.66	2.29	4.76
■ Services	0.30	0.88	1.76
■ Hardware	0.24	0.65	1.29

Total Value (USD Billion)	1.20	CAGR: 33.5%	3.80	CAGR: 19.5%	7.80

Artificial Intelligence as software is dominating the market owing to the increasing deployment of artificial intelligence in smartphones, social media apps, shopping apps, etc.

India Artificial Intelligence Market Size, By Deployment, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ On Cloud	0.62	2.21	4.84
■ On Premises	0.58	1.60	2.96

Total Value (USD Billion)	1.20	CAGR: 33.5%	3.80	CAGR: 19.5%	7.80

Artificial Intelligence deployment in the cloud market is dominating as it assists firms in developing and deploying applications in the existing software infrastructure expeditiously.

Source: TechSci Research

Executive Summary

India Artificial Intelligence Market Size, By Function, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ IT	0.48	1.53	3.32
■ Sales & Marketing	0.22	0.72	1.52
■ Finance & Accounting	0.10	0.34	0.73
■ Customer Services	0.08	0.27	0.59
■ Supply Chain Management	0.04	0.15	0.35
■ HR	0.02	0.07	0.16
■ Others	0.25	0.72	1.15

Total Value (USD Billion)	1.20	CAGR: 33.5%	3.80	CAGR: 19.5%	7.80

Others includes risk management, insurance claim processing etc

- The Artificial Intelligence market size in the IT industry was around USD 1.53 billion and is estimated to reach USD 3.32 billion by 2025.
- Key Growth Drivers of Information Technology (IT): Reduce the burden on developers, improve the efficiency of work, enhance the productivity of the employees., provide clean and bug-free code for developers.

India Artificial Intelligence Market Size, By End-User, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ IT & Telecom	0.61	2.02	4.21
■ BFSI	0.08	0.27	0.59
■ Advertising	0.07	0.27	0.62
■ Retail	0.07	0.22	0.48
■ Manufacturing	0.06	0.19	0.41
■ Healthcare	0.03	0.11	0.31
■ Automotive	0.02	0.10	0.27
■ Others	0.26	0.64	0.90

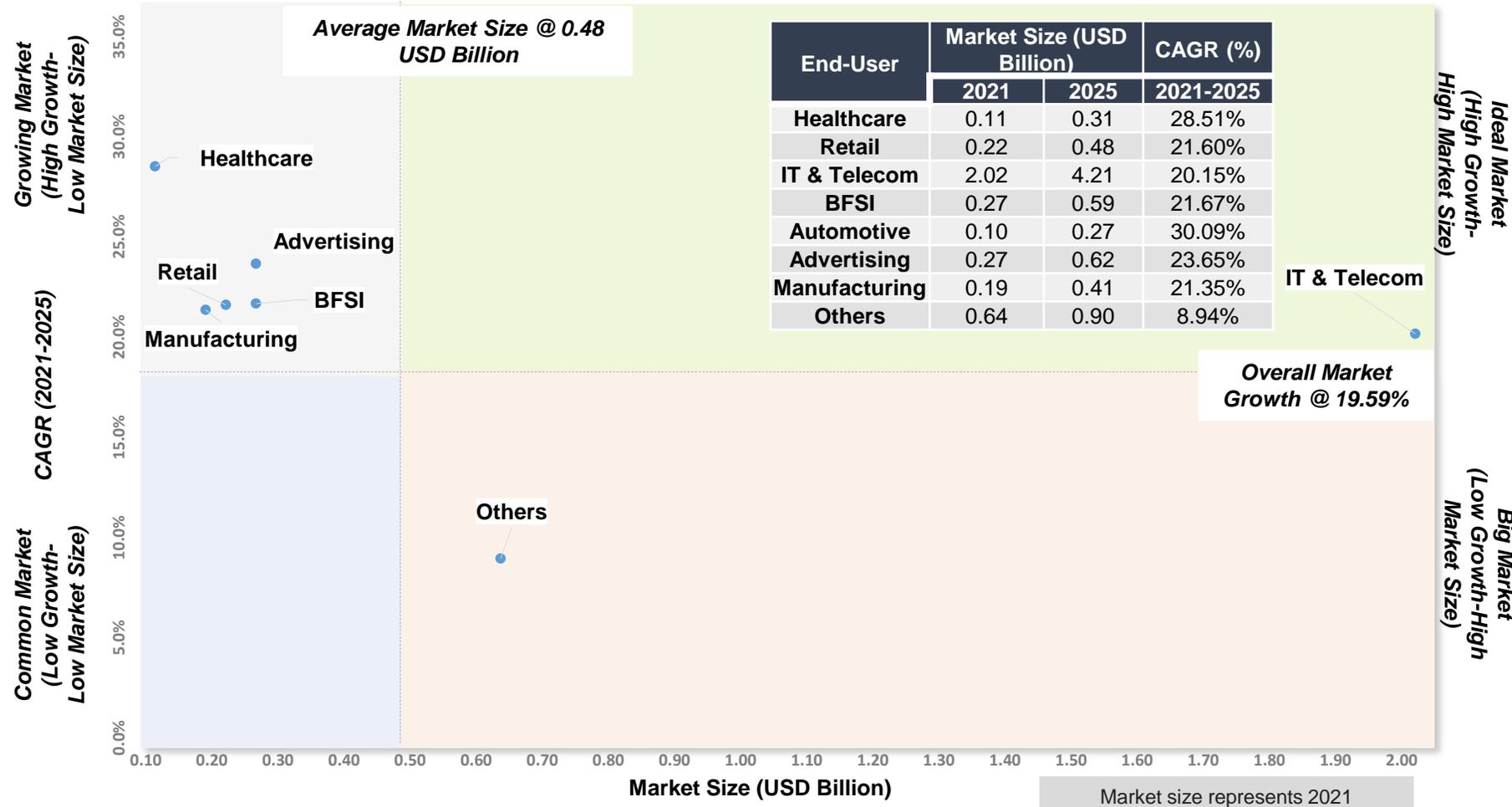| Total Value (USD Billion)	1.20	CAGR: 33.5%	3.80	CAGR: 19.5%	7.80

- The Artificial Intelligence market size in manufacturing was around USD 0.19 billion and is estimated to reach USD 0.41 billion by 2025.
- Key Growth Drivers of Manufacturing: limit downtime, quality assurance, monitoring, and maintenance costs.

Others includes Aerospace, Defence etc.

Source: TechSci Research

Executive Summary

India Artificial Intelligence Market, Market Potential, By End-User, Market Size (USD Billion) & Growth Rate (%)

Average Market Size @ 0.48 USD Billion

End-User	Market Size (USD Billion)		CAGR (%)
	2021	2025	2021-2025
Healthcare	0.11	0.31	28.51%
Retail	0.22	0.48	21.60%
IT & Telecom	2.02	4.21	20.15%
BFSI	0.27	0.59	21.67%
Automotive	0.10	0.27	30.09%
Advertising	0.27	0.62	23.65%
Manufacturing	0.19	0.41	21.35%
Others	0.64	0.90	8.94%

Overall Market Growth @ 19.59%

Growing Market (High Growth- Low Market Size)

Common Market (Low Growth- Low Market Size)

CAGR (2021-2025)

Ideal Market (High Growth- High Market Size)

Big Market (Low Growth-High Market Size)

Market Size (USD Billion)

Market size represents 2021

India Artificial Intelligence market, of IT and Telecom is the ideal market as it has the forecasted CAGR of 20.15% (2021-2025), which is higher than the overall market forecasted CAGR of 19.59%.

Source: TechSci Research

Key Focus Areas:

- Artificial Intelligence education to the students at all levels.

- Robust research & development to bring innovation in artificial intelligence by the different stakeholders.

- Penetration of artificial intelligence in startups, companies and educational institutions at one platform to make India an Artificial Intelligence innovation hub.

Policies & Initiatives

- **Task Force on Artificial Intelligence:** To develop AI for the country's economic, political, and legal purpose and to use in different industry.

- **National Education Policy 2020:** To Provide AI Education and Machine Learning to the Students at all Level

- **Responsible AI for Youth 2022:** To Encourage Students to Develop AI based impact solutions different industries.

- **The Responsible AI for Social Empowerment (RAISE 2020) Summit:** To exchange ideas for social empowerment, inclusion, and transformation in different sectors.

- **National Portal on Artificial Intelligence:** To provide articles, startups, resources, companies and educational institutions related to Artificial Intelligence at one platform.

- **U.S. - India Artificial Intelligence (USIAI) Initiative:** To bring key stakeholder to identify opportunities for bilateral R&D collaboration, enable AI innovation, share ideas to strengthen AI industry.

- **Centre of Excellence for Data Science and Artificial Intelligence (CoE-DS&AI), Government of Karnataka :** To position Karnataka as one of the top five global innovation centers AI over the next five years.

- **FRAS (Face Recognition Attendance System)– Government of Tamil Nadu:** To identify absent students

- **AI System to Fight Agriculture Risks- Government of Maharashtra: To use** Artificial Intelligence Solution to Assist Farmers to Reduce Agricultural Risk.

- **AI-Powered System For Monitor Driving Behaviour – Government of West Bengal:** To Develop Artificial Intelligence Solutions to Monitor the Movement of Vehicles .

- **Telangana AI Mission (T- AIM):** To Make Hyderabad among 25 global Artificial Innovation Hubs.

- **Tamil Nadu Safe & Ethical Artificial Intelligence Policy 2020:** To Encourage Research and Development in Artificial Intelligence by Academia, Start-ups, Private and Public Enterprise

Executive Summary

Key Focus Areas:

- Establishment of a centre of excellence, labs and incubation facilities to develop an Artificial Intelligence ecosystem.

- Artificial Intelligence solutions to end-user industries to address real-world problems in agriculture, healthcare and other industries.

- Artificial Intelligence and data science including deep learning, reinforcement learning, network analytics, and interpretable machine learning.

- Funding to researchers and scholars to conduct research.

Key Organizations Focus Areas		
Government Bodies	National Association of Software and Service Companies (NASSCOM), Manipal Global Education Services , National Informatics Centre (NIC), Centre for Artificial Intelligence and Robotics (CAIR), Ministry of Electronics & Information Technology (MeitY), National Institute for Transforming India (NITI Aayog)	Artificial Intelligence ecosystem covers startups, VC funds, research bodies, big tech companies, and educational institutions., Artificial Intelligence Industry Penetrations, establishing labs, incubation facilities, offers AI services to the end- user industry
Public Institutions/ Research Institutes	Indian Institute of Technology (IIT) (Madras, Hyderabad, Delhi, Roorkee, Bombay, Patna) Indian Institute of Science (IISc) , International Institute of Information Technology (IIIT), Bangalore	Conduct extensive research in several areas of AI and data science including deep learning, reinforcement learning, network analytics, interpretable machine learning, and domain-aware AI, conduct online courses, address real-world problems in agriculture, health care and the government's smart city and initiatives, including Computer Vision, Medical Image Analysis, Speech Processing, Database, Data Mining, Natural Language Processing, Information Retrieval, Agent-based Learning, Molecular Computing, AI in Biological and Chemical Sciences, Statistics.

Key Focus Areas:

- Extensive research on natural language processing, machine learning, neural network, virtual agents, and deep learning.
- Encouragement of Indian startups to use Artificial Intelligence in their business model and maintain ethics, privacy & security.
- Setting-up artificial intelligence digital lab to develop policy frameworks, standards, tools and assets related to Information Technology (IT) and Artificial Intelligence.
- Collaboration with industry leaders, Artificial Intelligence companies and startups to enhance artificial intelligence skills.

Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

• Accenture- Indian Institute of Technology (IIT), Bombay, & IIT Patna • Government of Karnataka- Microsoft Corporation India Pvt. Ltd • IIT Hyderabad- Japan's National Institute of Advanced Industrial Science and Technology • National Institution for Transforming India (NITI) Aayog- Google India	• Indian Institute of Technology(IIT), Goa - Express Analytics • Xoriants- Vishwakarma Institute of Technology (VIT) • Wipro Limited - IIT Kharagpur • NITI Aayog- Intel & Tata Institute of Fundamental Research (TIFR) • Intel India - Government of Telangana, International institute of Information Technology , Hyderabad (IIIT-H), and Public Health Foundation of India (PHFI)	• Government of Telangana- Companies (Intel, Nvidia, Abode) • India- Japan • NITI Aayog and Atal Innovation Mission- NASSCOM • Intel- Central Board of Secondary Education • Flipkart- IIT Patna • Atal Tinkering Labs- NITI Aayog & NASSCOM • SVKM's NMIMS - LivNSense Technologies Pvt. Ltd. • PTC India – AutoGrid IIT-Patna- SkyMap Global	• Teerthanker Mahaveer University - NVIDIA Corporation • Manipal Global Education Services- Axis Bank Limited • NITI Aayog- Amazon Web Services (AWS) – Intel • Indian Institute of Technology (Delhi) - eClerk Service Limited • Bharat Electronics Limited - Army Design Bureau of Indian Army • Indian Institute of Technology Roorkee-Deloitte	• Indraprastha Institute of Information Technology Delhi (IIIT- Delhi)- Artificial Intelligence Institute, University of South Carolina(AIISC) • India- UAE • NITI Aayog- NASSCOM • NASSCOM – Microsoft • India- Singapore • Nokia India- IISC • NASSCOM – MeitY & Andhra Pradesh Government • Indian Institute of Technology (Delhi) – IBM

Executive Summary

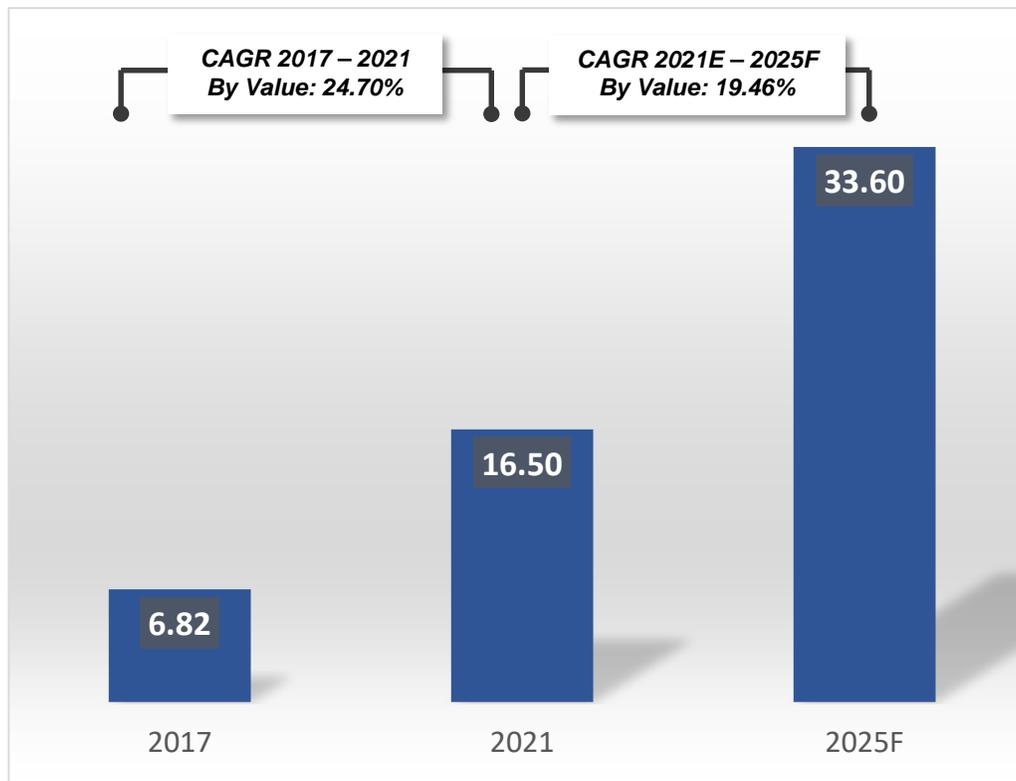| Competitiveness					
Parameter	**USA**	**China**	**European Union**	**Japan**	**India**
Market Size 2021-2025 (US$ Billion/ Growth Rate 2021-2025 (CAGR, %)	33.82 - 69.78	10.09 - 24.1	23.70 - 55.67	1.90 - 4.88	3.80 – 7.83
	19.85%	24.32%	23.80%	26.60%	19.81%
Government Policies, Investments, Initiatives 2021-2025	High	High	Moderate -High	Moderate-High	Low - Moderate
Workforce, Million 2021	0.70 -1	0.2- 0.4	0.5 -0.7	0.35 -0.4	0.3 – 0.32
R & D Expenditure	High	High	Moderate- High	Moderate- High	Low
Startups Penetration	High	Moderate -High	Moderate- High	Moderate -High	Low- Moderate
Domestic/ Established Player Penetration	High	High	Moderate- High	High	Low- Moderate
Domestic and international collaboration in AI software development in 2021	Moderate -High	Low- Moderate	High	Low - Moderate	Moderate
Intensity of Investments/ Collaborations	High	High	Moderate	High	Moderate
AI Skill Penetration Rank 2022	3rd Rank	11th Rank	Most of the European countries rank below India, USA , China and Japan except Germany (10th Rank). above China.	6th Rank	1st Rank

India and Japan share few characteristics directionally in the same direction

Source: TechSci Research, OECD, EU- Japan Centre

INDUSTRIAL TECHNOLOGY TREND SURVEY- ROBOTICS

Executive Summary

India Robotics Market Size, By Value (USD Billion), 2017-2025F

CAGR 2017 – 2021
By Value: 24.70%

CAGR 2021E – 2025F
By Value: 19.46%

- 2017: 6.82
- 2021: 16.50
- 2025F: 33.60

Source: TechSci Research

Key Growth Drivers:

- Technological advancements such as artificial intelligence, machine vision, cloud computing, big data, and 5g networks expanded the range of applications making assembly, installment, and maintenance of robotics faster and less costly.
- Increasing end –use industry focus towards automation implementation to increase production volume.
- Government policies & initiatives such as An Artificial Intelligence and Robotics Technology Park (ARTPARK product linked incentives etc.
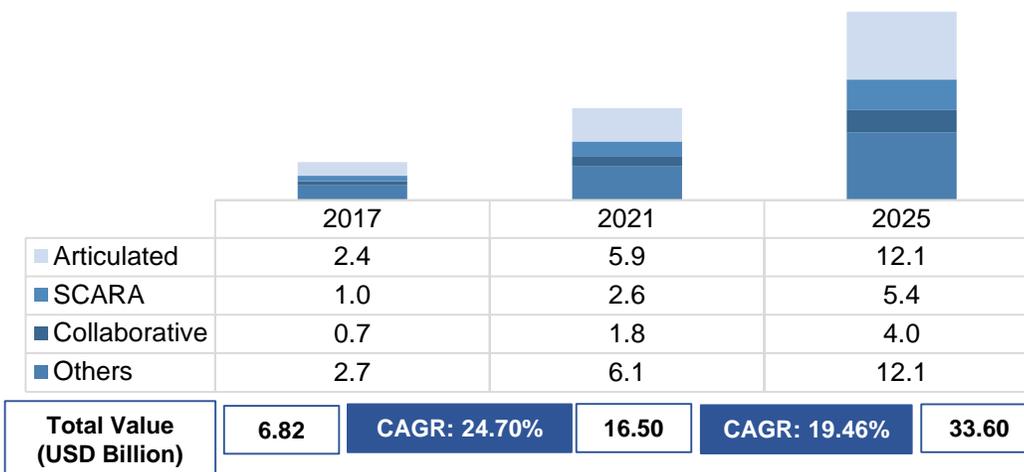
Key Challenges:

- Lack of capital investments and high cost of deployment.
- Lack of skilled workforce.
- Lack of hardware components.

- The Indian Robotics market stood at USD 16.50 billion in 2021 and is expected to grow at a CAGR of 19.46% to reach USD 33.60 billion by 2025.
- India's economy is one of the fastest growing among Asian emerging markets. The Indian manufacturing industry is rapidly implementing automation in order to increase production volume, accuracy, and safety.
- Recent technologies adopted in robotics are advances in artificial intelligence (AI), machine learning (ML), the Internet of Things (IoT) and big data.

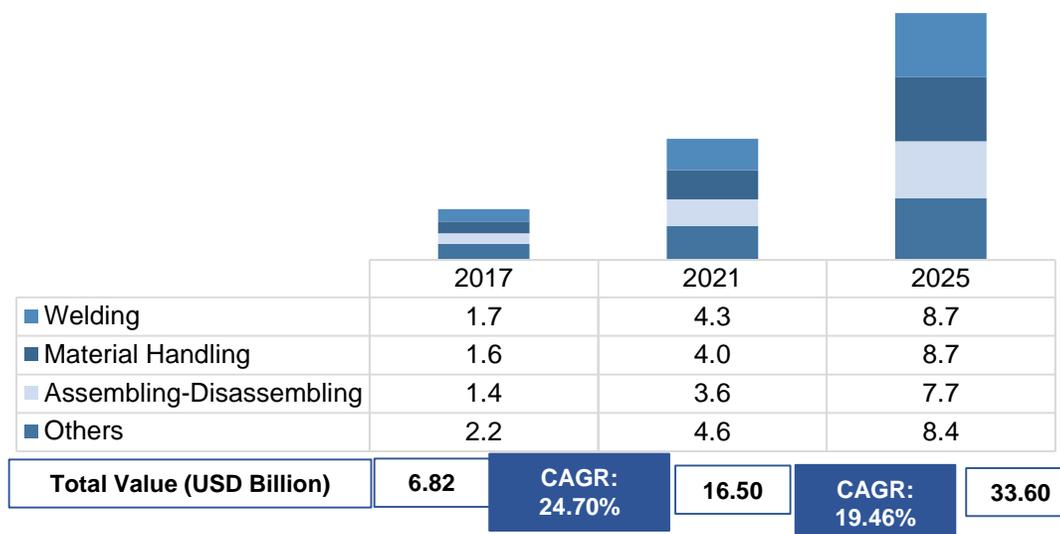Note: Market Size include hardware & software

India Robotics Market Size, By Type, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ Articulated	2.4	5.9	12.1
■ SCARA	1.0	2.6	5.4
■ Collaborative	0.7	1.8	4.0
■ Others	2.7	6.1	12.1

Total Value (USD Billion)	6.82	CAGR: 24.70%	16.50	CAGR: 19.46%	33.60

Other robots includes Delta, Automated Guided Vehicle, Autonomous Mobile Robot, Humanoid Robot

- The robotics articulated market was USD 5.9 billion in 2021 and is estimated to reach USD 12.1 billion by 2025.
- The articulated market is growing owing to versatile nature of articulated robots and the increasing industries such as electrical & electronics, e-commerce, food & beverage, rubber & plastic, chemical, etc., focus on automation and robotics.
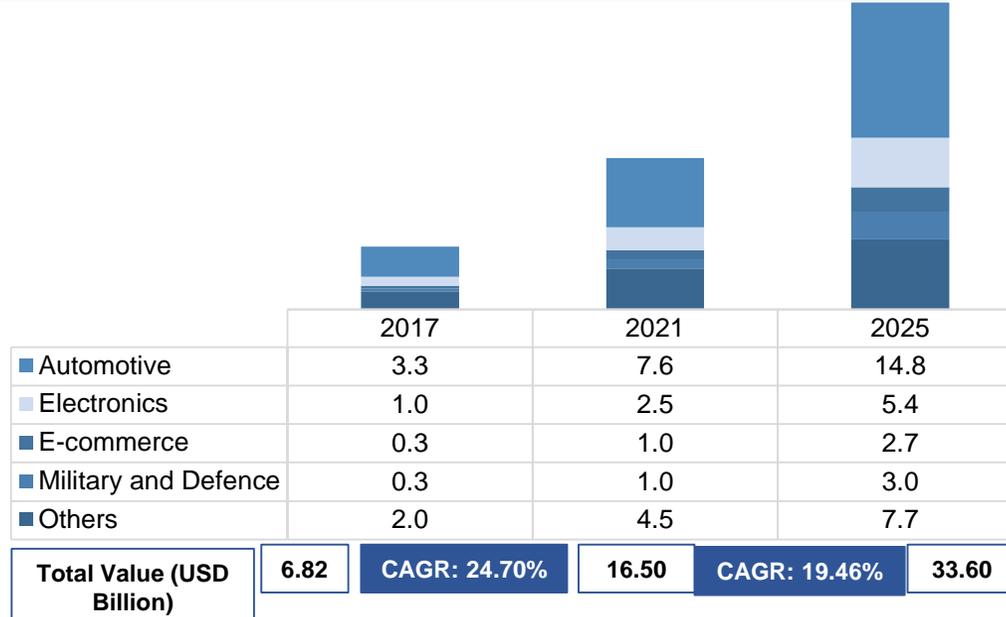
India Robotics Market Size, By Function, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ Welding	1.7	4.3	8.7
■ Material Handling	1.6	4.0	8.7
■ Assembling-Disassembling	1.4	3.6	7.7
■ Others	2.2	4.6	8.4

Total Value (USD Billion)	6.82	CAGR: 24.70%	16.50	CAGR: 19.46%	33.60

- Welding robot market was valued USD 4.3 billion in 2021 and is estimated to reach USD 8.7 billion by 2025.
- Welding robot is growing owing to fastly completes tasks and doesn't require breaks, annual leave, or slow down. The robot operates 24*7 reduces repair costs and time.

Source: TechSci Research

Executive Summary

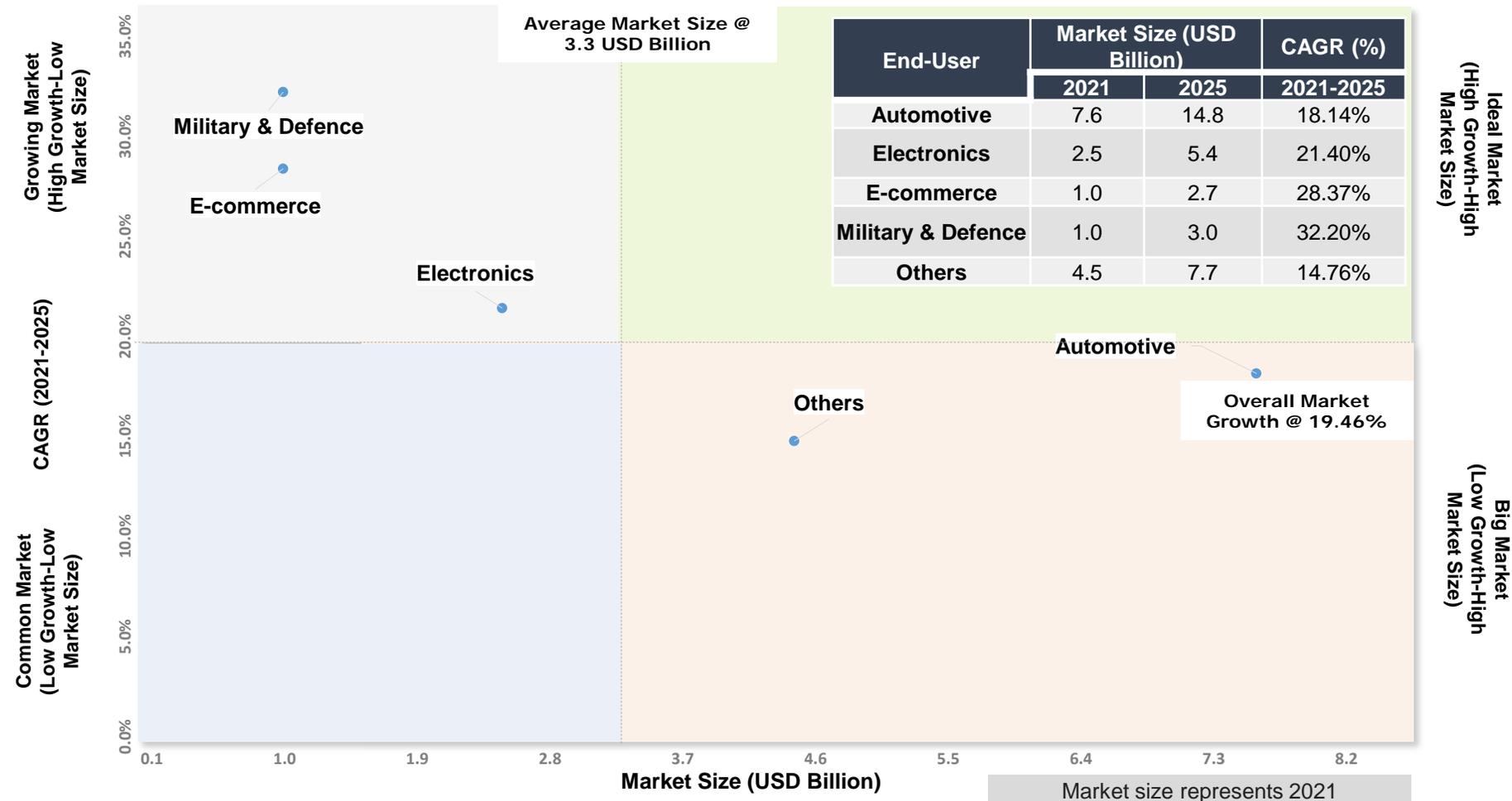**India Robotics Market Size, By End- User, By Value (USD Billion), 2017-2025F**

	2017	2021	2025
■ Automotive	3.3	7.6	14.8
■ Electronics	1.0	2.5	5.4
■ E-commerce	0.3	1.0	2.7
■ Military and Defence	0.3	1.0	3.0
■ Others	2.0	4.5	7.7

Total Value (USD Billion)	6.82	CAGR: 24.70%	16.50	CAGR: 19.46%	33.60

Others includes Food & Beverages, Chemical, Plastics & Rubbers, etc.

Source: TechSci Research

- Robot is widely used in automotive industry. The robot market in automotive industry was valued at USD 7.6 billion in 2021 and is estimated to USD 14.8 billion by 2025.
- Key Drivers of Robot in Automotive Industry: reduces waste caused by human error, enhance quality and reduce warranty costs, protect workers from dirty, difficult and dangerous jobs.

Executive Summary

India Robotics Market, Market Map, By End-User, Market Size (USD Billion) & Growth Rate (%)

Average Market Size @ 3.3 USD Billion

End-User	Market Size (USD Billion)		CAGR (%)
	2021	2025	2021-2025
Automotive	7.6	14.8	18.14%
Electronics	2.5	5.4	21.40%
E-commerce	1.0	2.7	28.37%
Military & Defence	1.0	3.0	32.20%
Others	4.5	7.7	14.76%

Growing Market (High Growth-Low Market Size)

CAGR (2021-2025)

Common Market (Low Growth-Low Market Size)

Ideal Market (High Growth-High Market Size)

Big Market (Low Growth-High Market Size)

Military & Defence

E-commerce

Electronics

Automotive

Overall Market Growth @ 19.46%

Others

Market Size (USD Billion)

Market size represents 2021

- In India Robotics market, of all End-User, Electronics, E-commerce and Military & Defence are the growing market as it has the forecasted CAGR (2021-2025) of 21.4%, 28.37%, and 32.20% respectively, which is higher as the overall market forecast CAGR is 19.46%

Source: TechSci Research

Executive Summary

Key Focus Areas:

- Robust Research & Development of Robotics.

- Domestic manufacturing of large-scale electronics and IT Hardware.

- Industry-relevant skill training to the youth.

Policies & Initiatives

- **An Artificial Intelligence and Robotics Technology Park (ARTPARK):** To strengthen Research and Development of Robotics

- **Production Linked Incentives:** To encourage domestic manufacturing of large-scale electronics and IT Hardware.

Executive Summary

Key Focus Areas:

- Short courses to provide quality education to advance STEM knowledge, training programs and career certification in robotics, automation and embedded systems.
- Establishment of robotics skill centres.
- Collaboration with global and local industries for designing and implementation of robotic systems to solve real-world problems.
- Mobile robotics, bluetooth robotics, maze solver robotics, sensor guided, wi-fi controlled robotics, Wi-fi controlled robotics, arduino based robotics, raspberry Pi based robotics , swarm robotics, bluetooth controlled robots.

Key Organizations Focus Areas		
Government Bodies	Indian Institute of Robotics , National Institute of Robotics & Artificial Intelligence (NIRA), Centre for Artificial Intelligence and Robotics (CAIR), All India Council for Robotics & Automation (AICRA), India STEM Foundation , Ministry of Electronics and Information Technology (MeitY)	Offers Certification in Robotic Process Automation (Beginners), Diploma Program in Robotic Process Automation, Master Program in Robotic Process Automation, Focus on R&D of robotics, Sets standards in robotics and advance the STEM Knowledge of member students by offering authorized training programs and career certification, focus on STEM Education with robotics and research-based learning programs for school and college students, offers certification programs including Gesture Control Robotics, Bluetooth Controlled Robots.
Public Institutions/ Research Institutes	Indian Institute of Science (IISc), Indian Institute of Technology, Kanpur, Indian Institute of Technology, Delhi, International Institute of Information Technology, Hyderabad (IIITH)	Collaborates with global and local industries, offers short courses, focuses on Mobile Robotics, Bluetooth Robotics, Maze solver Robotics, Sensor Guided, Wi-fi Controlled Robotics, Wi-fi Controlled Robotics, Arduino Based Robotics, Raspberry Pi based Robotics, Swarm Robotics, Quality education in robotics, automation and embedded systems, Robotics research in dynamics and control, robotic vision, navigation, UAV design and control, Multi Robotic Systems, AI and machine learning, Kinematics, Dynamics, Design, Motion Planning, Intelligent Control, Computer Vision,. etc.,

Executive Summary

Key Focus Areas:

- Robust research & development of Robotics and Artificial Intelligence.
- Enhancement of student knowledge to create skilled talent on robotics technology.
- Setting-up Centre of Advancement of Artificial Intelligence and Robotics.
- Product development of soft robotics, field robotics.
- Introducing foreign robotics technology.

## Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

- ISRO Inertial Systems Unit (IUST Global - College of Engineering Trivandrum (CET)
- ABB India - NITI Aayog
- Genrobotics - Kerela Government
- Punjab University - Vitti Research Foundation
- Wipro - Indian Institute of Science (IISc)
- Universal Robots - Bharat Fritz Werner
- Defence Research and Development Organization, India - Directorate of Defence Research and Development, Israel
- Sanjay Gandhi Postgraduate Institute (sGPGI) - Indian Institute of Technology (IIT)Kanpur
- Indraprastha Institute of Information Technology, Delhi - European Union
- Tata Consultancy Services (TCS) - Heriot-Watt University
- World Skill Center - ABB India
- Nokia Corporation - Indian Institute of Science, Bangalore
- Delhi Board of School Education - IIT Delhi
- IIT Delhi - National Science Foundation (NSF), USA

Executive Summary

Competitiveness

| Parameter	USA	China	Europe Union	Japan	India
Market Size 2021-2025 (US$ Billion/ Growth Rate 2021-2025 (CAGR, %)	5.0 - 8.0	15.1 - 27.7	8.5 - 15	5.4 - 10.9	0.3 -1.1
	12.3%	16.4%	15.2%	19.1%	39.9%
Government Policies/ Investments	Moderate- High	High	Moderate-High	High	Low -Moderate
Workforce Engagement, Million 2021	1.05-1.5	0.3-0.6	0.75- 1.05	0.52-0.60	0.45-0.48
R & D Expenditure	Moderate- High	High	Moderate	High	Low- Moderate
Startups Penetration	High	Moderate-High	Moderate	Low-Moderate	Low - Moderate
Domestic/ Established Player Penetration	High	High	Moderate- High	High	Moderate
Annual Installations of Industrial Robot, 1000 units, 2020	30.8	168.4	40.2	38.7	3.2
Annual Manufacturing, Million, 2021	1.23	0.27	1.08	1.35	0.005
Intensity of Investments/ Collaborations/ developments	Moderate- High	High	Moderate -High	High	Low-Moderate
Robot Density in Manufacturing, 2021 Per 10,000 Employees	274	322	235	399	4

Japan has stronghold in Robotics Market compared to India

Source: TechSci Research, International Federation of Robotics
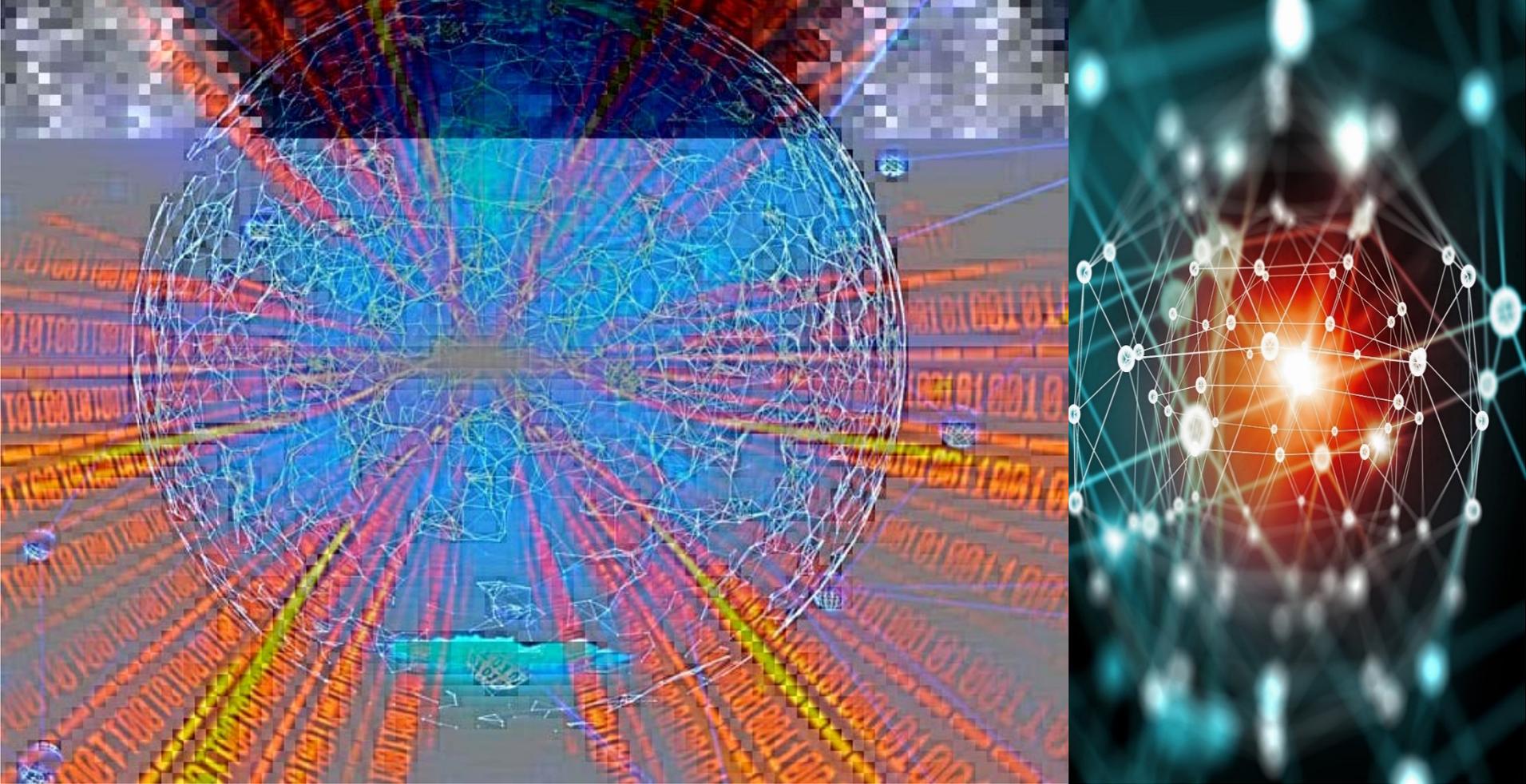
INDUSTRIAL TECHNOLOGY TREND SURVEY- QUANTUM TECHNOLOGY

Executive Summary

India Quantum Market Size, By Value (USD Billion), 2017-2025F

Bar chart showing values: 2017: 0.00, 2021: 0.00, 2025F: 5.40
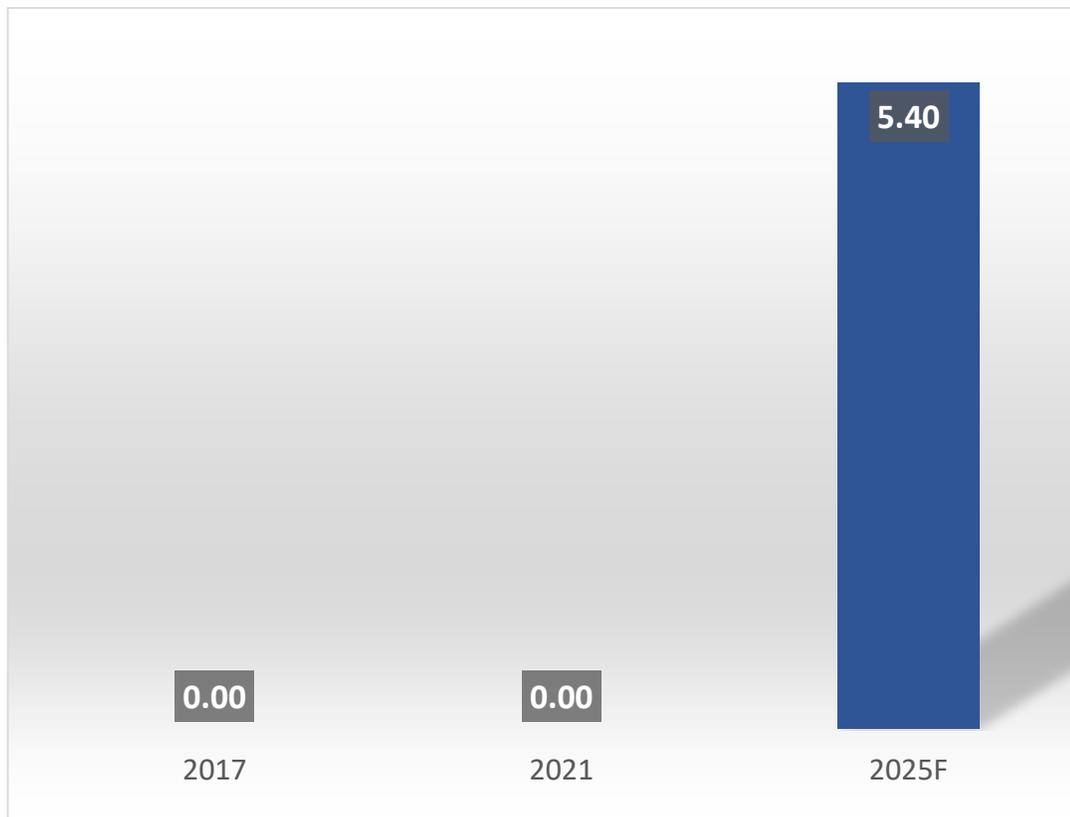
Source: TechSci Research

Key Growth Drivers:
- Growing demand of industrial revolution 4.0. technologies from end- user industries, support from government agencies, increasing participation from the academia, service providers, and the start-up community.
- Government policies & initiatives such as Qsim – Quantum Computer Simulator Toolkit, Quantum Communication Lab, Quantum Computing Applications Lab, National Mission on Quantum Technologies & Applications and others

Key Challenges:
- Suitable for specific tasks.
- Not open for public.
- Lacks the capability to domestically manufacture components and hardware.

- There is no market of quantum technology and is expected to reach USD 5.4 billion by 2025.
- Quantum Technology is highly focused on long-term R&D in India, and a few hundred researchers, industry professionals, academicians, and entrepreneurs are engaged.
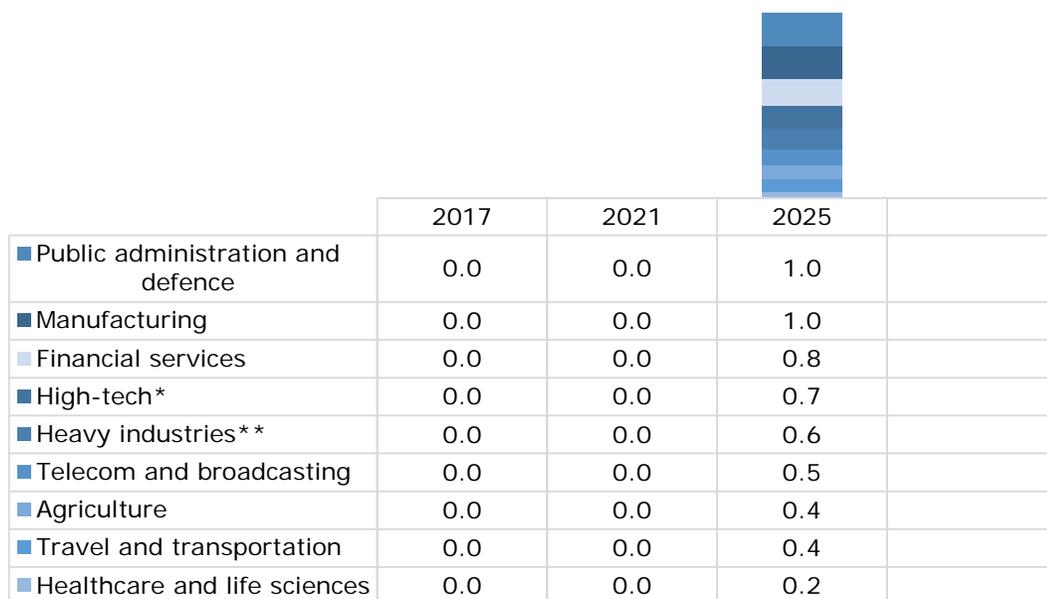
Note: CAGR can't be forecasted since there is no market of Quantum Technology

Executive Summary

India Quantum Market Size, By Technologies, By Value (USD Billion), 2017-2025F

	2017	2021	2025
Computing	0.0	0.0	2.8
Communications	0.0	0.0	1.1
Sensing	0.0	0.0	1.0
Materials	0.0	0.0	0.5

India Quantum Market Size, By Application, By Value (USD Billion), 2017-2025F

	2017	2021	2025
Public administration and defence	0.0	0.0	1.0
Manufacturing	0.0	0.0	1.0
Financial services	0.0	0.0	0.8
High-tech*	0.0	0.0	0.7
Heavy industries**	0.0	0.0	0.6
Telecom and broadcasting	0.0	0.0	0.5
Agriculture	0.0	0.0	0.4
Travel and transportation	0.0	0.0	0.4
Healthcare and life sciences	0.0	0.0	0.2

- Quantum computing is expected to dominate the market with USD 2.8 billion by 2025
- Key Growth Drivers of Quantum Computing: Quantum computers can manipulate information by tapping into quantum mechanical phenomena and are expected to solve complex optimization problems and boost the power of artificial intelligence. These could cover new scientific discoveries, life-saving drugs, and advancements in the supply chain, logistics, and financial data modeling.

- Public Administration and Defence is estimated to reach USD 1.0 billion by 2025.
- Key Growth Drivers of Public Administration and Defence: Increasing effects for military forces, intelligence services and law-enforcement agencies, increasing adoption in defense-related applications, such as communications, cybersecurity, intelligence services, and law-enforcement services.

Note
- *Denotes high-tech includes manufacturing of electric device
- **Denotes Heavy Industries includes utilities, resources, constructions

Source: TechSci Research

Key Focus Areas:

- Robust research and development in quantum communication, quantum cryptography, quantum computing, quantum communication, quantum metrology, sensing, quantum imaging, etc.
- Development of quantum computers, quantum algorithms and new applications, quantum key distribution (QKD) solution.
- Offering quantum computing as a service on the cloud to government ministries, departments, researchers, scientists, academia, and developers to bring advancement in manufacturing, healthcare, agriculture, and aerospace sectors.

Policies & Initiatives

- **QSim – Quantum Computer Simulator Toolkit:** Provide cost-effective research in Quantum Computing to students and researchers.
- **Quantum Communication Lab:** Introduced Quantum Key Distribution (QKD) solution that supports distance of more than 100 kilometres on standard optical fiber.
- **Quantum Lab:** To lead research and training in quantum key distribution, quantum communication, post-quantum cryptography and quantum computing.
- **Quantum Computing Applications Lab (QCAL):** To enhance quantum computing-led research and development and enable new scientific discoveries.
- **National Mission on Quantum Technologies & Applications (NM-QTA):** Focuses on Quantum Computers, Quantum Communication and produces quantum algorithmes and new applications.
- **Quantum-Enabled Science and Technology (QuEST) Program:** To build quantum computers and communication systems.

Key Focus Areas:

- Funding to quantum technology stakeholders to establish quantum technology ecosystem in India.
- Commercialization of quantum technologies.
- Developed Quantum Key Distribution.
- Establishment of centre of excellence to conduct extensive research on quantum computing, quantum communication, quantum sensing, quantum metrology, quantum cryptography, quantum error correction, and quantum algorithms. quantum crypto-analysis, quantum memory quantum materials and devices, quantum secure communication, quantum imaging and sensing.

Key Organizations Focus Areas		
Government Bodies	ASSOCHAM, Quantum Ecosystems Technology Council of India, Defence Research and Development Organization, Indian Space Research Organization	Roadmap of Quantum Computing Technology Adaptation, Commercialization and Future Strategies of Quantum Technologies Industry, and Supports Quantum Technology Stakeholders to Accelerate the Quantum Computing Ecosystem, Quantum communications
Public Institutions/ Research Institutes	Indian Institute of Technology (Madras, Jodhpur, Delhi), Indian Institute of Science(IISc) , Indian Institute of, Science Education and Research (IISER), Tata Institute of Fundamental Research (TIFR), Harish-Chandra Research Institute (HRI), Raman Research Institute, Bangalore, Indian Institute of Science Education and Research, Mohali	Quantum Key Distribution, Quantum Sensors, Quantum Computing, Post Quantum Cryptography, Quantum Error Correction, Quantum Communication, and Quantum Algorithms. Quantum Crypto-Analysis, Quantum Memory

Key Focus Areas:

- Development of 25-Qubit Quantum Computing, and Quantum-Based Security and Computing Technologies.
- Establishment of Quantum Computer.
- Establishment of Quantum Computing Application Lab to ease research and development of Quantum Computing.

## Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

- Defence Institute of Advanced Technology (DIAT) - Centre for Development of Advanced Computing (C-DAC)
- IIT Madras - Mphasis
- India - Israel
- QpiAI India Pvt. Ltd. - QuantrolOx
- Qnu - Amrita Vishwa Vidyapeetham
- Wipro - Tel Aviv university , Israel
- Tech Mahindra - Mahindra University
- Atos- Centre for Development of Advanced Computing
- India- Australia
- Indian Institute of Technology's (IIT) Alumni Council- Lomonosov Moscow State University (MSU) , Russoft
- India- Finland
- India – United States of America
- Harvard University - Amazon Web Series
- Tata Consultancy Services (TCS) - IIT Tirupati
- Infosys - Amazon Web Services (AWS)
- Ministry of Information and Technology (MeitY) - Amazon Web Services (AWS)
- Vellore Institute of Technology - QpiAI India Private Limited, NoPo Nanotechnologies India Private Limited
- QRDLab – University of Calcutta
- Ministry of Electronics and IT (MeitY),India – Directorate-General for Communications Networks, Content and Technology, European Union

Executive Summary

Competitiveness					
Parameter	**USA**	**China**	**Europe Union**	**Japan**	**India**
Market Size 2021-2025 (US$ Billion)/ Growth Rate 2021-2025 (CAGR, %)	0.9 – 4.3	0.3 – 1.6	0.6 – 1.8	0.2 – 0.9	Nil
	47.2%	43.7%	32.1%	36.2%	-
Government Policies/ Investments	Moderate	High	High	Moderate	Low
Workforce, Million, 2021	0.15	0.32	0.23	0.0015	0.0002
R & D Expenditure	Low- Moderate	High	Moderate	Low - Moderate	Low
Startups Penetration	Moderate- High	Low- Moderate	High	Low-Moderate	Low
Domestic/ Established Player Penetration	High	Moderate-High	High	Low –Moderate	Low
Share in scientific publications, 2021	23% - 25%	24% - 26%	21% - 23%	4% - 6%	1% - 3%
Number of Quantum Technology Patents, 2021	8% - 11%	52% - 55%	9% - 12%	13% - 16%	> 1%
Intensity of Investments/ Collaborations	High	Moderate- High	Moderate	Moderate	Low
Quantum Technology Skill Penetration	Moderate	Moderate	High	Low-Moderate	Moderate-High
Quantum Technology Master Program Offerings	High	Moderate- High	High	Low- Moderate	Low

Quantum Technology Market is at research stage in India
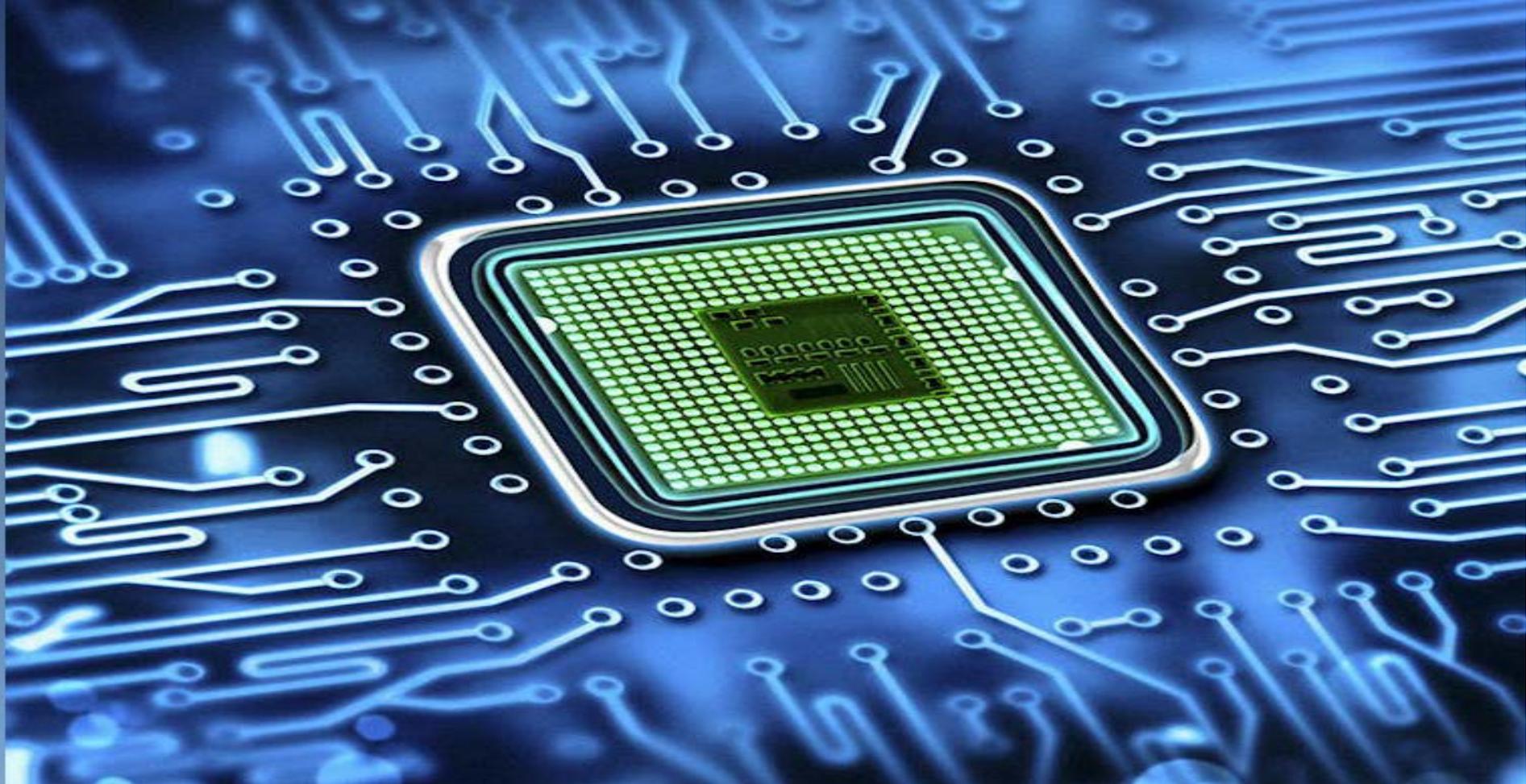
INDUSTRIAL TECHNOLOGY TREND SURVEY- SEMICONDUCTOR

Executive Summary

India Semiconductor Market Size, By Value (USD Billion), 2017-2025F

CAGR 2017 – 2021
By Value: 9.4%

CAGR 2021E – 2025F
By Value: 18.7 %

54.00 (2025F)

27.20 (2021)

19.00 (2017)

2017　　2021　　2025F

Source: TechSci Research

Key Growth Drivers:

- Increasing digital transformation among the country's consumers, enterprises and public sector through the adoption of new technologies, growing demand of electric vehicle, and increasing demand of high-speed connectivity.

- Government policies & initiatives such as Production Linked Incentives for Large Scale Electronics Manufacturing, National Policy on Electronics 2019, Modified Electronics Manufacturing Clusters (EMC 2.0) Scheme, Chips to Startup Programme (C2S) and others.

Key Challenges:

- High investment required.
- Setting of Fabrication facilities is expensive.
- Inadequate fabrication facilities.

- India semiconductor market stood at USD 27 billion in 2021 and is estimated to reach USD 54 billion by 2025. IOT, cloud computing & storage, machine learning & artificial intelligence, security are the latest technologies and trends in semiconductor.

Executive Summary

India Semiconductor Size, By Component, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ Memory	4.94	7.34	14.31
■ Micro Component	4.37	5.44	11.07
■ Logic	2.85	4.35	8.91
■ Analog	2.28	3.54	7.02
■ Discrete Component	1.90	2.72	4.86
■ Sensor	1.33	1.90	4.05
■ Optoelectronic	1.14	1.90	3.78

Total Value (USD Billion)	19	CAGR: 9.4%	27.2	CAGR: 18.7%	54

- The semiconductor in memory market was around USD 7.3 billion in 2021 and is estimated to reach USD 14.3 billion by 2025.
- The memory market is witnessing rapid growth as it is widely used in electronics items.

India Semiconductor Market Size, By End-User, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ **Communication**	**9.88**	**13.9**	**27.27**
■ **Data Processing**	**3.90**	**5.4**	**10.26**
■ **Industrial**	**1.52**	**2.4**	**4.86**
■ **Consumer Electronics**	**1.14**	**1.9**	**3.78**
■ **Automotive**	**0.86**	**1.4**	**3.78**
■ **Others**	**1.71**	**2.2**	**4.05**

Total Value (USD Billion)	19	CAGR: 9.4%	27.2	CAGR: 18.7%	54

- Semiconductor in consumer electronics was around USD 1.9 billion and is estimated to reach around USD 3.7 billion by 2025.
- Semiconductor in consumer electronics market is growing owing to increasing demand of electronic products by consumer in their day-to-day life.

Other includes Healthcare, Security, Banking, Manufacturing etc.

Source: TechSci Research

India Semiconductor Market, Market Map, By End-User, Market Size (USD Billion) & Growth Rate (%)

End-User	Market Size (USD Billion)		CAGR (%)
	2021	2025	2021-2025
Automotive	1.4	3.78	29%
Communication	13.9	27.27	18%
Industrial	2.4	4.86	19%
Data Processing	5.4	10.26	17%
Consumer Electronics	1.9	3.78	19%
Others	2.2	4.05	17%

Average Market Size @ 4.5 USD Billion

Overall Market Growth @ 18.70%

Market size represents 2021
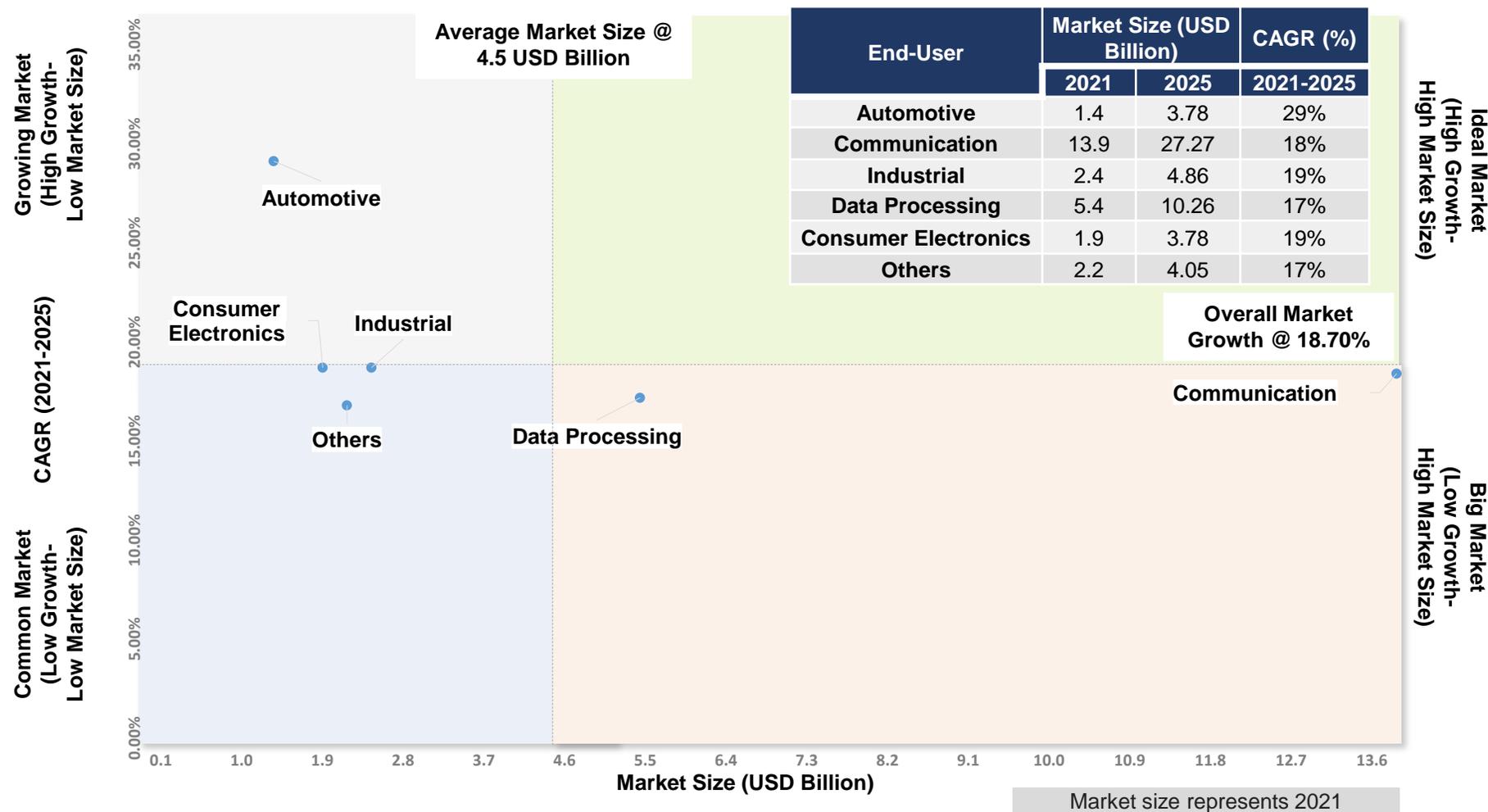
In semiconductor market, automotive, communication, industrial are the growing market as it has the forecast CAGR (2021-2025) of 29%, 18%, and 19% respectively, which is higher as the overall market forecast CAGR of 18.70%

Source: TechSci Research

Key Focus Areas:

- Financial incentive to boost domestic manufacturing, and to position India as a global hub for Electronics System Design and Manufacturing (ESDM).
- Development of an entrepreneurial ecosystem, bring innovation and catalyze the economic growth by attracting investments.
- Introduction of globally competitive incentive package to companies in semiconductors, display manufacturing as well as in design.
- Collaboration with global technology companies, government stakeholders, industry, academia, and experts to attract semiconductor design and manufacturing investments.
- Setting-up semiconductor wafer fabrication facilities.

Policies & Initiatives

- **Production Linked Incentives for Large Scale Electronics Manufacturing:** Focus on cell phone manufacturing and specified electronic components, including Assembly, Testing, Marking and Packaging (ATMP) units.
- **Production Linked Incentives for IT Hardware:** Focus on domestic manufacturing and attract large investments in the value chain including laptops, tablets etc.
- **National Policy on Electronics 2019:** To make global hub for Electronics System Design and Manufacturing
- **Modified Electronics Manufacturing Clusters (EMC 2.0) Scheme:** Focus on infrastructure, shared facilities and amenities, including Ready Built Factory (RBF) sheds, and plug and play facilities to deepen the electronic value chain.
- **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS):** To fill gap of disability for domestic manufacturing of electronic components and semiconductors to enhance the electronics manufacturing ecosystem.
- **Chips to Startup Programme (C2S):** To transform India into the next semiconductor hub.
- **India Semiconductor Mission:** To set up semiconductor fabs, display units, and to set up compound semiconductors/ Silicon photonics/ sensors fab and semiconductor assembly, testing, marking and packaging (ATMP)/ OSAT facilities., To enhance and ease access to semiconductor design infrastructure for the startups and MSMEs.

Key Focus Areas:

- Foreign Direct Investments in the ESDM sector.

- Establishment of the ESDM ecosystem through brownfield & greenfield clusters, incubation centers, and skill development programs.

- Workforce training in semiconductors and display manufacturing and expanding electropreneur parks.

- Assisting central government of India and state government of India on several initiatives to make global manufacturing hub for entire the electronic industry.

- Designing and development of low power semiconductor chips.

- Offering technical support for the growth of Indian start-ups and small and medium enterprises.

- Expansion of electropreneur parks.

Key Organizations Focus Areas		
Government Bodies	India Electronics and Semiconductor Association, Semiconductor Industry Association, Ministry of Electronics and Information Technology (MEITY), India Cellular and Electronics Association (ICEA), Electronic Industries Association of India (ELCINA), All India Council for Technical Education (AICTE)	Workforce training in semiconductors and display manufacturing, focuses on electronics & semiconductor design & manufacturing, expands electropreneur parks, initiated semiconductor fabless accelerator lab, supports the government of India and states on several initiatives to make the global manufacturing hub for the entire electronics Industry, organizing events to strengthen semiconductor ecosystem .
Public Institutions/ Research Institutes	Semi - Conductor Laboratory, Mohali, Indian Institute of Technology (Madras, Hyderabad, Kanpur, Indore, Bhubaneswar, Bombay, Banaras Hindu University) , National Institute of Science and Technology (NIST) Odisha,	Focuses on to set up prototype fabrication unit, semiconductor device, mass production of homegrown architected and designed chip, focuses on knowledge sharing and offer technical support for the growth of Indian start-ups and SMEs, designed and developed lower power semiconductor chips .

Key Focus Areas:

- Collaboration with domestic and foreign players to establish labs, high- tech semiconductor park and to support semiconductor design start-ups.

- Planning to establish fabrication units to manufacture next generation displays for smartphones, tablet computers, and laptops.

- Education and Innovation in Semiconductor Technology, Nanoscience, Communications.

- Designing and manufacturing of narrowband-internet-of- things system system-on-chip.

Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

- Applied Materials India Pvt. Ltd. – IIT Bombay

- Qualcomm India- Centre for Development of Advanced Computing (C-DAC)

- Telangana Government- Elest (Rajesh Export)

- IIT BHU- Applied Materials India Pvt. Ltd.

- Semiconductor Research Corporation - IIT Bombay

- Tamil Nadu- IGSS Venture

- Karnataka Government –ISMC Analog Fab Private Ltd

- Centre for Development of Advanced Computing - Synopsys, Cadence Design Systems, Siemens EDA, Silvaco Group, Inc.

- Signalchip- Centre for Development of Advanced Computing

- AICTE- SEMI Tech Services India Pvt. Ltd., India Semiconductor Mission (ISM) and VLSI Society of India (VSI)

- Polymatech- Tamil Nadu Government

- NIST Odisha- National Taiwan University, University of Electro Communications , Japan

- IEEE India- Centre for Development of Advanced Computing (C-DAC)

- Cyient- WiSig Networks (IIT- Hyderabad)

- India Electronics and Semiconductor Association - Semiconductor Industry Association

- Karnataka Government –ISMC Analog Fab Private Ltd

- Messe Muenchen India – India Cellular and Electronics Association (ICEA)

- Atal Community Innovation Center- Kalasalingam Innovation Foundation- Centre for Development of Advanced Computing(C-DAC)

- Qualcomm India- Centre for Development of Advanced Computing (C-DAC)

- AICTE- SEMI Tech Services India Pvt. Ltd., India Semiconductor Mission (ISM) and VLSI Society of India (VSI)
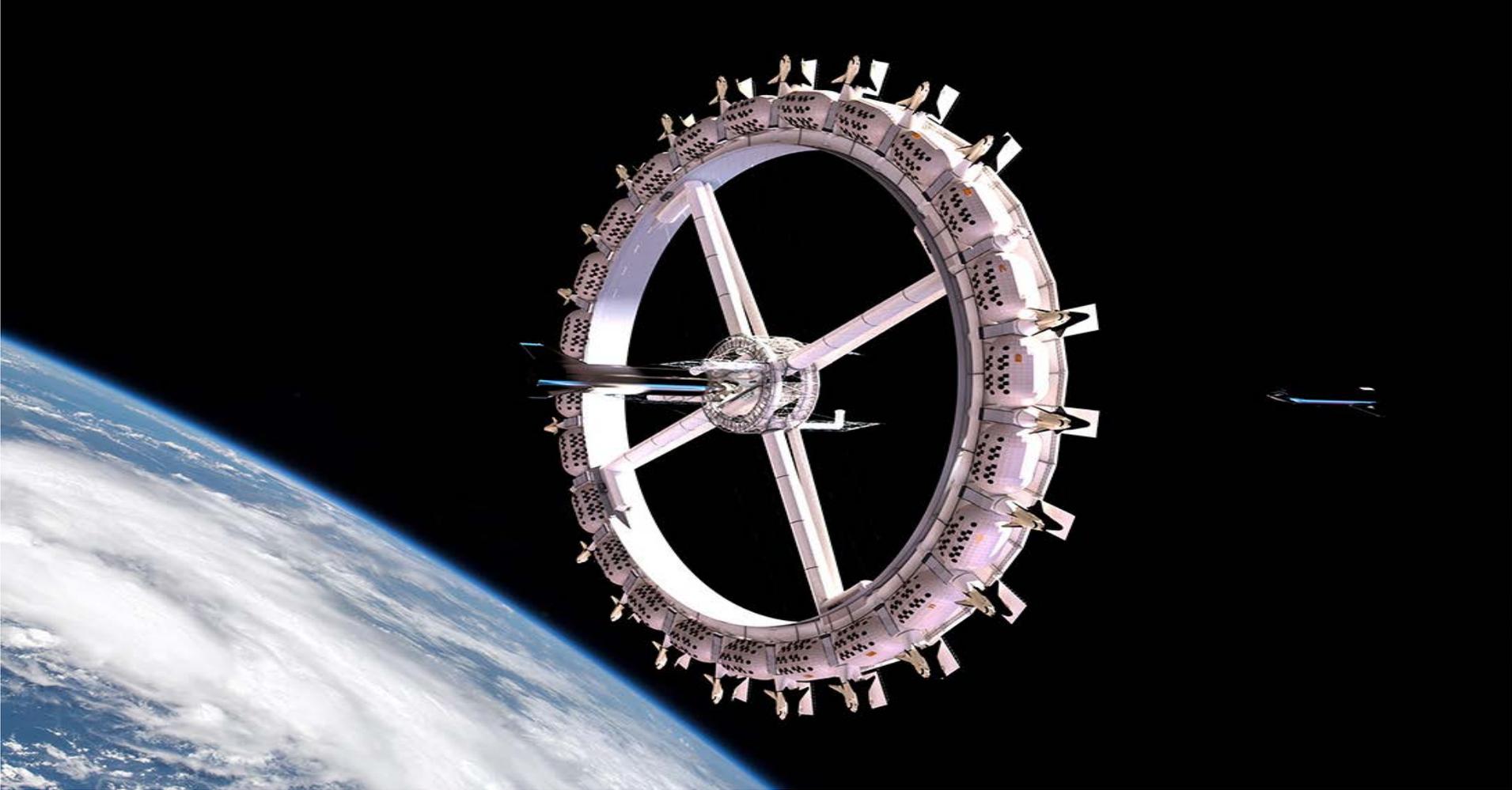
Executive Summary

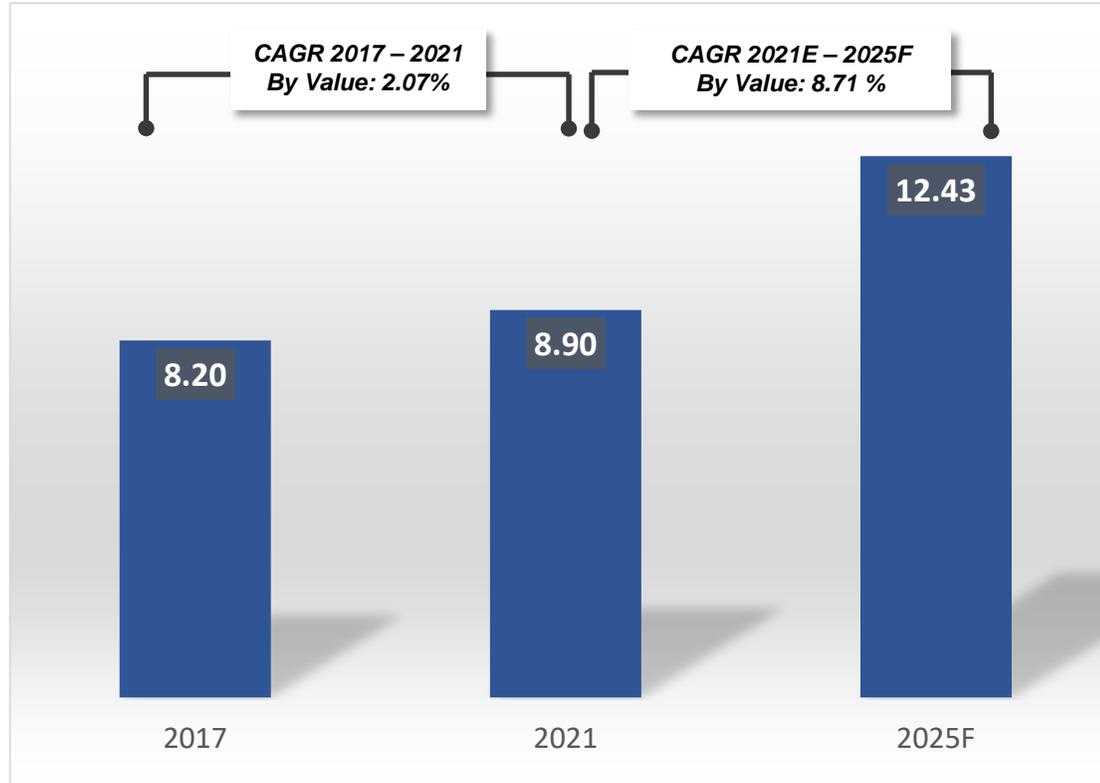| Competitiveness					
Parameter	**USA**	**China**	**European Union**	**Japan**	**India**
Market Size 2021-2025 (US$ Billion/ Growth Rate 2021-2025 (CAGR, %)	258 - 483	40 - 117	44 - 90	48 - 146	27 - 54
	16.9%	30.6%	19.5%	31.8%	18.7%
Global Semiconductor Market Share	48%	5%	10%	11%	Less than 1%
Government Policies, Investments, Initiatives 2021-2025	High	High	Moderate - High	Moderate - High	Low - Moderate
R & D Expenditure, % Overall Sectors	19%	7%	10%	7%	Les than 0.1%
Workforce, Million 2021	1.8 - 2.5	0.5 - 1	1.2 - 2	0.2 - 0.5	0.13 – 0.16
Intensity of Investments / Collaborations/	High	High	Moderate – High	Moderate	Low- Moderate
Startups Penetrations	Low	Moderate	Moderate – High	Low-Moderate	High
Domestic Players Penetrations	High	High	Moderate - High	High	Low- Moderate
Semiconductor Ecosystem Penetration — EDA & Core IP	High	Low	Moderate	Low	Semiconductor manufacturing is at nascent stage and the country has design talent.
Logic	High	Low	Moderate	Low	
DAO	High	Low	Moderate	Moderate	
Water Fabrications	Moderate	Moderate	Low	High	
Manufacturing Equipments	High	Low	Moderate	Moderate	
Materials	Low	Moderate	Moderate	High	

Semiconductor Manufacturing in India is at nascent stage

Source: TechSci Research, Semiconductor Industry Associations

INDUSTRIAL TECHNOLOGY TREND SURVEY- SPACE

Executive Summary

India Space Economy Size, By Value (USD Billion), 2017-2025F

CAGR 2017 – 2021
By Value: 2.07%

CAGR 2021E – 2025F
By Value: 8.71 %

8.20 (2017)

8.90 (2021)

12.43 (2025F)

Source: TechSci Research

Key Growth Drivers:
- Increasing private companies' participation and funding, technological advancements, rising security concerns, growing public interests, development of reusable rockets.
- Government initiatives such as Satellite Communication Policy, SATCOM, Space-based Remote Sensing Policy of India.

Key Challenges:
- Research and development costs
- Space travelling costs
- Risk to astronauts
- High collection of debris around planet

- India's space economy size stood at USD 8.9 billion in 2021 and is estimated to reach USD 12.43 billion by 2025. Artificial Intelligence, big data, biometrics, blockchain, and the internet of things are the latest technologies and trends in space.

India Space Economy Size, By Type, By Value (USD Billion), 2017-2025F

	2017	2021	2025
■ Satellite Services	3.20	3.56	4.97
■ Ground Segment	2.62	2.85	3.85
■ Satellite Manufacturing	1.80	1.87	2.86
■ Launch Services	0.57	0.62	0.75

Total Value (USD Billion)	8.20	CAGR: 2.07%	8.90	CAGR: 8.71%	12.43

Source: TechSci Research

- The satellite services market size in space economy was around USD 2.8 billion in 2021 and is estimated to reach USD 3.9 billion by 2025.

- Key growth Drivers of Satellite Services: Growing consumer demand of Direct- To-Home services, the presence of giant satellite service providers, and rising business opportunities in content distribution through Over-The-Top (OTT).

Key Focus Areas:

- Encourage various stakeholders, including private companies, to enhance the commercialization of space technology.
- Encourage spatial thinking, knowledge, and infrastructure, and promote the use of geospatial data, products, solutions and services.
- Improve satellite communications service industry, launch vehicle and ground equipment industry.
- Ensure the protection of space assets and adopt measures to space assets under administrative control to utilize space-based communication for national needs.
- Focuses on the transfer of technologies, license fees and other charges related to technology transfer.
- Enable participation of various national stakeholders in Indian human space programme.

Policies & Initiatives

- **Satellite Communication Policy, SATCOM:** Focuses on satellite communication, launch vehicles and ground equipment industry.
- **Space-based Remote Sensing Policy of India:** Encourage to participate in space based remote sensing activities.
- **Draft Space Activities Bill:** Supports Commercial Space Activity.
- **Draft Spacecom Policy 2020:** Encourages private companies' participation, and govern satellite communication, launch vehicles and ground equipment industry.
- **Technology Transfer Policy 2020:** Focuses on transfer of technologies, fixes license fee and other charges for transfers.
- **Draft National Space Transportation Policy 2020:** Focuses on rocket launching, launchpads etc.
- **National Geospatial Policy 2021:** Encourage spatial thinking, knowledge, infrastructure, and promote use of geospatial data, products, solutions and services.
- **Draft Indian Satellite Navigation Policy (SATNA V Policy – 2021):** Focuses on satellite- based navigation and applications in commercial, strategic, and societal applications.
- **Humans in Space Policy for India 2021:** To achieve the vision of human presence in space for development, innovation and foster collaborations.

Key Focus Areas:

- Conduct extensive research on astrophysics, observational astronomy, Geo-information (GI) science, galactic and extragalactic astronomy, space research and applications, earth observations satellite, atmospheric, space science and astronomical instrumentation, Indian Network for Space Weather Impact Monitoring.

- Launched platforms, and events to inspire youngsters, and introduced programme to train foreign candidate from selected countries on assembling integrating and testing nano satellites.

- Design and development of new space transportation solutions, development of navigation satellite systems, satellites for space science and planetary exploration, earth observation applications, and space-based systems for societal applications.

- Focus on policy, resources, technology, R&D, design, development, manufacturing, engineering, infrastructure, business, applications, operations, management, services, institutions, multi-disciplinary and inter-domain integration aspects where applicable, market trends and human resources.

- Focus on space communications & services (SCS), including broadband platform, equipment, infrastructure, applications, services, & human resources.

Key Organizations Focus Areas		
Government Bodies	Indian Space Research Organization, India Space Association (ISpA), New Space India Limited, Indian National Space Promotion and Authorization Center (IN-SPACe), Indian Institute of Remote Sensing	Geo-information (GI) Science and Earth Observation, Satellite Communications Programs, Disaster Management Support Program, Space & Atmospheric Science Programs, Communication Satellites, Earth Observation Satellites, Launch Vehicles (LV) including Platform, Space Equipment, Space Infrastructure, Space Applications, Space Services & Human Resources, Remote Sensing, Space Science, Space Technology, Space Communications & Services (SCS) including Broadband Platform etc.
Public Institutions/ Research Institutes	India Institute of Technology (Kanpur, Bangalore, Bombay), Indian Institute of Space science and Technology, Indian Institute of Astrophysics	Astrophysics, Observational Astronomy, Galactic and Extragalactic Astronomy, Space and Astronomical Instrumentation, Space Bricks, Satellite, Space Research and Applications, Earth Observations

Key Focus Areas:

- Feasibility study on lunar pole surface exploration and focuses on earth remote sensing, satellite communication, navigation, space science and planetary exploration.
- Focus on space infrastructure, satellite-based navigations, spacecraft, launch vehicles, space systems, ground systems.
- Collaboration with foreign or domestic companies, universities and government bodies to ease research, academic exchange, exploration and development and use of outer space.
- Developed facilities to train its astronauts.

Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

• New Space India Ltd. (NSIL) – Hindustan Aeronautics Limited (HAL) Larsen & Turbo (L&T)	• Indian Space Research Organization (ISRO) - Department of Information Technology & Telecom	• Indian Institute of Space Science and Technology (IIST) - Nanyang Technological University (NTU), Singapore
• Department of Space (DOS) – NewSpace India Limited (NSIL)	• Indian Space Research Organization (ISRO) - Mexico Space Agency	• Space Physics Laboratory (SPL) collaborations in Space Science and Technology
• Indian Space Research Organization (ISRO) – National Space Research and Development Agency (NASRDA)	• Indian Space Research Organization (ISRO) – Bahrain National Space Science	• Physical Physics Laboratory (SPL) collaborations in Space Science and Technology
• Indian Space Research Organization (ISRO)- National Aeronautics and Space Administration (NASA)	• Government of India - Government of Mongolia	• National Atmospheric Research Laboratory (NARL) collaborations in Space Science and Technology
• Indian Space Research Organization (ISRO)- Russian State Space Corporation 'Roscosmos'	• Indian Space Research Organization (ISRO) – Canadian Space Agency (CSA)	• U R Rao Satellite Centre (URSC) collaborations in Space Science and Technology
• Indian Space Research Organization (ISRO)- Japan Aerospace Exploration Agency (JAXA)	• Indian Space Research Organization (ISRO), Bengaluru and Central University of Himachal Pradesh (CUHP)	
• Indian Space Research Organization (ISRO)- French space agency Centre National d'Études Spatiales (CNES)		

Key Focus Areas:

- Focus on electric propulsion systems for small satellites and GEO-LEO (Geosynchronous Earth Orbit- Low Earth Orbit) optical link.
- Transfer technologies to the Indian Industry, to build cost competitive and reliable satellite communications systems.
- Establish optical telescope observational facilities for space object tracking, R&D studies in space weather, astrophysics, Near Earth Objects, Space Situational Awareness (SSA) and Astrophysics.

Joint Initiatives/ Cooperations of Foreign Companies/ Research Institutes/ Indian Companies

- Indian Space Research Organization (ISRO)- Israel Space Agency
- Indian Space Research Organization (ISRO)- Luxembourg Space Agency
- Jio Platforms Limited (JPL)– SES S.A.
- Department of Space, India – Brazilian Space Agency (AEB)
- Indian Space Research Organization (ISRO) - Defence Research and Development Organization (DRDO) & Hindustan Aeronautics Limited (HAL)
- Department of Space (DOS) – NewSpace India Limited (NSIL)
- Indian Space Research Organization - Indian Institute of Astrophysics
- Taiwan Space Industry Development Association (TSIDA) - SatCom Industry Association of India (SIA-India)
- Indian Space Research Organization – IIT Roorkee

- ISRO and University of Texas, Austin, USA
- Indian Space Research Organization (ISRO) - South African National Space Agency (SANSA)
- Indian Space Research Organization (ISRO) – China National Space Administration
- ANANTH Technologies Ltd.- Saturn Satellite Networks Inc. (Saturn)
- India – Indonesia
- Indian Space Research Organization (ISRO) – National Space Research and Development Agency (NASRDA), Nigeria
- Indian Space Research Organization (ISRO)- Russian State Space Corporation 'Roscosmos'
- Indian Space Research Organization (ISRO) - Luxembourg Space Agency
- Indian Space Research Organization (ISRO) - Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital

- Raman Research Institute (RRI)
- Institute of Radio Physics and Electronics
- European Space Agency(ESA)- Indian Space Research Organization
- Australian Space Agency - ISRO
- Indian Space of Research Organization - National Centre for Cartography and Remote Sensing, Tunisia
- Indian Space Research Organization (ISRO) - University of Texas, Austin, USA
- New Space India Ltd. (NSIL) – Hindustan Aeronautics Limited (HAL) - Larsen & Turbo (L&T)

Executive Summary

	Competitiveness				
Parameter	**USA**	**China**	**European Union**	**Japan**	**India**
Size 2021, 2025 (US$ Billion)/ Growth Rate 2021, 2025 (CAGR, %)	160.1-170.2	46.9- 51.0	57.5-64.4	11.2- 15.6	8.9 - 12.4
	1.5%	2.1%	2.8%	8.6%	8.7%
Government Policies and Investments	High	Moderate- High	Moderate- High	Moderate	Low-Moderate
Workforce*, Million 2021	~0.15	~0.33	~ 0.22	~0.0016	~0.05
R & D Expenditure	High	Moderate-High	Moderate -High	Moderate- High	Low - Moderate
Startups Penetration	High	Moderate-High	Moderate -High	Low –Moderate	Low
Domestic/ Established Player Penetration	High	Moderate- High	Moderate - High	Low- Moderate	Moderate
Estimated Government Space Budget, 2021, US$ Billion	54.6	12	9	4.1	1.9
Number of Space Tech Companies and Organization, 2021	~ 5,600	~ 300	~ 600	~190	~ 600
Space Launch , 2021	High	High	Moderate- High	Low- Moderate	Low- Moderate
Intensity of Investments/ Collaborations	High	Moderate- High	Moderate- High	Moderate- High	Low- Moderate

India and Japan share few characteristics directionally in the same direction

Note: * The Workforce Number are for the Government Space Organization/ Institutions

Source: TechSci Research, Indian Space Associations