State of IoT:

The Post Pandemic Resurgence

NASSCOM®

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1. Executive Summary

Technology is playing a pivotal role in helping societies respond, recover, and thrive in the COVID-hit world. The increasing importance of capturing real-time data and acting upon the insights is driving focus on Internet of Things (IoT) – both in terms of its wider applicability and the path towards achieving scale. IoT spending has been increasing each year across the globe even in times of the pandemic. While economic barriers are receding, significant obstacles remain in adoption, security, and reliability of this technology. A positive, virtuous cycle of accelerated growth can be charted when scale of adoption will meet sophistication in terms of more automation, to deliver both cutting-edge solutions, as well as, technology for the larger social development. As intelligent devices and machines become more available, IoT technology will begin to be viewed as having a reinforcing positive impact on the everyday lives of citizens.

IoT evolution over the years

01

- 2010-2020, a decade famously known as a period of digital disruption, **focused mainly on tech adoption**
- Witnessed **technologies intertwining** into every industry and industry value chains
- **Industry convergence** was witnessed as firms saw competition coming from outside their sectors; e.g. in automobiles, eCommerce and manufacturing sectors

02

- Witnessed trends such as **accelerated IoT adoption to focused sectoral IoT implementation** across businesses
- **Changing consumer/patient preferences** and work-from-anywhere model further pushed IoT application/spending in all the sectors
- **Global IoT spending to return to double-digit growth** rates in 2021 (11.3% CAGR from 2020-2024)
- **HealthTech, EdTech, and RetailTech** sectors are the top most sectors in adopting IoT

03

- Adoption of IoT/IIoT attaining ground
- **IoT's conjunction with other technologies** such as AI/ML and Big data will gain momentum to generate more value
- Spending pattern to shift from devices and sensors to **cloud, data & analytics, and software** to manage daily tasks and be ahead of the digital curve
- **Indian Government's digital transformation agenda** will be an imminent boost to India's digital transformation imperative

CURRENT ADOPTION TRENDS AND FUTURE OUTLOOK

1 EVOLUTION OF IOT AND ITS JOURNEY IN THE PRE-PANDEMIC ERA

- IoT will likely grow to $1.1 trillion in 2023 growing at a CAGR of 12.6% from 2019-2023 period
- Key developments have been seen in the sectors including **Healthcare, Manufacturing and Supply chain, Education, and Smart homes**
- IoT, being a foundational technology, has been significantly leveraged in conjunction with other technologies such as AI/ML and Big data to generate higher value

2 DEFINITIVE IRREVERSIBLE PUSH FOR ACCELERATED ADOPTION DURING THE PANDEMIC

- The IoT worldwide spending will likely **return to double-digit growth rates in 2021** and achieve a CAGR of 11.3% over the 2020-2024 period
- **Healthcare, insurance, and education sectors** to deliver the strongest industry gains in IoT spending in 2021
- COVID-19 has been unknowingly acted **as the catalyst of the accelerated IoT adoption in multiple sectors and provided the fasted transformational push** leading to accelerated local adoption of the IoT

3 ONGOING INVESTMENTS AND M&A ACTIVITY IN IOT

- IoT M&A market remained red hot during the pandemic **–$93 billion aggregate deal volume** witnessed from Q1 2020 to Q1 2021 – this strong activity will likely continue in 2021
- **Healthcare, Consumer and Smart building sectors** saw the highest M&A activity from 2020-2021 period

4 THE WAY FORWARD FOR IOT IN 2021-2022

- In the next 5 years, the four segments that will see highest investments/spending are **Connected health, Smart cities, Industrial IoT, and Connected transportation**
- All of these areas underpin the importance of implementing IoT in combination with other digital technologies
- Hence, there is a spending pattern shift from devices and sensors to more integrated utilization of **cloud, data and analytics, and software**

5 IOT ADOPTION in INDIA AND WAY FORWARD

- IoT investments to go up **to $15 billion in 2021** from $5 billion in 2019 in India
- In India, similar to global, **Agriculture, Manufacturing, Transportation, and Lifescience and pharma** are likely to adopt IoT at a higher pace
- The government of India (GoI) is also stepping up IoT ecosystem to scale up India as an IoT destination; Multiple government backed initiatives to strengthen IoT's growth including developing **100 smart city projects and a $100 billion investment in the telecommunications sector by 2022,** (the National Digital Communications Policy 2018)
- GoI should also join hands with other organizations, from R&D in IoT viewpoint, **to work on a conducive national IoT policy**

6 KEY CHALLENGES AND ASSOCIATED RISKS

- **Building the core infrastructure for the IoT supply and demand ecosystem**, to domestically drive particularly changing mind of people and removing job loss fear
- **Data security and privacy concerns** around personal and non-personal data and effective management of data continue to be a concern
- **Building IoT technologic skilling** at scale will be required in the next 4-5 years

Table of Contents

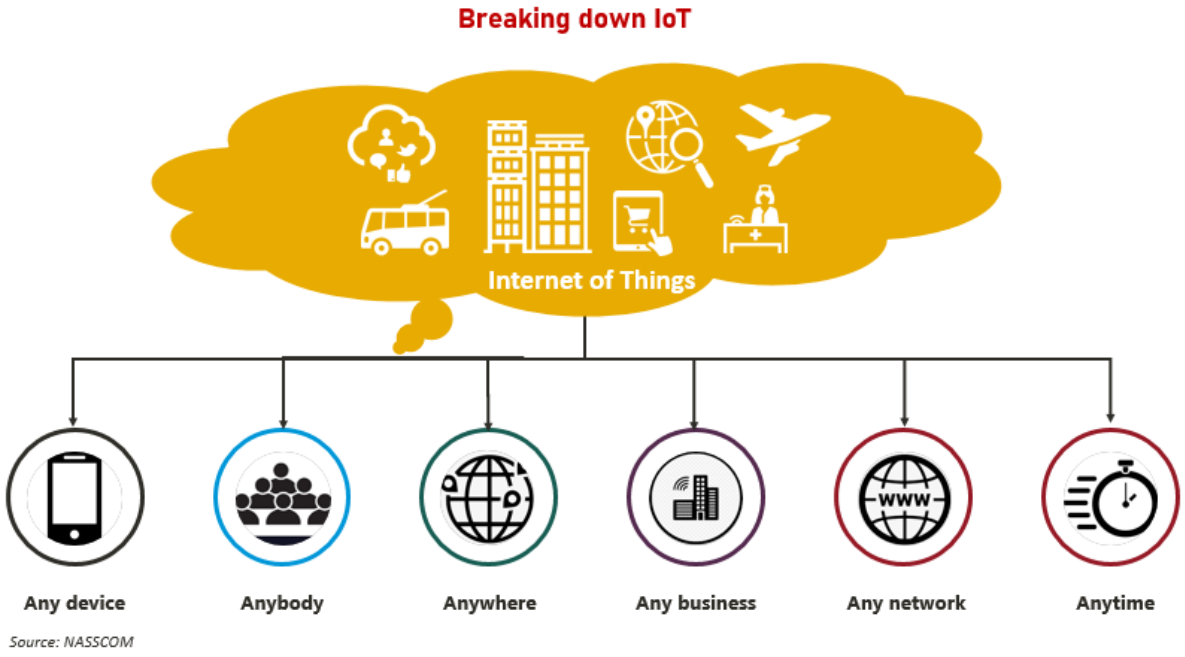
The IoT Landscape

2. The IoT landscape

How would be the world without the Internet? It is difficult to imagine such a scenario we have never seen. Today, the Internet has become more important for everybody in both personal and professional lives. Different devices that are increasingly IoT-enabled, such as smartphones, sensors, mobile computers, and other smart appliances and objects are examples of everyday "things" getting more and more infused into our lives.

2.1 IoT – One paradigm, many definitions

IoT is an ecosystem of connected devices that exchange data over a wired or wireless network to deliver some preset conditional data, and derive both, intelligence and next-stage decisions, from that data. These devices could be smartphones, laptops, smart electric appliances, smart office equipment, or any device tagged with sensors. Data generated by these devices is routed to on-premise data centers or cloud storage, and more recently, to Edge storage, where it is analyzed for insights. Increasingly, the data generated by one equipment is also getting routed directly to another equipment to initiate a response action, thus creating a series of machine-to-machine or M2M communication, where it is processed to gain insights that help in taking decisions.



Source: NASSCOM

World Economic Forum defines IoT as:

A growing network of internet-enabled devices, with applications as wide-ranging as smart cities today, and driverless cars in the future. Along with other emerging technologies, such as AI, the IoT is a part of the Fourth Industrial Revolution

Gartner offers a more elaborate functional definition of IoT, as:

A network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment. The connecting of

assets, processes and personnel enables the capture of data and events from which a company can learn behavior and usage, react with preventive action, or augment or transform business processes. The IoT is a foundational capability for the creation of a digital business.

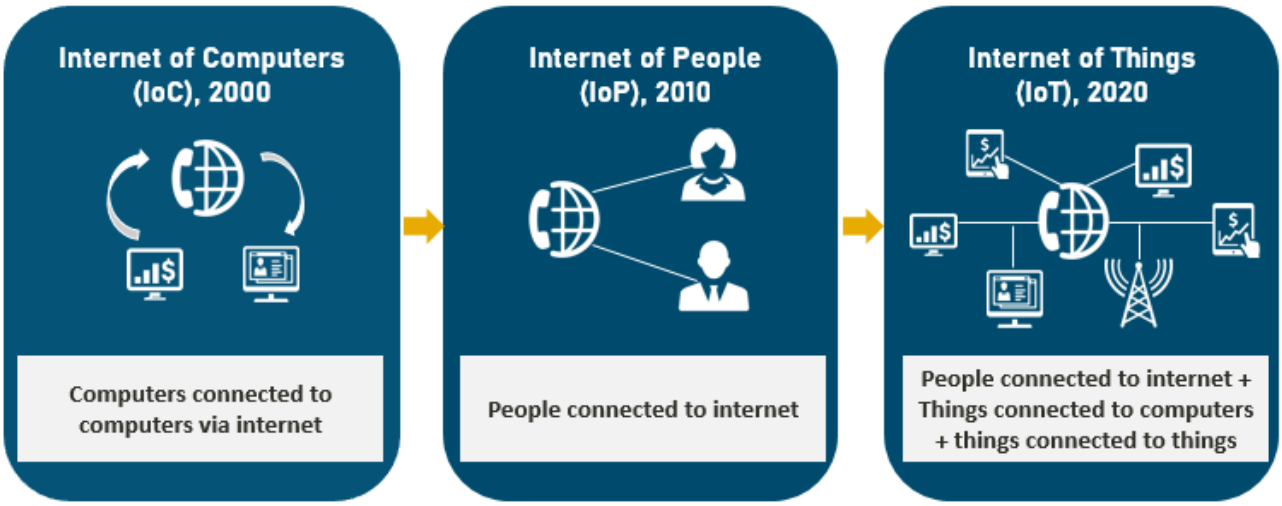
Simply put, IoT is

> IoT is a network of physical objects that…
> …contains embedded technology to communicate and sense or interact…
> …with their internal states or the external environment.

2.2 Evolution of IoT

Since its first commercial use outside of academic labs in the early 1990s, Internet has grown, from the Internet of Computers in the early 2000s that connected two or more computing devices over LAN or WAN networks, to the Internet of People, that mushroomed rapidly from 2010s to give us the Twitter, LinkedIn, Instagram that we know today. Now, we are in the IoT era where people-to-machine (and back), and M2M communications rule. An estimate suggests that by 2025, 60-67% of all data generated will be non-human or M2M.

Evolution of IoT over the years



Source: NASSCOM

IoT's evolution synchronizes well with certain enabling demand and supply factors that supported its formative stages:

Supply-side factors:

1. Rapid R&D reduced the cost of cutting-edge devices and greatly enhanced accessibility across consumer genres
2. Embedded software became a mainstay of industrial equipment, and lately, personal devices
3. IoT equipment costs – costs of basic sensors that are internet-enabled – and more complex devices – decreased rapidly in the 15 years from 2004 to 2020, from US$ 1.3 per sensor to less than US$0.4 (Statista)

Demand-side factors:

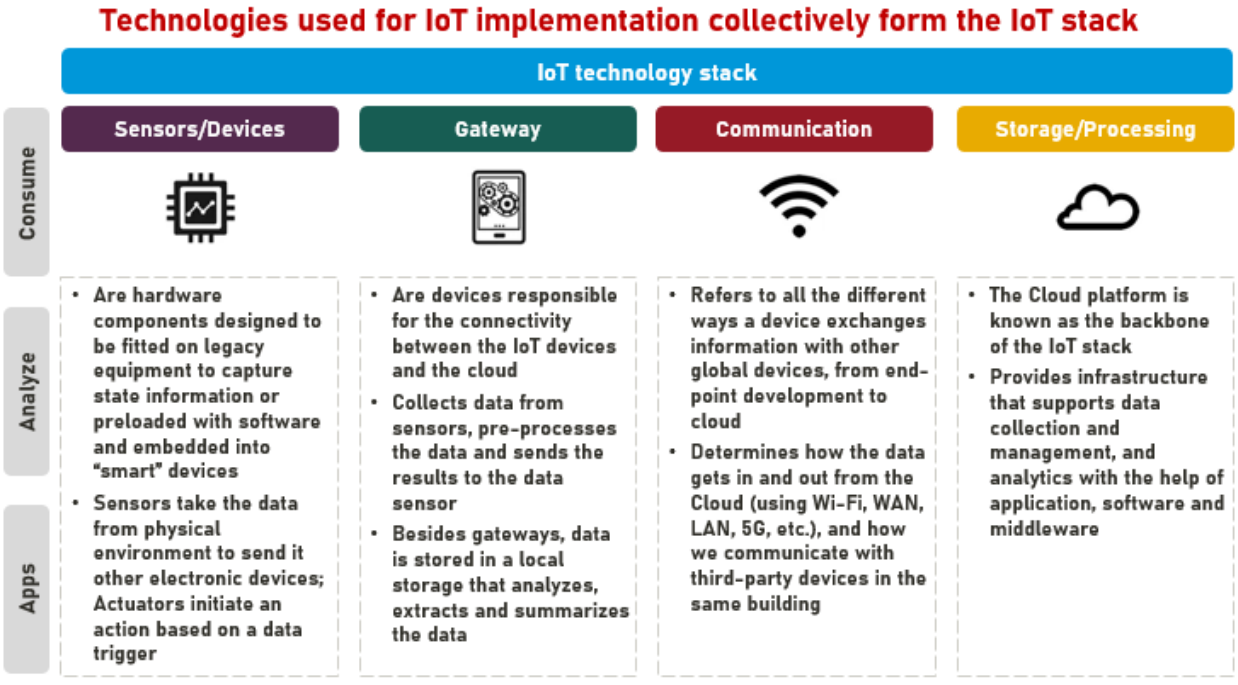
1. Non-linear growth in demand for smartphones and the Internet
2. Rising middle-class and their discretionary spend propensity has pulled suppliers of personal and home devices to go smart
3. The fast pace of technological sophistication in the industrial and agricultural sectors world over, a lot of which got attributed to retrofitted traditional equipment showing early benefits, has driven significant adoption and opened avenues for more integrated products and services

How does this bode for IoT advancement? The frontier is being shaped by M2M communications and how these could be fine-tuned with emerging communications technologies, such as 5G, and more API-based and open architecture developmental platforms to build autonomous processes. Areas that could see stronger adoption in the future include manufacturing operations, transportation, smart grid technologies, smart buildings, and, increasingly, consumer IoT, smart home automation, and retail.

2.3 Core technologies of IoT implementation

IoT Technology stack

An IoT solution is formed of several elements, across hardware, software, and platforms, that each contributes to creating the IoT value chain, as illustrated.

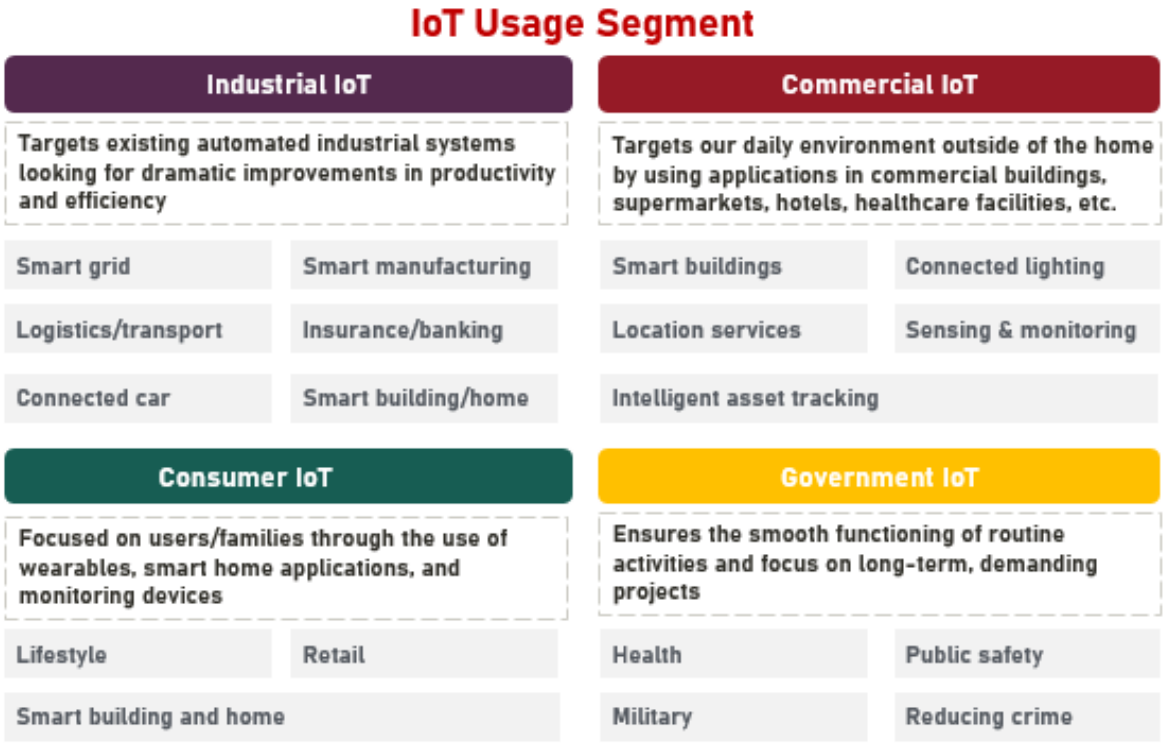


Source: NASSCOM

IoT Usage Segments

The positive impact that the IoT solutions brought to various industries has been capturing the attention of industrial companies and manufacturers who aim to optimize their current processes by implementing new capabilities like remote controlling or monitoring of their supply chain processes, as well as implementing sensors directly to their machines to

carry out predictive and preventive maintenance, to save millions of dollars. Key application areas in the four major user segments – industrial, commercial, consumer, and government – are illustrated below:

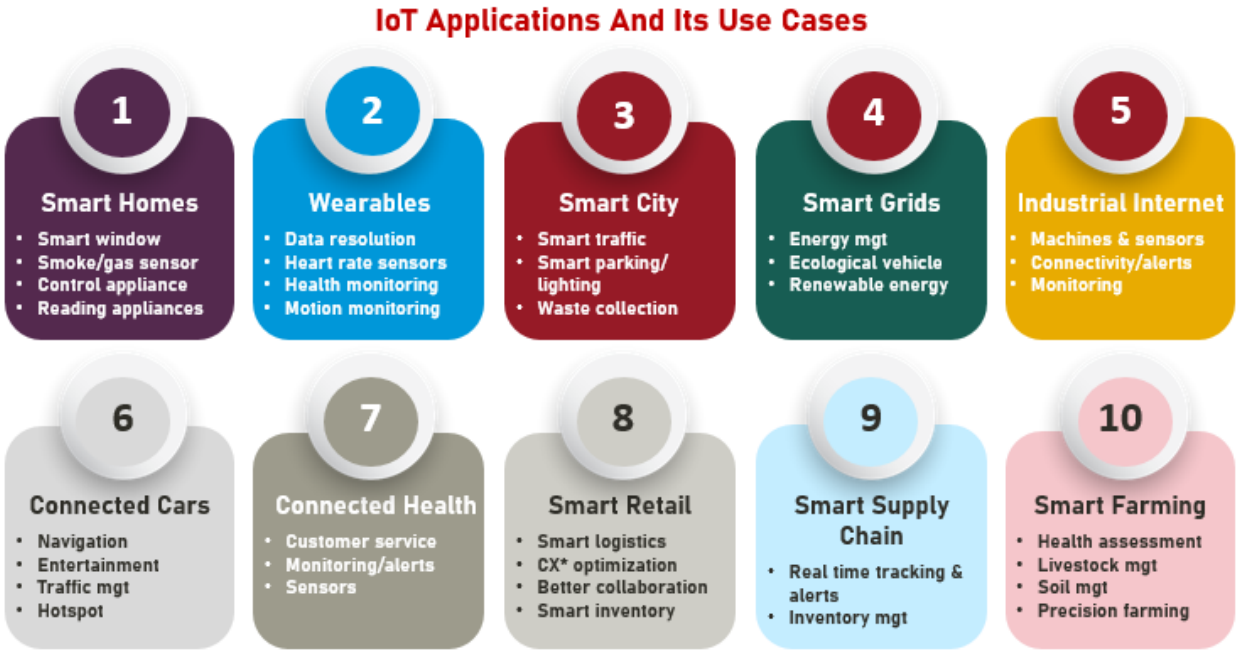


Source: NASSCOM

2.4 IoT applications and use cases

IoT applications span the spectrum from need-based to real-time decision making, single-condition to multi-condition reporting, and human-controlled to autonomous operation triggers. Based on where one is on the spectrum, IoT tech can be fine-tuned to deliver the desired functionality. Hence, it makes for a versatile and general-purpose digital technology with immense future possibilities.

The major application areas across various sectors are:



**CX-Customer experience; Mgt - management*
Source: NASSCOM

IoT will change our lives and organizations dramatically – just as cloud computing and big data have been a major shift, the Internet and mobile devices revolutionized the world, robots and AI impact and will impact our lives deeply, blockchain is a major game-changer and Industry 4.0 will significantly alter the face of manufacturing and industrial markets.

COVID-19 impact on IoT

3. COVID-19 impact on IoT

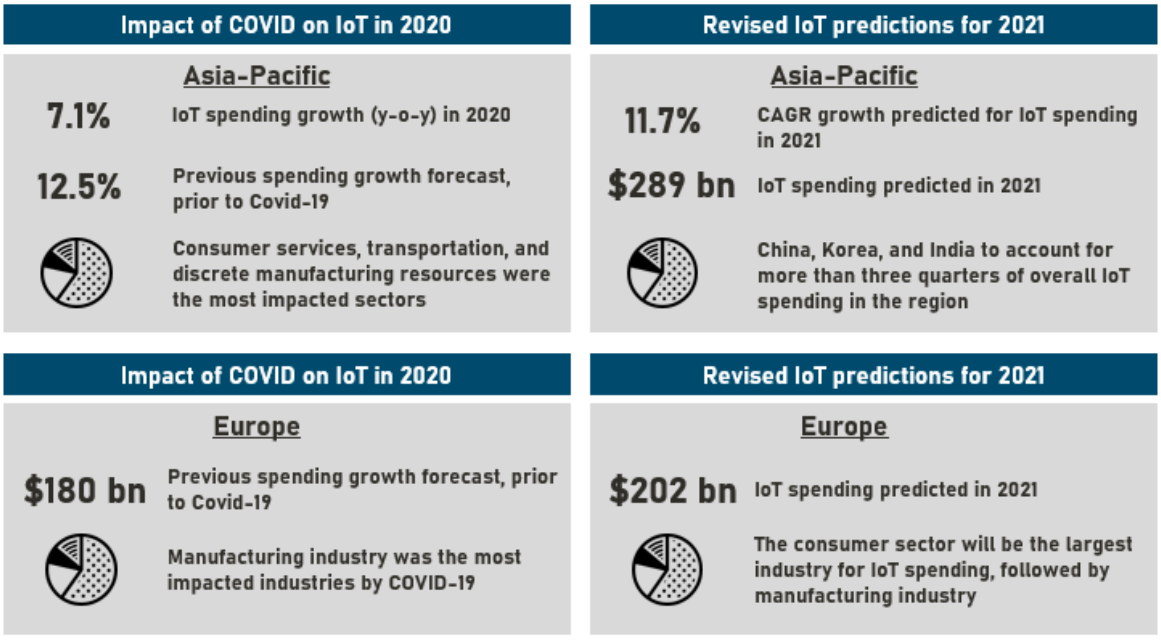
COVID-19 has impacted countries and communities in immeasurable ways. Like all the other sectors, the IoT set to technologies also took a dip globally during the COVID-19 pandemic. Majorly, the Asia-Pacific and European IoT markets were immensely impacted.

- Consumer services, transportation, and manufacturing sectors were impacted the most
- Enterprises started engaging in proof of concepts and accelerating their IoT-related technology investments to improve efficiencies/reduce downtime.

3.1 Impact on global IoT landscape

A brief snapshot of how the pandemic impacted the IoT sector globally is explained below:

IoT in 2020 and 2021 – from "then" to "now" (Asia-Pacific and Europe viewpoint)



Source: International Data Corporation (IDC)

IoT will impact certain demographics, sectors, and application areas more as emerging global megatrends suggest from our research conducted in 2020 on Techade 2020: Digital Tech Opportunities.

Globally, as organizations and governments have struggled to address COVID-19 related impacts, a trend of implementing different technologies was seen, including IoT. As a result, COVID-19 has unknowingly acted as the catalyst of accelerated IoT adoption across multiple sectors. Consequently, in the latter part of 2020, some positive market trends started to emerge including:

- The IoT worldwide spending readjusted for 2021; to return to double-digit growth rates and achieve a CAGR of 11.3% over the 2020-2024 forecast period
- Healthcare, insurance, and education sectors to deliver the strongest industry gains in IoT spending in 2021

3.2 IoT spending accelerated during the pandemic

IoT spending in various sectors across the globe has significantly increased owing to the significant digitization need generated during the pandemic period. Organizations and governments started investing in IoT technologies to have a seamless virtual working experience. A brief snapshot of IoT spending drivers that have accelerated IoT adoption during the pandemic is provided below:

How IoT spending accelerated because of COVID-19

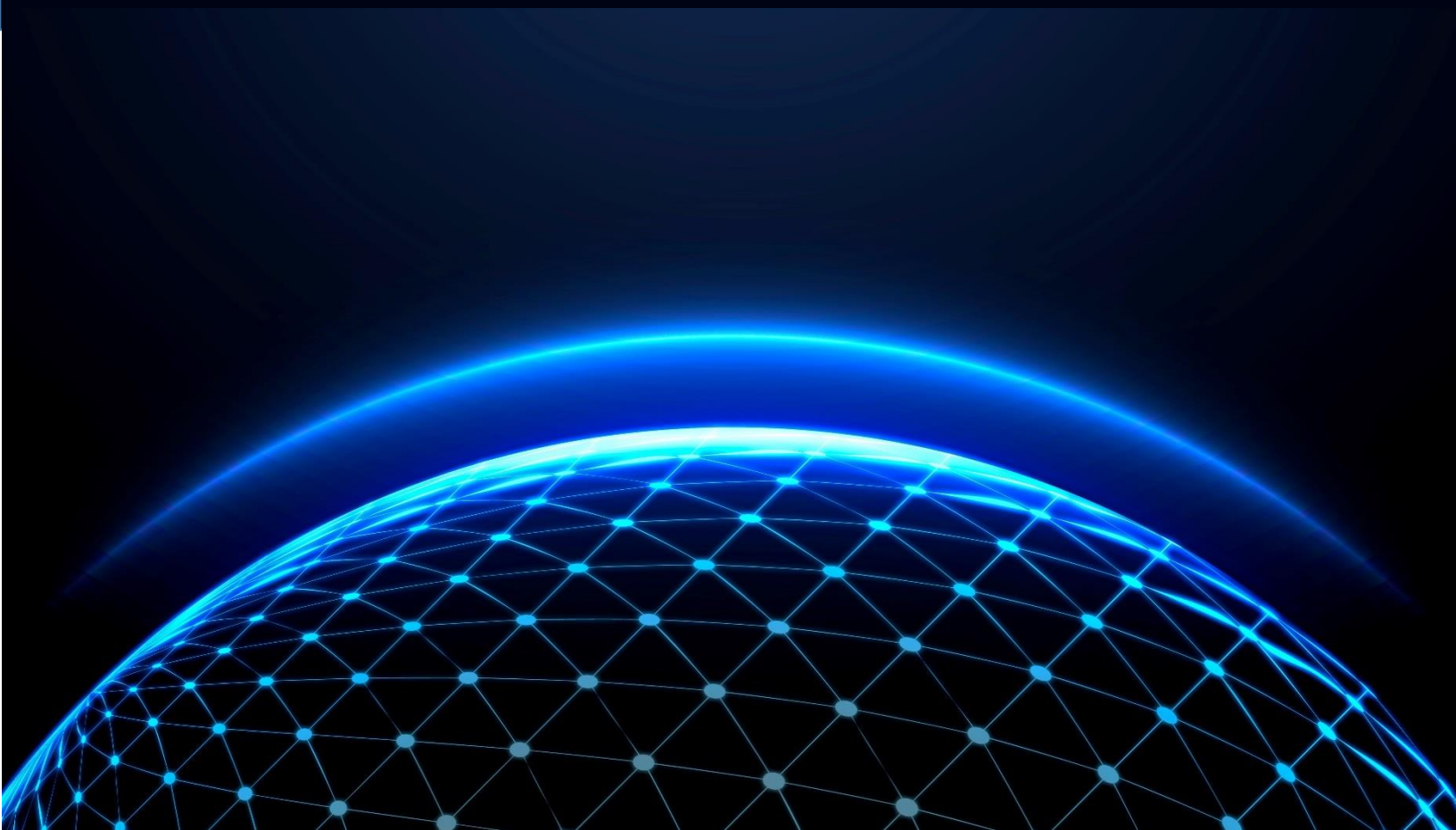
Key drivers of IoT spending during the pandemic

IoT spending drivers in Healthcare	
Wearable Devices	• Used to track health related facts, provides alerts and helps in monitoring the health
IoT for Test and Trace	• Monitors users with COVID-19 symptoms, used by governments for analysis • Adopted by UK, South Korea, Germany, Spain, Vietnam and Taiwan
Regulations and Procedures	• Regulatory response to minimize hospital and clinic visits has accelerated the adoption of telehealth and home care
IoT spending drivers in Smart Homes	
lifestyles & consumer behaviors	• During the work-from-anywhere (WFA) scenario, adoption in IoT devices such as smart speakers, security lighting, and energy & HVAC sensors have increased
New features/ sensors	• New features/sensors are being introduced in response to COVID-19, e.g. Amazon's Alexa Care Hub that can help people to remotely check in on their family members
New energy saving features	• During the WFA scenario, energy saving features are introduced. E.g. smart meters, Amazon Alexa's new feature to update about the energy consumption, etc.
New features to Assist xFH	• During the xFH scenario (work/education/shopping from home), other new features to assist during xFA are introduced. E.g. Google Workspace
IoT spending drivers in Transportation	
Smart Logistics	• Smart fleet management solutions are gaining more attention • Adoption of cold chain logistics has increased
In-Cabin Sensing and Analytics	• Sensors and technologies being deployed to measure CO, CO2 and other pollutants • Adoption in chain environment control and UVC based cleaning has increased
IoT spending drivers in Industrial	
Remote Monitoring & Machine Health	• IoT is also used for remote monitoring and operation of the industrial machines • Machine health prognostics and remote monitoring and operations are prime focus
Smart Manufacturing & Inventory Mgt	• Need of a smart inventory management system that can monitor items and available space, and communicate it to the concerned warehouse team is increased • Geotags, ultrasound transducer and NFC are being used to build autonomous inventory management systems

Source: NASSCOM

The list is illustrative/not exhaustive

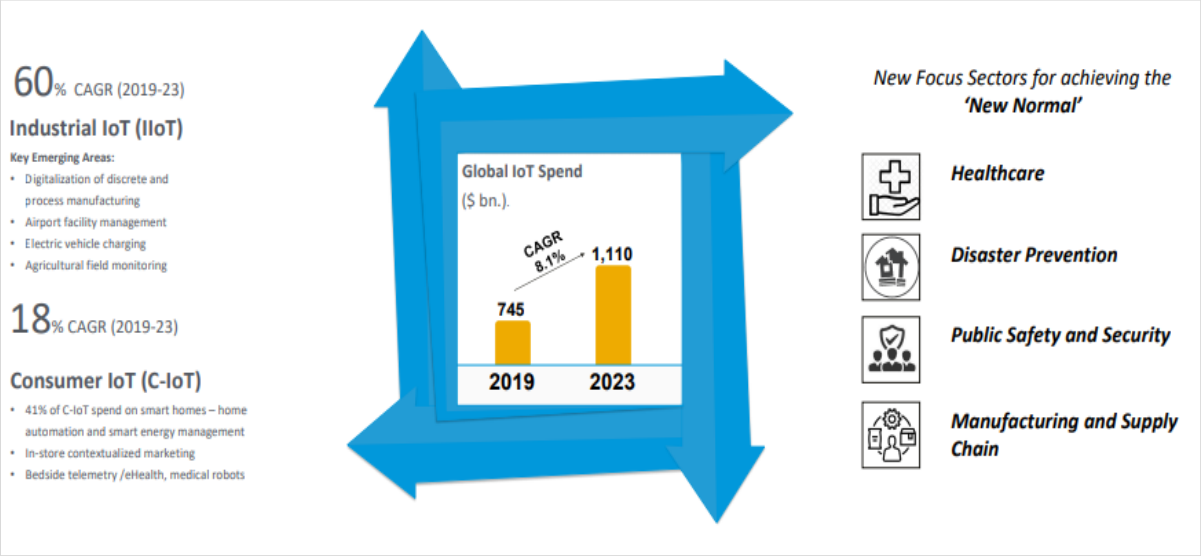
Global IoT Overview



4. Global IoT Overview

A lot has been said about the global impact of COVID-19 on IoT however, on a positive note, it is worth looking at how the IoT has evolved post-COVID-19 introduction. At the latter part of the pandemic's lifecycle and its declining significant impacts, the global IoT market size/spending predictions have evolved to a great extent. An acceleration trend in IoT adoption has been redefining the dimensions of the already evolving IoT space. A quick snapshot of how the market looked like during the pre-pandemic period and how it is going to evolve by 2023 has been provided below:

IoT market snapshot 2019-2023



Source: NASSCOM's Technology Sector in India 2020, TECHADE- The New Decade/Strategic Review

4.1 The emerging IoT opportunity – Market and Spending Trends

The tale of how IoT market was booming during the pre-pandemic period, to how it almost took a hit, dipped down, and came back rebounding in 2021 will always fascinate the coming generations. The IoT market was immensely impacted owing to the pandemic. Sectors such as consumer services, transportation, and manufacturing were the most impacted sectors. The global spending pattern also saw a shift– from devices and sensors to cloud, data & analytics, and software in the work-from-anywhere scenario.

However, the IoT market is showing signs of positive recovery in 2021 and is expected to follow the same trends beyond 2021 as well. In terms of sectors, the IoT spending focus has shifted – from Industrials & services to connected devices. A significant increase in IoT spending in sectors including healthcare, manufacturing and supply chain, education, and smart homes is also witnessed. We expect this trend of sector-wise IoT adoption to further accelerate in the future as well.

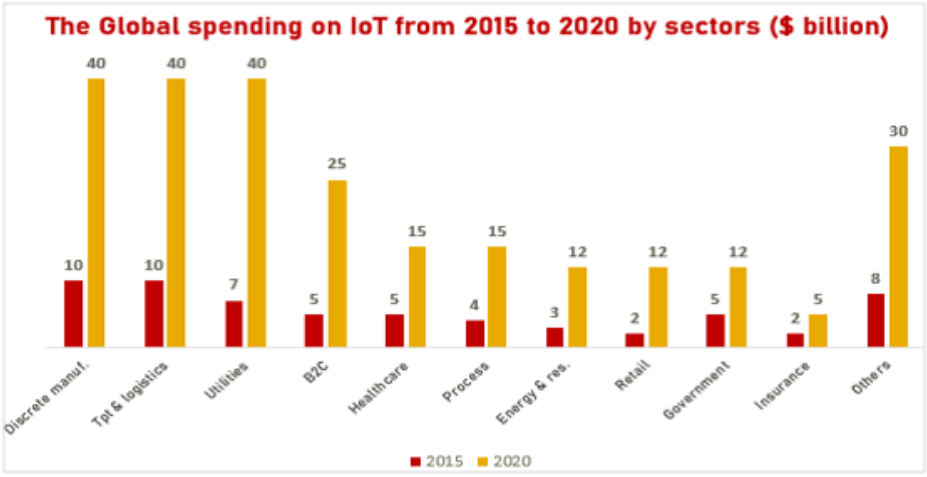
A brief pre- and post-pandemic IoT market snapshot explaining how the future IoT opportunity is likely to shape and the vertical IoT implementation areas are explained below:

The IoT opportunity – a pre and post pandemic snapshot

Overall global IoT spend

Global IoT spend	Global Endpoint security spend	IoT active device connections*	Non-IoT active device connections**
~$730 billion – 2019 $1.1 trillion – 2023	$459 million – 2019 $631 million – 2021	$8 billion – 2018 $ 30.9 billion – 2025	9.9 billion in 2018 10.3 billion by 2025

Global IoT spending – sector-wise pre-pandemic analysis



Sector-wise global IoT spend/market size

Smart Homes consumer spend: $300 million in 2021	Wearables spend: $81.5 billion in 2021	Smart City*** spend: $327 billion by 2025	Smart Grids (grid software) spend: $5.2 billion by 2025	Industrial Internet spend: $263 billion by 2027
Connected Car market size: $198 billion by 2025	Connected Health market size: $590 billion in 2024	Smart Retail market size: $94 billion by 2025	Smart warehouse mgt market size: $19.06 billion by 2025	IoT in Agriculture market size: $29 billion by 2023

Sources: NASSCOM, McK, Forbes, IDC, Forbes, Ericsson, Statista, Forbes link 2, Statista link 2, F&S, BNEF, GSMA, McKinsey, McK link 2
**include connected cars, smart home devices, and connected industrial equipment; **include smartphones, laptops, and computers;*
****Smart cities' spending on technologies such as IoT, AI, big data, etc.*

4.2 Global IoT vendor landscape, IoT spending by sectors, and spending trends

Global IoT vendor landscape in 2021

Hundreds of global organizations across the entire IoT stack are offering services in various sectors. The below infographic provides a view of the global IoT landscape (2021).

Global IoT vendor landscape (illustrative, as of 2021)

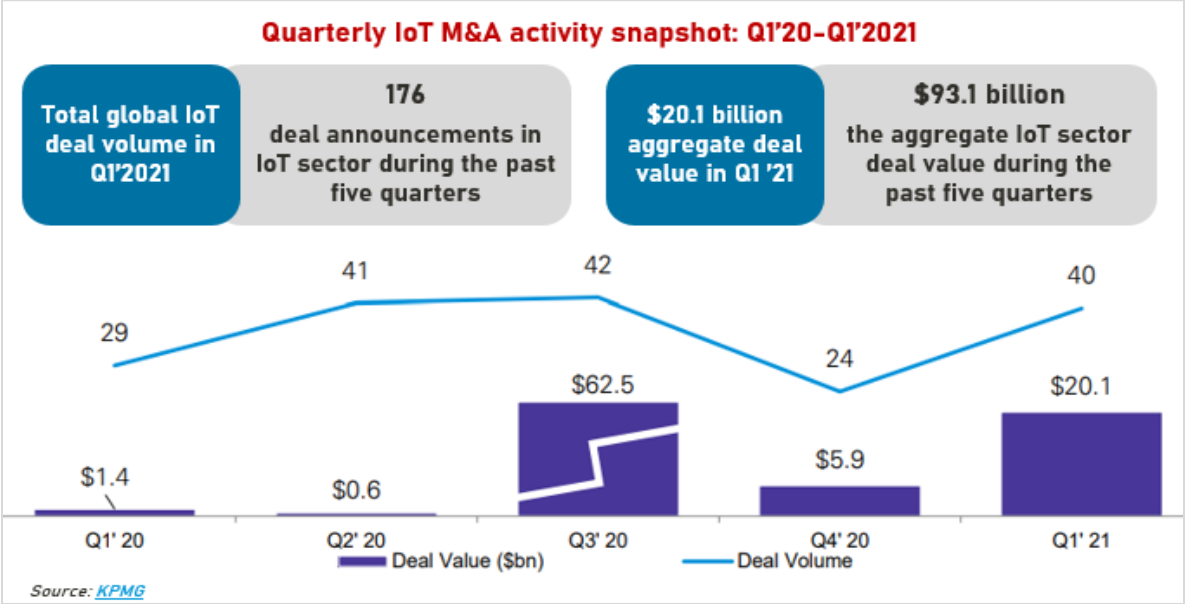
Source: IDC

The list is illustrative/not exhaustive

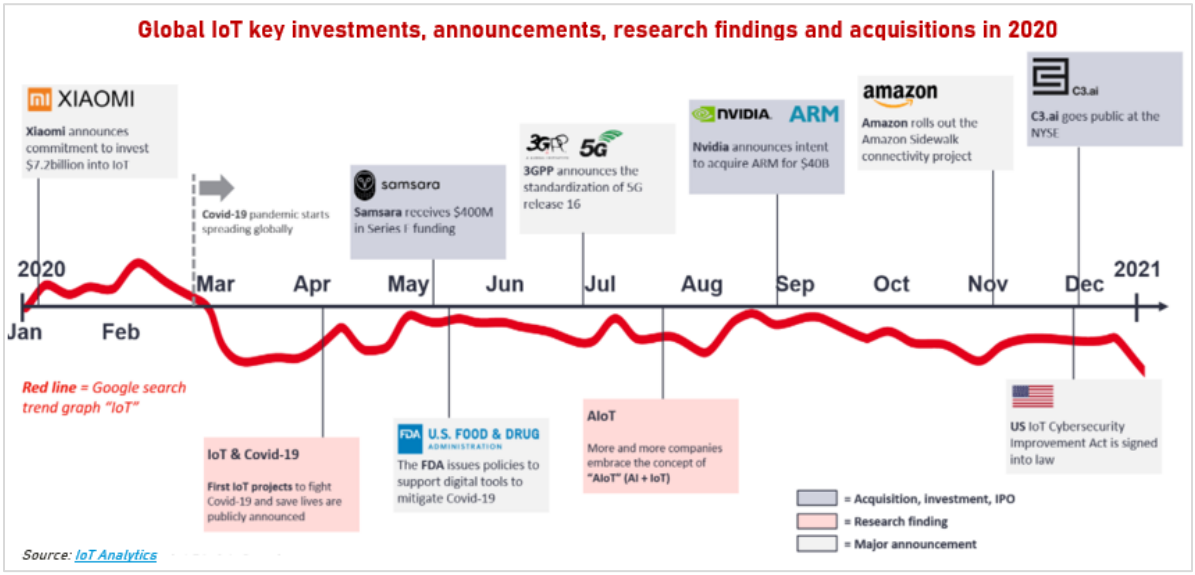
4.3 Major global IoT developments – partnerships and M&As in 2020-2021

The disruptive impacts of COVID-19 have resulted in accelerating IoT implementation across various sectors. IoT M&A market remained red hot during the pandemic and the continuation of this strong activity in the IoT space is expected in 2021 as well, owing to improved COVID-19 situation and multiple federal relief packages being rolled out globally. Acquisition activity around IoT healthcare market has increased and is expected to continue as companies increasingly see the importance of such solutions. Consumers increase their spending through the OTT/online retail platforms. Smart building technologies will be critical as businesses reopen and IoT use cases, such as remote temperature checks, occupancy detectors, and air filtration sensors, among others, help buildings reopen safely.

The below infographic provides insights around the global IoT investments, key developments, and M&As happened in 2020 through 2021 that further confirm the technology's accelerated implementation.



Notable IoT key developments happened during tha pandemic include:



Notable IoT-related global acquisitions of 2020:

Acquirer	Acquired company	Deal size	Category
Nvidia	ARM	$40 billion	Semiconductor
Infineon Technologies	Cypress	$9.4 billion	Semiconductor
Nvidia	Mellanox	$7 billion	Semiconductor
Aveva	OSIsoft	$5 billion	Industrial IoT
BMC	Compuware	$2 billion	Smart Enterprise
HPW	SilverPeak	$925 million	Edge Computing
Netapp	Spot.io	$450 million	Edge Computing

Silicon Labs	RedpineLink	$308 million	Semiconductor
Synaptic	DisplayLink	$305 million	Semiconductor
Amdocs	Openet	$180 million	Smart Enterprise
Microsoft	CyberX	$165 million	IoT Security

Notable IoT-related global top start-up investment rounds of 2020:

Company	Funding stage	Amount	Country	Category
Samsara	Series F	$400 million	USA	Industrial IoT
Infarm	Series C	$170 million	Germany	IoT-based vertical farming
COSMOplat	Series A	$150 million	China	Industrial Iot Platform
Skylo	Series B	$103 million	USA/India	IoT Connectivity (Satellite)
ForgeRock	Series D	$93.5 million	USA	IoT Security
Verkada	Series C	$80 million	USA	Smart Buildings

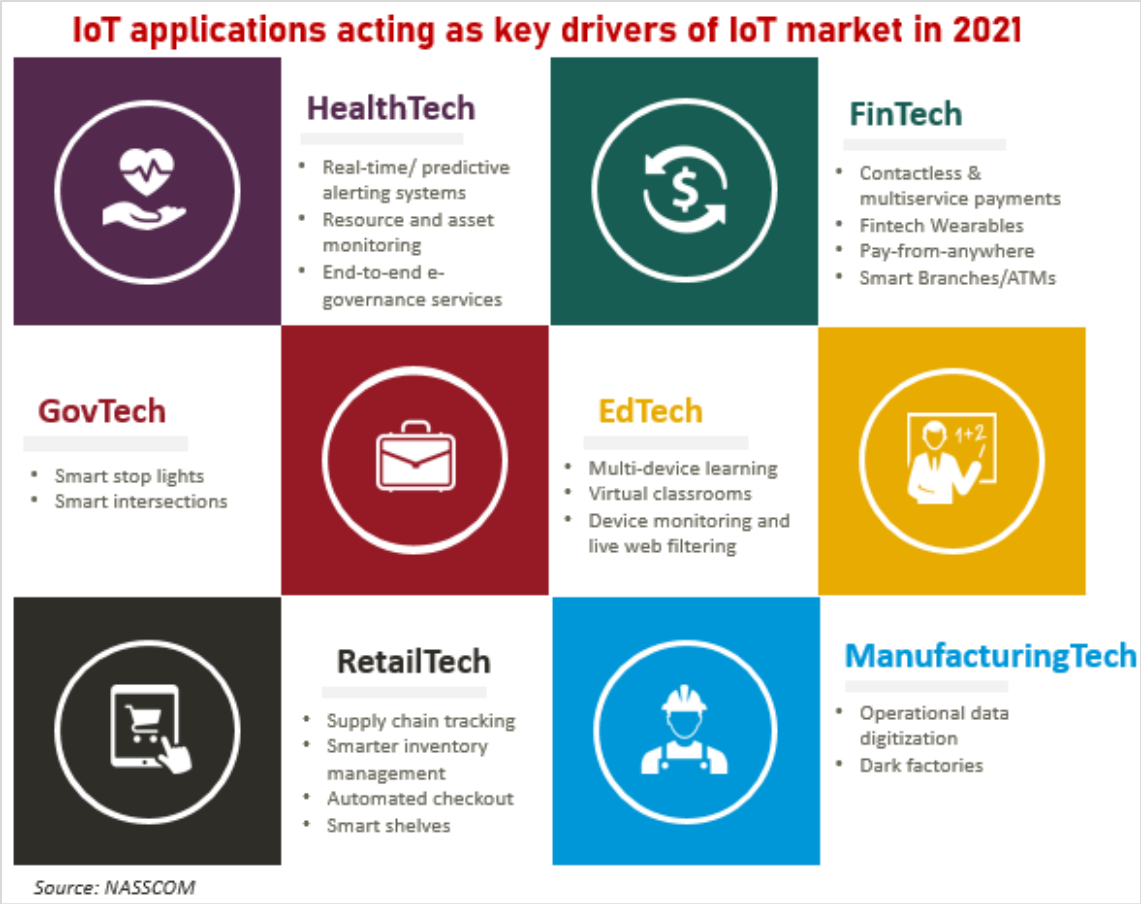
Source: IoT Analytics

Globally, the year 2021 will be expected to be amicable to enterprises adopting an IoT-based enterprise security system while at the same time not being so well received by enterprises that have still chosen to take on a traditional way of managing their operations. Some firms still believe in the pace of accelerated IoT implementation and its forthcoming future. As per IDC, key IoT specific market insights for 2021 are:

- The worldwide IoT spending will return to double-digit growth rates in 2021
- Healthcare, insurance, and education to deliver the strongest industry gains in IoT spending
- Adoption of IoT/IIoT amongst other emerging technologies including, AI/ML, Edge computing and analytics, Robotics, etc. will continue gaining ground rapidly
- Acceleration of the consumer/patient preferences originated by the pandemic will likely follow
- HealthTech, EdTech, and RetailTech sectors are ahead of the curve in adopting IoT
- Both central and state governments in India have shown immense agility in developing technology solutions to enable citizen services and pandemic management. GovTech, or the government's digital transformation, is an imminent boost to India's digital transformation imperative.

4.4 IoT technology implementation priorities and drivers in 2021

While the global IoT spending is expected to return to recovery in 2021, many technology implementation priorities came into portrait after the COVID-19 hit and have been recognized as major drivers driving the IoT market in 2021. Some of the major technology implementation priorities that are driving the IoT 2021 market are explained below:



Note: We will cover a detailed sector-wise analysis of IoT implementation/adoption (pre/post-pandemic) in the second part of this PoV

4.5 Top IoT global trends in 2021

IoT trends in 2021 will focus on core needs such as health-and-safety efforts and equipment monitoring, however, IoT in customer experience will also develop. Several trends continue to gather momentum, fueling IoT's prominence in 2021, from data-intensive experiences that use IoT devices (such as self-driving cars or wearable devices) to basic health and safety needs as COVID-19 continues.
In 2021 some uses of IoT will focus on core health-and-safety initiatives (such as building cleaning technologies and track-and-trace capabilities). Many IoT technologies will lay a foundation and then help organizations progress to focus on more mature areas, such as customer service and customer experience.

Top global IoT trends in 2021

Healthcare investment in IoT to skyrocket

- From telemedicine to automated home help for the elderly and disabled, smart wearables, sensors, and connected devices will continue to change the way healthcare is delivered.
- It will also be used to minimize unnecessary contact in situations where the risk of contamination is high.

IoT means more productive Work-from-home (WFH)

- WFH is the new normal due to safety concerns in offices and city centers. With AI-powered personal assistants like Alexa, more applications could be seen in the future to help us manage our day while working remotely.

IoT in retail

- New purpose for innovative models such as Amazon's fully-automated supermarkets, which cut down on the need for non-vital human interaction could be seen over the next few years.
- Automation via IoT-enabled devices will continue to grow and contact-less payment methods will see a surge.

IoT at City Scale

- The "smart city" concept has been growing in popularity over recent years, with IoT technology used to monitor traffic on road networks, use of public transport/civic amenities. We expect a surge of resources going into building digital capabilities within municipal authorities to enable them to better use new technologies that are becoming available.

IoT at the Edge

- With edge computing, rather than IoT devices sending all of the data they collect to the cloud for analysis and extraction of insights, this work is carried out directly on the devices themselves.

Source: NASSCOM, secondary research

The list is illustrative/not exhaustive

Indian IoT Overview

5. Indian IoT Overview

5.1 Accelerated Adoption and Market Growth Potential

India's digital economy is one of the largest and fastest-growing markets for digital consumers. A digitally transformed economy, a $1 trillion digital economy aim for 2025, as part of the $5 trillion 2025 GDP vision, will usher India into the realm of sustainable and inclusive development, of which, IoT will form a core technology pillar. So, how is IoT playing a role in meeting India's digital growth?

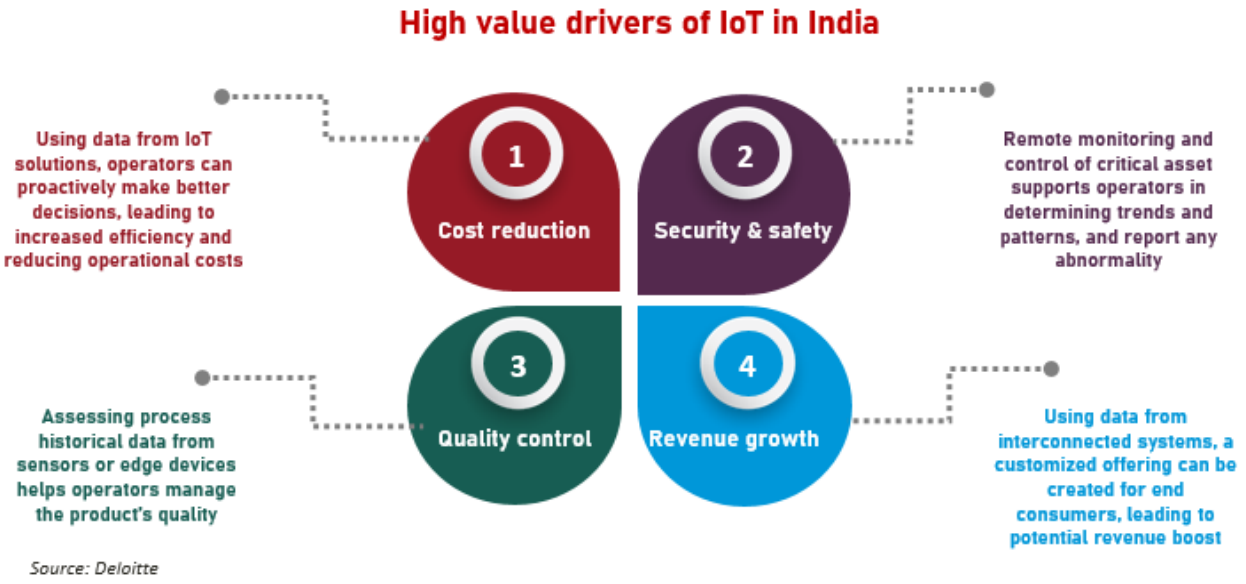
IoT investments in India are expected to go up to $15 billion in 2021 from $5 billion in 2019, according to research by NASSCOM's sister organization, DSCI. This will also get reflected in the fact that IoT devices in India will likely increase significantly. Industrial IoT (IIoT) is already well on its way to rejig the Indian manufacturing landscape. The Indian government has made the "Make in India" initiative a priority to strengthen India's manufacturing prowess while making the country an attractive location for Indian and international manufacturers.

5.2 Enablers of IoT in India and Unique Use Cases

IoT can transform India in unique ways to reach the masses where sophisticated technology may not reach, through applications such as intelligent tracking systems in transportation, industrial wireless automation, public safety, personal health monitoring, and health care for the aged community.

- India has unique problems where remote access to necessities, such as primary healthcare with adequate doctors, basic education to children in rural and semi-urban areas, adequate market access to the agricultural population, reach of core government services, etc., has been a challenge and continues to limit the rapid pace at which the country can evolve. India's mobile-first digitalization success, leapfrogging from no computerization to mobile usage straight away, can be a potent tool in its armor. IoT-enabled services through this medium can bring dramatic transformation in the lives of people with limited amenities.
- While COVID-19 created an unavoidable survival push for many urbanites and companies to also embrace technology, the challenge will be to continue to build on this momentum.
- India's true IoT potential lies in implementing both, sophisticated Smart City and Smart Living concepts, as well as, enabling mass-scale Tech4Good applications.

High value drivers of IoT in India are explained below:



5.3 IoT Vendor Landscape in India

India's IoT landscape has evolved both in coverage and depth. Be it the IoT start-up ecosystem, IoT-specific patents, or IIoT space, India is seeing significant growth in all these areas.

- Around 5,000 IoT patents were filed from 2014-2019, and this trend is expected to continue through 2021. Increasing internet bandwidth and availability, a rise in smartphone usage and a growing number of devices with built-in sensors will drive the IoT market in India. IoT implementation in healthcare will gain more impetus. Other segments to see more push for IoT solutions includes disaster prevention, public safety, and security, manufacturing and supply chains
- India's 480+ IoT start-ups number is expected to increase in 2021, owing to improving telecom connectivity and the need for connected solutions. In 2020, fewer newly formed start-ups have leveraged IoT due to supply chain and customer access challenges, conversely, in 2021, we could see these challenges diminishing and some new start-ups leveraging IoT coming up in the space
- Manufacturers of smart products and industrial devices are expected to implement remote monitoring and diagnostic solution (RM&D) for data monetization in 2021. Another vendor activity in the IIoT space is expected to grow in 2021 as well

A snapshot of the Indian IoT vendor landscape is provided below:

5.4 Top trends and drivers of the Indian IoT domain

Major trends driving the Indian IoT landscape

IoT will unlock new opportunities when harnessed and integrated with other technologies. India has already started working on the latest upcoming trends. Below are the top IoT 2021 trends in India.

Top trends to be seen in the IoT domain in India

Interconnected manufacturing through IIoT

- Converting linear legacy supply chains into interconnected digital supply networks (DSNs) that enable track and trace across the ecosystem
- Operational efficiency and effectiveness (OEE) improvements using predictive maintenance, efficient utilization, and productivity optimization concepts
- Boosting manufacturing with "Local for Global" via smart industrial corridors as part of Make in India

Powering Smart Cities

- Data captured by IoT endpoints can serve as the lifeline, on which analytics, AI engines and advanced automation can be made to operate to smoothen urban living. Real-time energy optimization and redistribution via reverse grid connectivity, personalized healthcare, time-optimizing traffic solutions, smart waste management.
- GoI is working towards its 100 smart cities project, with IoT being deployed extensively for public services in traffic management, energy efficiency, and smart citizen alerts
- The National Digital Communications Policy 2018 also announced investment of US$ 100 billion in the telecommunications sector by 2022, as per IBEF

Computing at the edge

- Edge computation take the computing power of the cloud to enable the devices to enable data analytics anywhere and anytime in a secure environment
- Edge computing uses cases continue to expand in India, as per NASSCOM's Edge computing compendium report. It will become more critical for enterprises as they look to achieve faster/better management. Some recent developments include
  - Wipro acquired US-based Eximius Design, that provides end-to-end services for building smarter connected products for various use cases of Edge Computing, IoT, Ind 4.0, Cloud, 5G and AI
  - NTT Ltd. collaborated with AlefEdge in India to deliver the Edge Internet to application developers

Enabling an efficient fleet management

- Apart from the predictive maintenance capabilities, transportation systems powered by AI and ML can identify threats. E.g., video-based safety systems can now be enhanced using ML to detect risks.
- IoT implementation in these technologies helps in vehicle tracking/monitoring, analytics, remote diagnostics, etc.

Optimizing asset and energy management

- As the focus shifts to better asset management and finding sustainable solutions for energy consumption, IoT is enabling mass-scale digital transformation and automation for asset-intensive enterprises for smart asset management.

Connectivity

- Better reliability and latency are the key benefits provided by 5G networks, and will allow connected devices to send and receive data faster and take data analytics and insights unto an expedited and efficient level.
- Lower Power Wide Area Networks such as NB – IoT and LTE M are empowering better connectivity of wide range of IoT devices and mission critical applications.
- App downloads in India is expected to increase to 18.11 billion in 2018F and 37.21 billion in 2022F, thereby creating immense opportunities for the IoT domain.

Source: NASSCOM, secondary research *The list is illustrative/not exhaustive*

5.5 The role of the Government of India in IoT adoption

India's IoT adoption and growth journey will be a collaborative process, vis-à-vis, other economies where either the government or the private sector may take a dominant lead. Even before the pandemic, policy and project initiatives by the central and various state governments in India took shape and were leveraged successfully during the pandemic.

Some of the key initiatives on IoT taken by the Government of India

PLI* scheme 2019 and Atmanirbhar Bharat 2020	Jointly meant to drive Indian MSME segment to boost digital technology usage in their operations & supply chain management. India's IoT and adjacent digital technology adoption will make for exponential growth in next 5-10 years
National Digital Communications Policy (NDCP) 2018	Futuristic goals and policy initiatives undertaken by NDCP to address the problem of communications and access of digital services in India
IoT Centre of Excellence (CoE) by NASSCOM, MeitY and ERNET	CoE is specifically designed to help Indian IoT Start-ups to create market-leading products. CoE is India's largest deep tech innovation ecosystem
IoT lab, a partnership between IIT Delhi and Samsung	MoU between IIT Delhi and Samsung was signed in 2016, with the objective to enhance research capabilities and industry collaboration in IoT space
Draft IoT Policy 2015	Ministry of Electronics and Information Technology launched India's first draft of IoT Policy Document in 2015, a governance framework, for holistic implementation and execution of IoT-related policies
Smart Cities Mission (SCM) 2015	SCM was launched in 2015 to drive economic growth and improve quality of life by using technology as a means to create smarter outcomes

*Source: Mondaq, Gov.in, Mohua.gov.in, Ernet.in, ET; *Production Linked Incentive Scheme (PLI)*

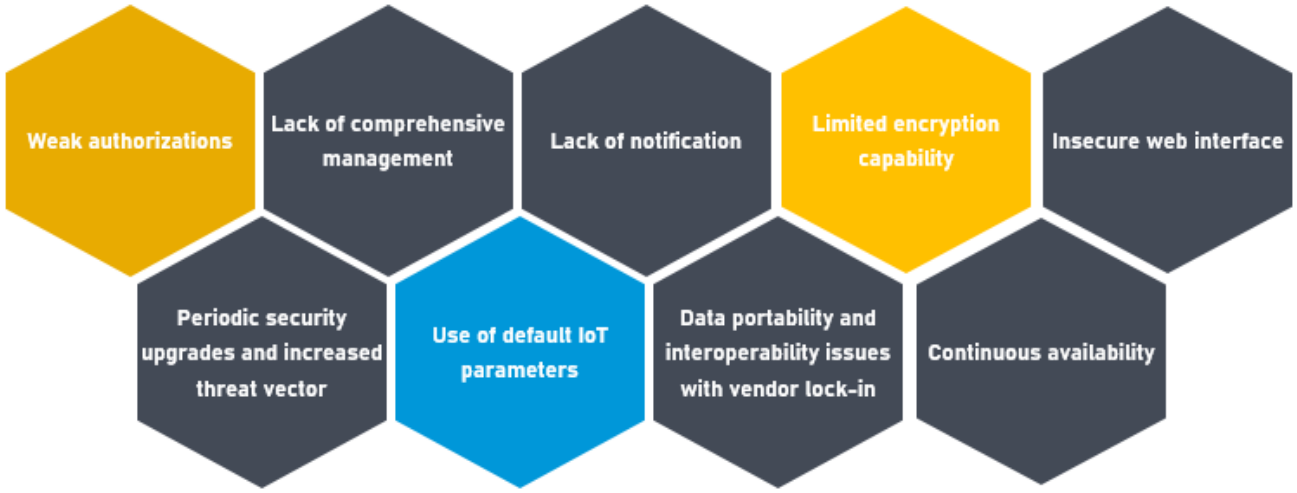
The list is illustrative/not exhaustive

Key challenges and risks in IoT adoption

6. Key challenges and risks in the IoT adoption

The IoT platform can intertwine nimbly across business-sector platforms, raising security concerns about the collected information and effective management. The following are some observations per industry analysis:

Top Security challenges



Source: NASSCOM, secondary research

The list is illustrative/not exhaustive

Top Privacy challenges

Source: NASSCOM, secondary research

The list is illustrative/not exhaustive

IoT has a lot of scope and a long runway for becoming a foundational technology that will speed up the Indian digital transformation goals of becoming a $1 trillion digital economy and $5 trillion overall economy globally by 2025. In the following PoV, we will focus on the key IoT sector-wise adoption trends and use cases from an industry viewpoint.

Related Publications

April, 2021 **Free for all**

IoT Adoption in Indian Agriculture: A 2020 Landscape

June, 2020 **Free for all**

IoT: Driving the Patent Growth Story in India

September, 2018 **Free for all**

IoT Beyond the Obvious

November, 2019 **Free for all**

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