KPMG

Confederation of Indian Industry

Convergence towards inclusive digital growth

October 2018

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Preface

Technology is changing our lives and business at an astonishing pace. Future advancements in technology are accelerating faster than an organisation's ability to adopt or even adapt to them.

From emergence of new technologies to digitisation of our day-to-day activities, things are rapidly changing around us; and India, with its numerous digital initiatives, is changing with it. The country, on the back of technological advancements and speedy digitisation drives, is steadily marching towards its vision of becoming a trillion-dollar 'digital economy'. As the digital infrastructure further expands and adoption of emerging technologies becomes widespread, the role of three key stakeholders – consumer, companies and the government – in fostering inclusive digital growth is likely to become more noticeable.

Consumers, with their changing preferences and desire for more customised experiences, are the actual demand generators. They are gradually getting used to the digital environment and are constantly on the lookout for better offerings. As the digital wave reaches to the technologically deprived corners of the country and the rural-urban digital divide narrows further, digital adoption across income classes promises a huge digital consumer opportunity.

Companies, driven by increasing competition and towering consumer demands, are customising their offerings and playing the role of a provider. Digitisation has not only allowed companies to come up with a huge catalogue of offerings, it has also lead to back-end process innovation.

The government's role in this digital - tech revolution is pivotal to shape the impact of technological advancements at a local and national level. We need governance frameworks, infrastructure protocols and policy systems to ensure that the technological advancement is human-centered and human-led. For any digital economy, the government acts a facilitator who helps in adoption and deployment of these advanced technologies on larger scale. The government, in the digital economy, has agenda to make the dream of Digital India more inclusive and scalable for the nation.

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A digital marathon: India's journey towards becoming a trillion-dollar 'digital economy'

From getting medicines at our doorstep to booking a three-wheeler ride from a mobile app, the rapid growth of the country's digital economy has made India, the fastest growing major economy, stand out on the world map. Digital is no longer mere a term associated with the internet, but is now embedded in our day-to-day activities and is used by all – the commoners, the companies and the government – in abundance.

The convergence of government, start-ups and private companies, the confluence of broadcast and mobile networks, the growing prominence of social media platforms, and the increasing connectivity of numerous devices has fueled a digital wave in the country. And with over 450 million internet users in India, this wave is unlikely to wither.[01]

The benefits and challenges of digital transformation go hand-in-hand, with people, the companies and the government playing a key role in this notable makeover. A common man's longing for a personalised, transparent and connected experience, a private company's contest to be number one in catering that desire and the government's efforts to provide adequate digital infrastructure to all; everyone is playing their part in the country's inclusive digital growth.

Stakeholders contributing to the country's inclusive digital growth

The common man

Rapid technology adoption has not only disrupted the industry, but has also brought a tectonic shift in consumer behavior and preferences. Merely a decade ago, it would have been unrealistic to even think of getting groceries at our doorstep at the click of a button. Now, with the advent of numerous technology-driven applications that are poised to ease our day-to-day regime, 'digital' is fast becoming an active participant in our daily activities.

Did you know?

An Indian user on average spends

200

minutes a day on mobile apps[02]

In the coming years, as the people's anticipation for transparent, connected and more personalised experience grow, the role of digital is likely to become more crucial.

The companies

With the growing competition and rising consumer expectations, organisations have realised the importance of having digital strategy in their scheme of things to achieve a competitive lead. Companies are not just providing seamless and connected experience to their customers and hiring the right talent to do that job, they are also digitising their processes.

KPMG India CEO Outlook 2018[03]

70%

CEOs in India consider data scientists as the most important workforce in supporting their organisation's growth plans

By providing seamless experience in the financial and retail sector, strengthening access in the healthcare sector and helping underprivileged groups connect to such services, private sector's contribution to digital India cuts across sectors.

The government

As the plethora of services that the private sector offers to the end customer increases, so do people's expectations from the government. People expect the government to be equally participative in providing responsive services. And thus, the government is not just making its offerings responsive, it is also introducing logical policies, developing a supportive digital infrastructure and launching skilling programmes to create an efficient digital workforce.

Government of India has doubled the allocation for Digital India programme to

INR3,073

crore in 2018-19

Source: Govt doubles Digital India allocation to INR3,073 crore; telecom sector disappointed, The Hindu Business Line, 30 January 2018

01. The IT-BPM Sector In India 2018: Amplify Digital, Nasscom, February 2018
02. Indians spend 70% of mobile internet time on social media, entertainment, Time of India, 19 December 2017
03. Growing pains – India CEO Outlook 2018, KPMG India, July 2018

Inclusive Digital growth - Drivers accelerating digital growth in country

Facilitator space

Creating digital infrastructure

- Universal access to mobile connectivity
- Broadband highways
- WIFI access everywhere
- Smart bio identification
- Secure cyberspace
- Adaptive e-governance

Digital offerings

- Digitisation of local mandis
- Automation of government back office work
- Digital locker to secure personal documents

Digital empowerment of citizens

- Integrated platform for online courses
- Mobile applications and web portals of government utility services

Provider space

Skilled labour

Digital infrastructure

Favorable policies

Digital offerings

- Customised and immersive customer experience applications
- Digital solutions for social and economic challenges - pollution, health hazard, security
- Digital in-store experience

Automation of business processes

- Improved governance and reliability
- Reduced TAT
- Operational excellence (improving profit margins, cost reduction)

Mergers and acquisitions

Emergence of new start-ups

Hiring skilled labour

Consumer space

Personali-sation

Transparency

Connected experience

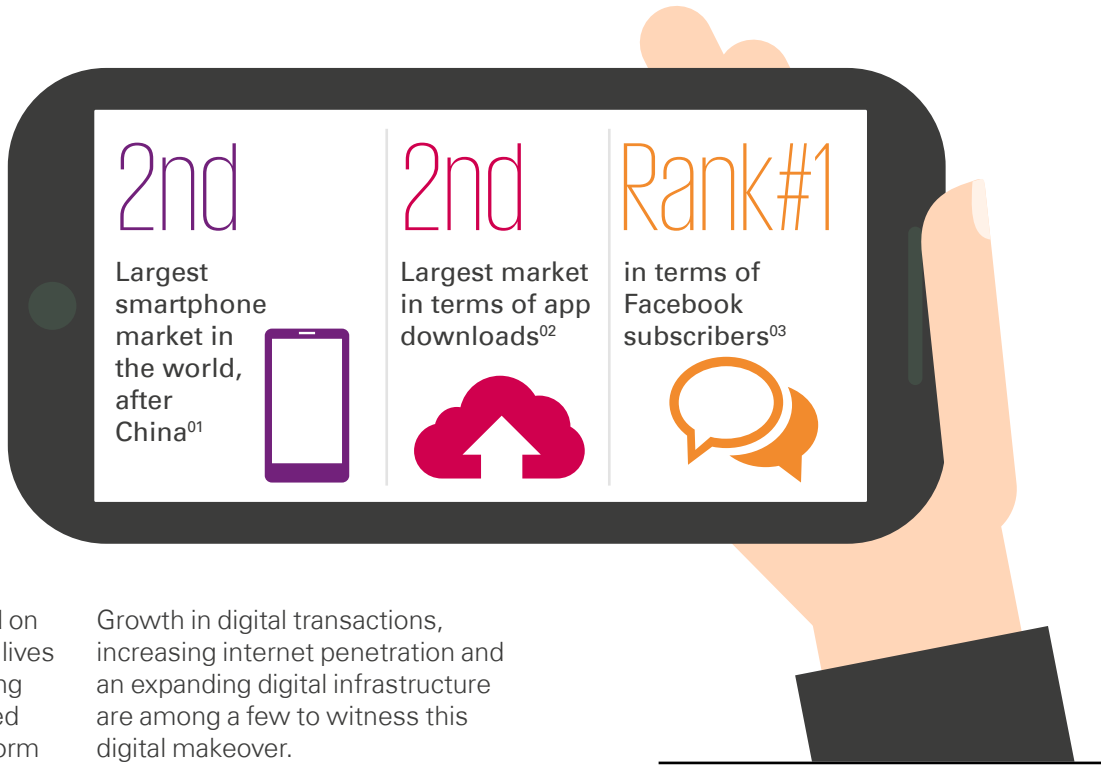
- Smart wearable technology
- Virtual assistants
- 3D Printed prosthetics
- Voice enabled gadgets
- Facial and biometric recognition devices
- Smart homes and domestic robots
- Driverless cars, trains and pod taxis

What the provider demands from the facilitator

What the consumer demands from the provider

India progressing towards the new era of digital growth

On the global stage, India is among the top two countries on many dimensions of digital adoption. The country's continued investment in the digital infrastructure has not just made India a major digital hub, but also an attractive market for global corporations.

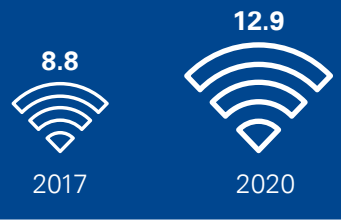


The digital wave has embarked on a journey to not only touch the lives of people in the country, shaping them into a digitally empowered society, but also to truly transform India into a developed economy.

Growth in digital transactions, increasing internet penetration and an expanding digital infrastructure are among a few to witness this digital makeover.

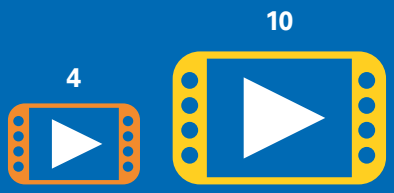
Average internet speed (MBPS)[04]

In October 2017, the Government of India kick-started the process of increasing the minimum-mandated internet speed from existing 512 kbps to at least 2 mbps[05]

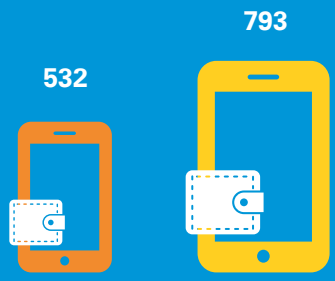


Average data consumption (per user per month, GB)[04]

Online video consumption in the country grew about 5X in 2017, outpacing that of social media and data as a whole[06]

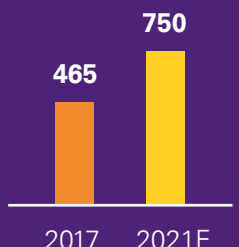


M-wallet transactions (INR billion)[04]



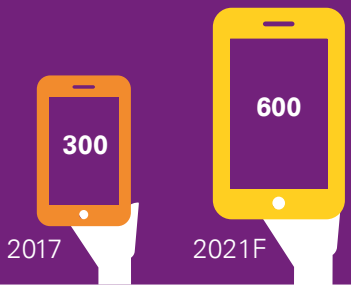
Internet Subscribers (million)[04]

Rural users in India are expected to account for about 50 per cent of the total internet users by 2020



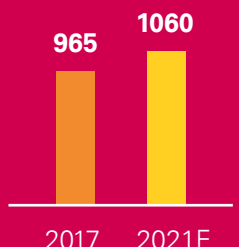
Smartphone users (million)[04]

As of June 2017, about 109 million users owned smartphones in rural India



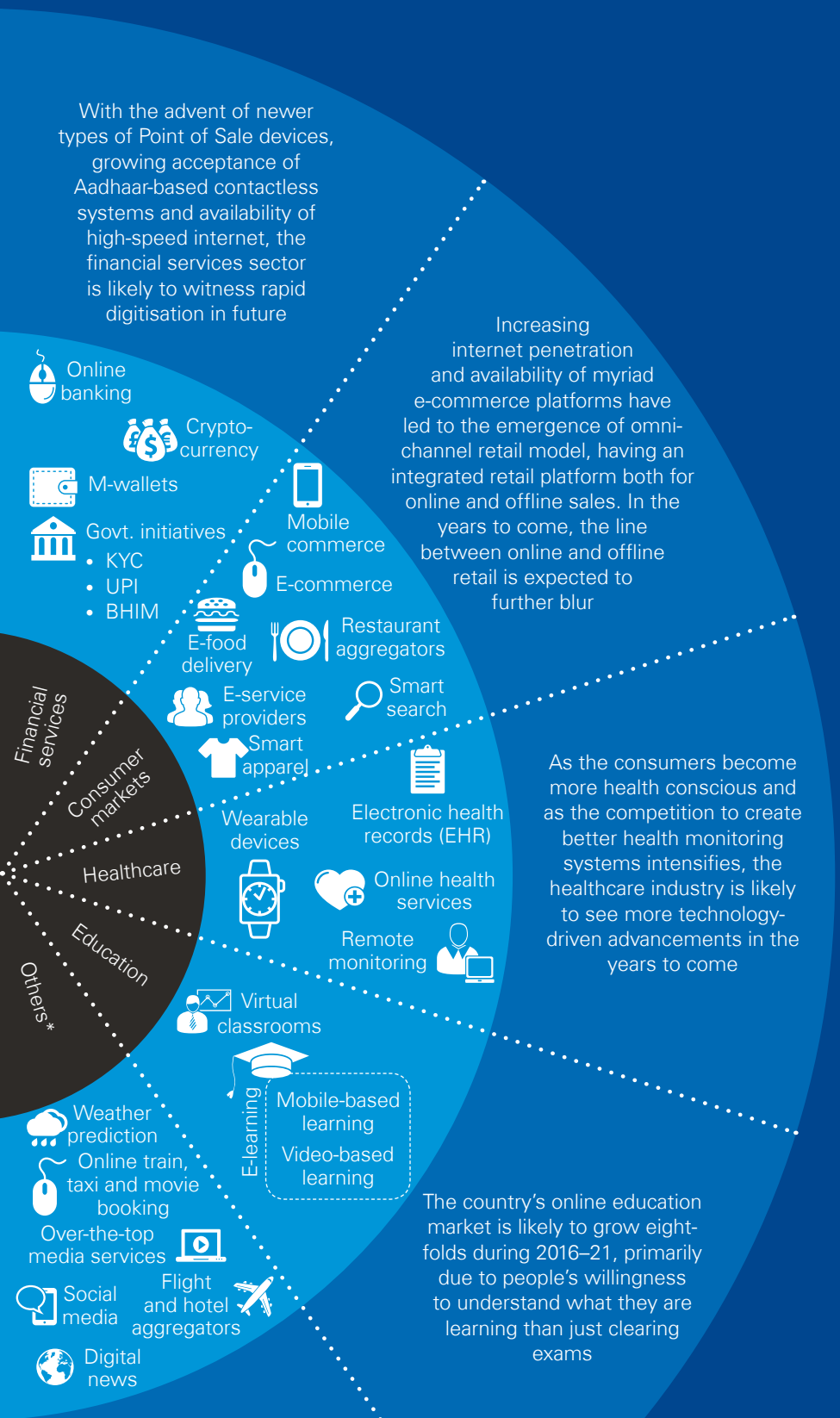
Number of digital transactions (million)[04]

According to provisional data provided by the Reserve Bank of India, the number of digital transactions further crossed 1.11 billion in January 2018[07]



01. India overtakes the US to become the world's second largest smartphone market, Tech Crunch, 27 October 2017
02. Global app downloads surge to 175 B, India second largest market after China, YourStory, 18 January 2018
03. India now has highest number of Facebook users, beats US, Live Mint, 14 July 2017
04. The IT-BPM Sector in India 2018, Nasscom report, 2018
05. Govt looks to hike minimum net speed nearly four-fold, Time of India, 24 October 2017
06. Trends shaping digital India, Kalaari, May 2018
07. Digital transactions rise to 1.11 billion in January, Live Mint, 7 February 2018

Digital influence on key sectors



Source: India's ed-tech industry to grow eight-fold to $2 bn by 2021: Google-KPMG study, VCCircle, 30 May 2017

The 'Digital' government: Steps taken by the government to promote digitisation

From improving digital infrastructure to launching numerous initiatives to increase digital literacy in the country, the government of India has played the vital role of a facilitator-cum-provider in steering India towards a digitally empowered society.

The government is not only taking necessary steps to make high-speed internet available to every citizen in the country, it is also making continuous efforts towards improving its applications and processes to provide a transparent and connected experience.

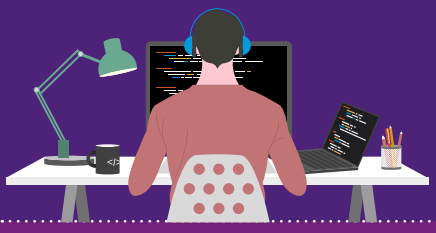
At the heart of India's endeavor to become a digital nation is the country's flagship programme – Digital India. 'Digital India', by bringing in many ideas, thoughts and policies under one comprehensive umbrella, aims to transform India into a well-connected nation.

Key highlights[08]

About **35 million** e-governance transactions took place per day in 2017, up from 30 million transactions per day in 2016

India is the world's **fourth-largest** app economy

400 million people are expected to be trained in various industry skills by 2022 under National Skill Development Mission (NSDM)

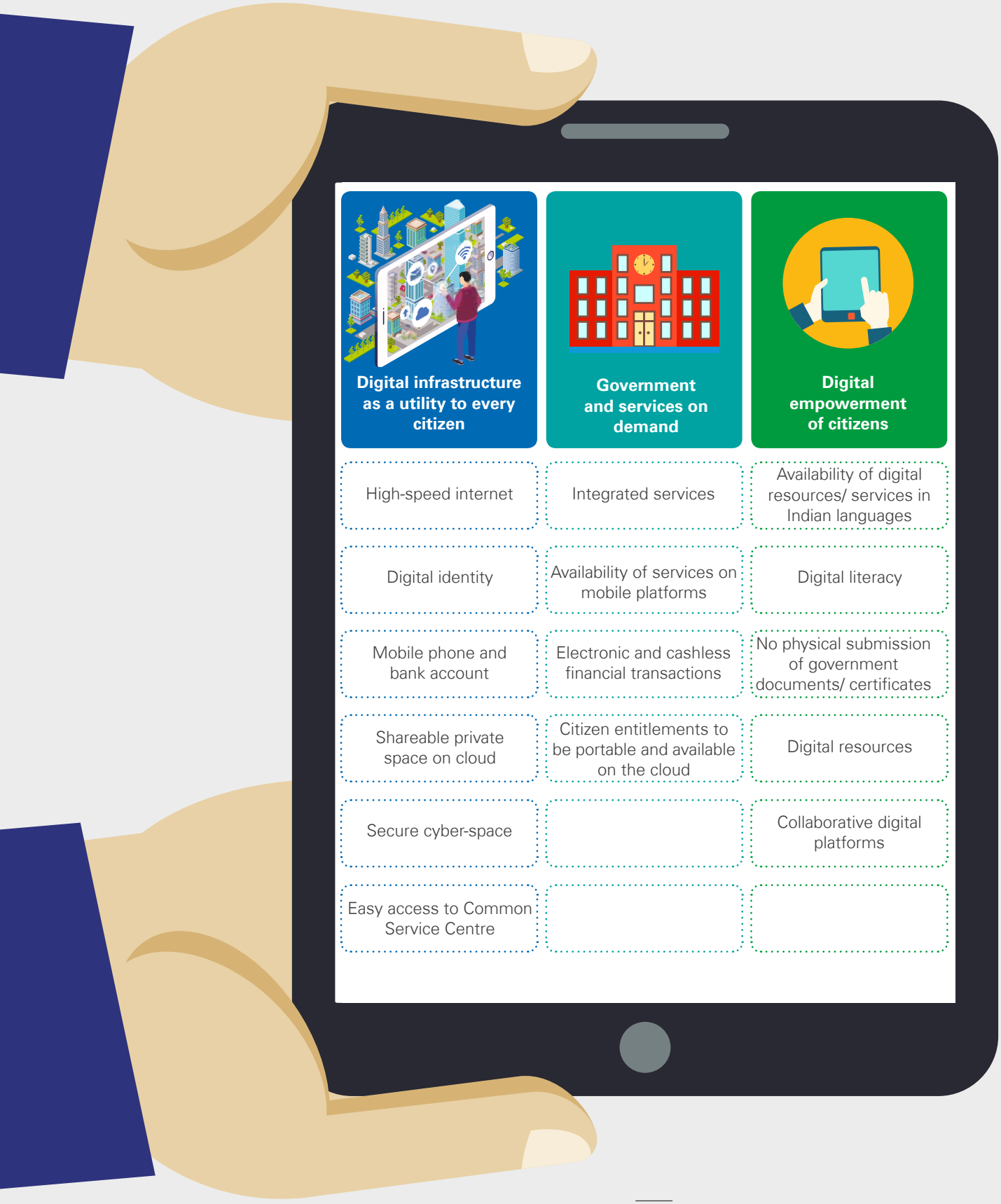


By 2020, the Government of India plans to roll out **5G**

By the end of 2020, about 2.5 million institutions and 5 million households are expected to get broadband via BharatNet

08. The IT-BPM Sector in India 2018, Nasscom report, 2018

Vision areas of Digital India[09]



09. Digital India, NIO, accessed on 20 August 2018

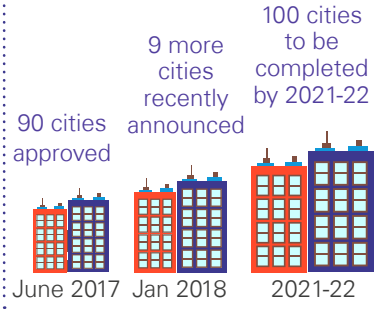
5G: In 2017, the government formed a committee of 22 members to focus on 5G ecosystem[10]

BharatNet: By the end of 2020, about 2.5 million institutions and 5 million households are expected to get broadband via BharatNet[10]

MeghRaj: To reap the benefits of cloud computing, the government launched MeghRaj, an initiative to accelerate delivery of e-services in India while improving government spending

DigiLocker: The government launched DigiLocker, a digital locker service that enables Indian citizens to securely store e-documents on the cloud

Smart City Mission: With a goal of providing better quality of life and smart IT solutions to citizens, the government launched the Smart City Mission[10]



GSTN: The Goods and Service Tax Network (GSTN) was developed by the government of India in 2013, to connect the income tax databases of all states and centre[10]

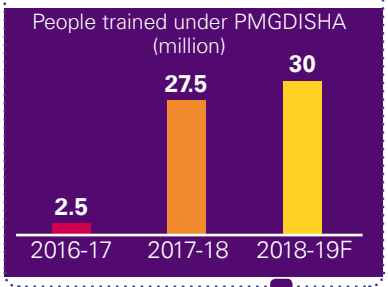
81% of the 7.23 million indirect tax payers are registered on GSTN*

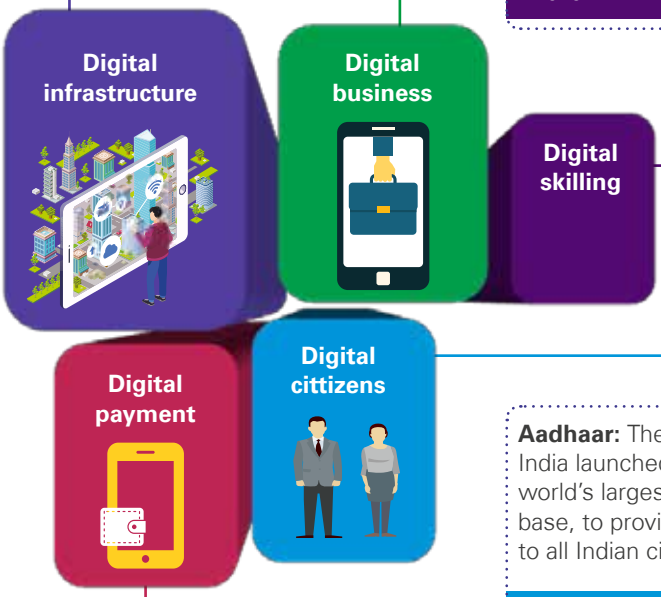
370 mn invoices uploaded on the portal**

*As of August 2017
**Till November 2017

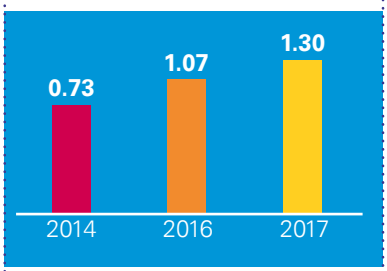
NSDM: The National Skill Development Mission aims to provide training to 400 million people by 2022[10]

Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA): This initiative launched to digitally literate people has made notable progress in the last couple of years[10]





Aadhaar: The Government of India launched Aadhaar, the world's largest biometric data base, to provide national identity to all Indian citizens[11]



44 Mission Mode projects such as eGov AppStore, MyGov platform and e-bhasha that are focused on providing government services via electronic mode have been launched by the government

Digital payments per day after Demonetization[11]

Digital payment mode	8 Nov 2016	17 May 2017	Growth
UPI/BHIM	3,721	3.31 lakhs	8,803%
Debit Cards (RuPay)	3.9 lakhs	14.26 lakhs	270%
Aadhaar Enabled Payment System (AEPS)	32243	1.58 lakhs	390%

10. The IT-BPM Sector in India 2018, Nasscom report, 2018
11. Digital India, Trai.gov, 24 August 2017

E-governance in India

The Government of India has laid special focus on providing its services to the citizens in an easily accessible and comprehendible manner, under its National e-Governance Plan. The concept of e-governance is aimed at reducing complexity and time lag in availing services for citizens.

E-governance initiatives in India

E-governance success stories

- **Road and Transport mission mode project:** Various states in India have collected taxes to the tune of INR10,000 crore online since the rollout of transport mission mode project (MMP), which has also automated regional transport operations, under the governments e-governance initiative.
- **Central Public Procurement Portal:** Since its launch, the portal already has around 3.5 lakh contractors and vendors registered. In November, 2017 alone, electronic bids for over one lakh tenders valued at around two lakh forty thousand crore were invited through this portal.
- **Government E-Marketplace (GeM):** The third version of the Government E-Marketplace (GeM) has been launched in 2018. The platform till date has 7,800 buyers, 5600 sellers, 3,75,000 products and twelve services listed.

Planned e-governance initiatives

- **Government Integrated Financial Management Information System (GIFMIS):** The system is planned to be administered by Controller General of Accounts, for budgeting, accounting, expenditure and cash management for more effective fiscal management of Government.
- **E-Vidhan:** This platform would aim to digitise and make the functioning of all State Legislatures paperless.
- **Non Tax Receipt Portal:** The portal would seek to provide one stop services for depositing fees, fines and other non-tax dues into Government account.
- **E-courts:** The E-courts platform would bring about universal computerisation of all Districts and Subordinate Courts. Further, a National Judicial Data Grid would provide an online platform for information relating to judicial proceedings and decisions from over sixteen thousand computerized Courts and Subordinate Courts in the country.

- The Tamil Nadu Government has launched an e-governance policy that would enable public, government and commercial establishments to obtain all its services through digital mode by 2023
- The policy has a provision for the government to allocate 0.5 per cent of the total funds in a financial year for the digital initiatives and later increase it to three per cent in the next five years in a phased manner
- The Tamil Nadu government is creating a centralised repository of digital maps, which would provide all the departments access to GIS spatial layers that are expected to come in handy while taking key policy decisions and also during disasters

The role of technology

India's massive push towards digitisation via the 'Digital India' initiative has been predicated upon the proliferation and subsequent confluence of technologies within an ecosystem.

Technology has enabled millions of Indians to gain access to platforms which were considered inaccessible in the not too distant past. The combination of cheap data, expanding digital infrastructure, declining cost of hardware, increasing digital literacy and miniaturisation of technology platforms has unlocked the universe of technology related benefits across the country.

Today, it is commonplace for universities, schools, libraries, hospitals, government departments, utility services and end users to be interconnected via the ever-expanding network of the internet and this has laid the foundation for the digitisation of the entire country.

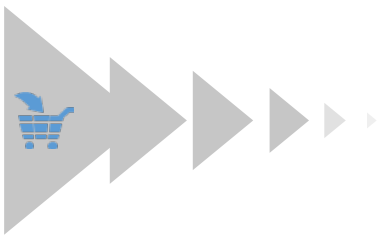
Technologies forging the path for digital economy

As India stands on the cusp of transforming itself into one of the world's fastest growing digital economies – emerging technologies such as big data, AI, IoT, among others, have had a significant role to play. These technologies to a large extent form the core of what is driving the digital revolution throughout the country - from a nation of relatively disconnected geographical pockets to one seamlessly interwoven into a web of connected nodes.

While emerging technologies are fueling India's digital journey, it is the confluence of these technologies which is accelerating the pace of digital growth. The fusion of these technologies – backed by the availability of cheap data and large scale proliferation of smart devices among the country's masses, is aiding and abetting a change in the pattern of business and consumerism, and bringing about a societal transformation by making it more inclusive.

Rapid technological innovation, catalysed by emerging technologies is reshaping the way goods and services are produced and consumed - with profound implications for the dynamics of productivity, jobs, trade and investment. These innovations represent a significant opportunity for enterprises to get ahead of the curve and embrace the change, while reimagining and reinventing their business models to remain in-sync with the times.

A coming together of such disruptive technologies into an effective system is bringing about a paradigm shift in the way business operate – from the traditional models whereby enterprises operated predominantly offline, to operating models that are based on the concept of instant input, door step delivery, zero inventory and connected devices.

Warehousing inventory Traditional business models depended on effective inventory management and the enterprises ability to manage the supply chain effectively		**Zero inventory models** Technology has enabled firms to drastically reduce the inventory management models and move towards the concept of minimal inventory
Physical stores Business largely comprised brick and mortar stores, stocking tangible products and operating on a standalone or a franchise model		**Online operations** With the advent of the internet and proliferation of connected devices – enterprises have in several cases adopted 'online' as their sole mode of operations
Restricted consumer base Costumers of businesses have traditionally comprised those living in geographical proximity and had specific requirements		**Customer segmentation** With greater volume of data and analytics available with enterprises, they are able to segment potential consumers into minute groups in order to target them specifically
Market entry barriers Traditional enterprises faced issues in entering an industry and scaling up – in terms of finance, supply chain, geography, economies of scale, etc.		**Minimal barriers to entry** Technology has significantly reduced the market entry barriers across varied industries – by bringing down the cost of doing business, as well as the effort

Technology is compelling entrepreneurs into reimagining and reshaping traditional business

This technology-enabled transformation of business has manifested itself across the globe and is increasingly visible within the Indian ecosystem as well. In the last 5-10 years, business models of various industries have completely changed, thereby bringing about a corresponding change in consumption behaviour as well.

These technology-enabled operating models are enabling firms to accomplish multiple goals, such as achieving exponential revenue growth, cost optimisation, easing logistics and distribution chains and enhancing the bottom line. On the customer side, disruptive technology implementation has enabled a significant enhancement in reach, response time and overall levels of customer satisfaction.[01]

To understand the evolving business models and their subsequent impact on consumers in specific and society at large – it is imperative to understand the specific technologies which are the forefront of driving this change and how they might impact the future of business and society.

01. How technology has changed the way businesses function in 2017, Qrius, 2 January 2018

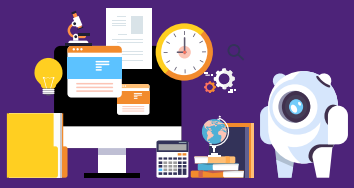
Key technologies driving the digital revolution in India

While emerging technologies are an essential factor in driving innovation and inclusion in the country, it is imperative to understand the key levers or technology components that are behind this change, in order to fully comprehend their future potential.

Emerging technology levers driving digital inclusion in India

Mobile internet (5G)

Artificial Intelligence (AI)

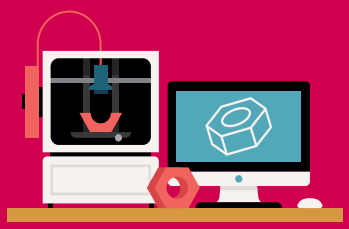


Cloud computing

Blockchain

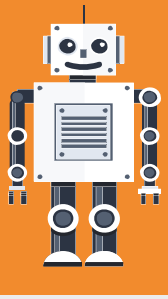
The Internet of Things (IoT)

3D printing / Additive manufacturing



Big data analytics

Robotics Process Automation (RPA)



Mobile internet (5G)

5G networks are the next generation of mobile internet connectivity, offering faster speeds and more reliable connections on smartphones and other devices. 5G networks are capable of offering connections that are several times faster than current connections, with average download speeds of around 1GBPS. The network is expected to begin rolling out in India by 2022 and could prove to be a huge boost to Internet of Things technology, providing the infrastructure needed to carry huge amounts of data, allowing for a smarter and more connected world.[02]

The government has already taken several steps to roll out this technology, including the 2018 budget, where the Finance Minister announced that the Department of Telecom (DoT) will support the 5G test bed at IIT Chennai.

With 5G at its helm, it would be possible to envision a future for India where the Internet of Things (IoT) and Artificial Intelligence (AI) are mainstream, and connectivity is seamless, designed to improve the quality of e-governance and education, as well as to enable financial inclusion, smart cities, and an intelligent transportation system.[03]

Additionally, in a rapidly developing economy such as India, 5G is expected to show impactful results in key social sectors such as agriculture and healthcare.

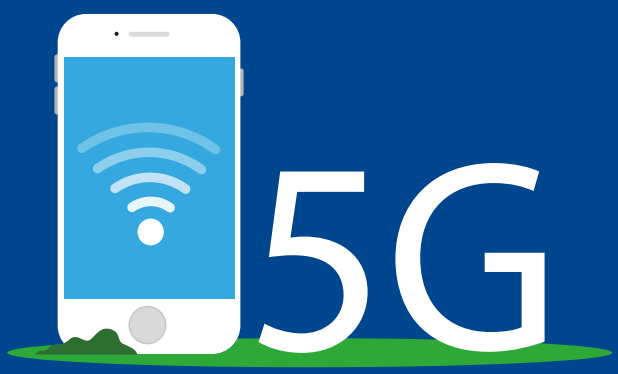
Inclusive applications of 5G

An assessment made by the UN shows that 5G could enable the agriculture industry to deliver a 70 per cent increase in food production worldwide by 2050.

With the government's stated aim of doubling farmer's income by 2022, 5G technology could prove to be a game changer.

Using 5G technology, farmers could have access to agro advisories on their mobiles, including weather forecasts and recommended actions, as well as information on pests, seed varieties and techniques for conservation agriculture.

02. Accelerating India's future with 5G, The Hindu Business Line, 9 March 2017
03. What is 5G? Everything you need to know, techradar, accessed on 21 August 2018



Cloud computing

Cloud computing is one of the fastest growing digital technologies in India, in terms of adoption. The cloud services market in India is expected to witness strong growth in its adoption by both private enterprises as well as government services - with the market size in India expected to reach USD4.1 billion in 2020, up from USD1.3 billion in 2016.[04]

Despite initial concerns regarding data security and challenges in high-speed internet connectivity, power supply, bandwidth, and optical fibre connections, – the growth in cloud technology adoption has been consistent. It is being driven by the increasing need for business innovation and agility, the need to up-scale fast in a competitive market, the need to manage huge volumes of data and the government's thrust towards Digital India.

Cloud technology forms the fundamental backbone on which other emerging technologies such as big data, IoT and AI can thrive. Its ability to combine with other technologies and provide a common platform for enabling seamless and extendible digital services is critical to the task of digital transformation of the country.[05]

In India, cloud technology is expected to find large scale application in a variety of sectors such as healthcare, education, safety and security which require extensive reach beyond just the urban areas – in order to reach the masses scattered across the length and breadth of the country.

Inclusive applications of cloud

The Government of Tamil Nadu has announced an agreement with Microsoft India to improve the integration of technology in teaching and learning in the state, using could technology.

The collaboration aims to reform education, build tech capacity and enhance digital literacy across all levels. Microsoft, as a part of the agreement, will adopt seven schools in the state.

04. India's Booming Cloud Market Is Set To Be Worth $4.1 Billion By 2020 – Here's Why, Forbes, 23 March 2018
05. Tamil Nadu, Microsoft Join Hands To Accelerate Cloud Technology Adoption In Education, NDTV, 23 February 2018

The Internet of Things (IoT)

The Internet of Things (IoT) typically refers to a network of interconnected 'Smart Devices' that are capable of integrating into a vast information network.

While IoT is still in nascent stages of adoption in India, it continues to gain traction within the country. According to NASSCOM, the IoT market in India is expected to reach USD15 billion by 2020, accounting for 5 per cent of the global market, with the number of IoT devices going up to 1.9 billion units by 2020 from the figure of 60 million in 2017.[06]

Industries such as utilities, manufacturing, automotive and transportation and logistics are expected to see the highest adoption levels in India, whereas the healthcare, retail and agriculture sectors are also expected to witness significant progress in IoT adoption. The government's planned investment worth USD1 billion for 100 smart cities over the next five years is expected to be a key enabler for IoT adoption across these industries.[07]

Large scale adoption of IoT in India is expected to provide a major boost to the development of Smart Cyber-Physical Systems (SCPS), which are an essential component for the development of smart solutions that can be deployed in a variety of sectors.

Inclusive applications of IOT

Tamil Nadu has among the largest number of smart cities in India and IoT is expected to be a key component of these Smart Cities.

IoT is capable of providing smart solutions for cities in the domain of traffic management, utilities and smart grids, safety and security, waste management in addition to several other aspects pertaining to urban planning.

06. Future picture: Why India will need Internet of Things to bring in major transformation, The Economic Times, 22 November 2017
07. Why Internet of Things can become the game changer that India needs, Livemint, 16 July 2018

Big data analytics

Big data analytics is a set of techniques and tools to process and interpret large volumes of data, including data mining, profiling, business intelligence, machine learning and visual analytics. In combination with IoT, Big Data analytics is capable of generating critical insights which can provide firms with competitive advantage.[08]

In India, the adoption of big data is on the upswing. According to cloud major Oracle, Indian enterprises are adopting big data and analytics technologies to improve operations and enhance customer experience at a greater pace than the rest of the Asia-Pacific (APAC) countries.[09,10]

Going forward, big data analytics is expected to play a key role in decision making for private enterprises – with 41 per cent of CEO's in India intending to enhance the use of data analytics over the next three years (According to the KPMG in India CEO outllok report 2018). Additionally, the use of big data analytics is also expected to enable quick processing of vast ammounts of data available with the governments – enabling them to use the insights generated to develop a policy framework, based on concrete data.

Inclusive applications of Big Data

Big data analytics is gradually making its way into Indian policy making decisions. Economists at the Ministry of Finance have used preliminary data from the Goods and Services Tax network (GSTN) to understand the patterns of trade between states, enabling them to be proactive in driving state-specific policy initiatives.

Tamil Nadu could apply Big data to conduct district wise assessment and gain insights into development patterns and productivity factors.

08. ACHIEVING INCLUSIVE GROWTH IN THE FACE OF DIGITAL TRANSFORMATION AND THE FUTURE OF WORK, OECD report, 19 March 2018
09. India tops Big Data and Analytics adoption in APAC region: Oracle, Business Standard, 24 February 2018
10. Big Data can rejuvenate India's statistical system, Livemint, 20 June 2018

Artificial Intelligence (AI)

Artificial intelligence (AI) refers to the ability of machines and systems to perform a broad variety of cognitive tasks, such as sensing, processing oral language, learning, making decisions and manipulating objects accordingly – using a combination of big data analytics, cloud computing, IoT and machine-to-machine communication.

AI applications in India are on the rise in private enterprises as well as within the government sector. According to the KPMG India CEO Outlook report 2018, – 42 per cent of CEO's in India are piloting the use of AI in a small number of processes. Additionally, the Government of India's think-tank has recently published a working paper named National Strategy for Artificial Intelligence, which presents a comprehensive AI vision for India. The paper has identified five focus areas where the gains could drive not just growth but greater inclusion. These include — healthcare, agriculture, education, urban-/smart-city infrastructure, and transportation and mobility.[11,12]

The deployment of AI-enabled software in the aforementioned sectors could help develop 'smart machines', which are capable of learning from existing patterns and providing pro-active and flexible solutions for unique problems. These include applications in disease prediction, quality assessment, crime detection, etc.

Inclusive applications of AI

Indian Railways has adopted an artificial intelligence system to ensure hygienic food for passengers onboard. The Railways authority has installed CCTV cameras at 16 of its base kitchens in order to track real-time cooking and packaging of meals. The CCTV cameras will be monitored from IRCTC's headquarters based in New Delhi.

Other potential areas of adoption for AI include crop management wherein AI can be used for the purpose of crop prediction, health management and selection based on historical data and current factors.

11. AI on the future: Artificial Intelligence add ~$1 billion to India's GVA by 2035, says NITI Aayog, Financial Express, 6 June 2018
12. Indian Railways to adopt artificial intelligence system to ensure hygienic food for passengers onboard, Zee News, 8 May 2018

Blockchain

Blockchain is a distributed ledger which can record transactions between multiple parties in a verifiable and permanent manner.

Originally invented as a platform for tranfer of the digital currency, Bitcoin – the blockchain platform has been lately recognised for its potential application across multiple sectors. The platforms ability to validate data records in a quick and efficiant manner, increase transparency and reduce counterparty risk, make it ideal for application in a multitude of sectors.

In India, the Reserve Bank of India has successfully tested blockchain technology for trade application and settlement purposes. At the state level, Andhra Pradesh has become the first state in India to adopt blockchain for governance. It has piloted two key projects: managing land records and streamlining vehicle registrations, using blockchain technology.

With the ever-increasing importance of data in the country, the adoption of blockchain technology is expected to increase significantly, as it enables significant ease in data management as well as providing added transparency and security – with its shared ledger concept.

Going forward, blockchain has a key role to play in maintaining transparent records as well as preventing corruption and data theft.[13,14]

Inclusive applications of blockchain

Blockchain technology can be used by banks to secure data regarding depositors and their assets.

In the healthcare sector, blockchain could be a platform for recording the medical attention of a patient and identifying a trend from the data recorded.

The blockchain platform can also help reorient the education system by delivering academic transparency. It can build an e-portfolio of academic credentials which contains test scores since the day a student is enrolled, till such time he/she completes their education.

13. This Indian City Is Embracing BlockChain Technology – Here's Why, Forbes, 5 March 2018
14. How blockchain will fundamentally change our lives in future, The Economic Times, 9 March 2018

3D printing / Additive manufacturing

3D printing or additive manufacturing encompasses different techniques that build products by adding material in layers, often using computer-aided design software. 3D-printing processes are primarily used for rapid prototyping, models and tools. The technology, has the potential to transform many industries in the years to come and its adoption in India is set to grow in the short to medium term, given that key players are now arriving in the country with their 3D solutions and technologies. Although at a nascent stage currently, India's 3D printer prototyping and materials market is expected to reach USD79 million by 2021.[15]

A key factor driving the growth of 3D printing technology in India is the government's thrust on manufacturing. As the Government of India intends to boost the share of manufacturing in GDP, it is likely to promote technologies which could hasten the advent of Industry 4.0 in India.

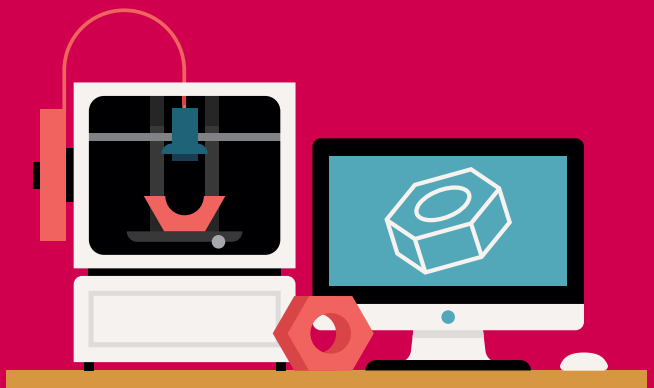
Advancements in 3D printing could bring a significant reduction in the cost of manufacturing components as well as the entire manufacturing process by enabling mass production whilst maintaining quality standards. The technology is expected to find widespread application in the industrial manufacturing and healthcare segments in India.[16]

Inclusive applications of 3D printing

3D printing or additive manufacturing has the capability to bring down the cost of manufacturing in India. It has widespread applications in the automobile, aerospace, infrastructure, education sectors in India.

In Tamil Nadu, there is significant scope for the adoption of 3D printing technology in the automobile sector, owing to its significant presence across the state.

15. From healthcare to manufacturing, 3D printing set to grow big in India, Yourstory, 30 January 2018
16. '3D printing helps levelling competition', The New Indian Express, 21 August 2018



Robotics Process Automation (RPA)

Robotic Process Automation is a technology that allows configuration of computer software, or a robot to emulate and integrate the actions of a human interacting within digital systems to execute a business process.

RPA continues to gain popularity amongst firms in India as a way of automating repetitive, tedious tasks to handle higher-value analysis and decision-making. It is estimated to generate a 2 lakh related job opportunities in the country by 2021.[17]

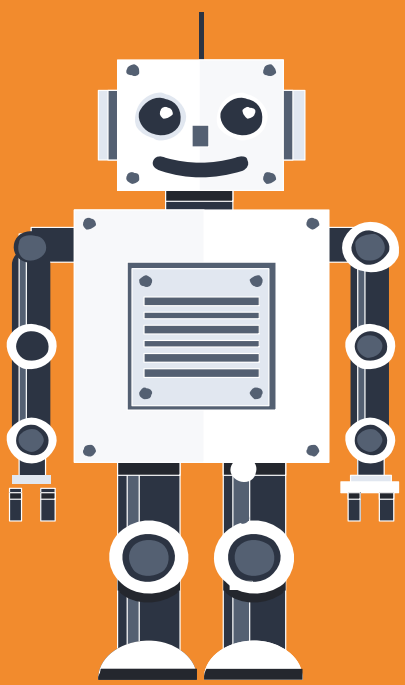
Early adopters of RPA globally, as well as, - in India, have been banking and financial services, telecom, retail, insurance and the healthcare sectors.[17]

Going forward, RPA is expected to be a key component of the manufacturing sector in India, as enterprises continue to make the move towards smart, efficient and more cost effective manufacturing techniques.[18, 19]

Inclusive applications of RPA

RPA could find extensive application in India's insurance sector. RPA could help insurance companies automate their workflows and streamline their operations. This would help them handle claims processing, underwriting as well as policy quotations. The technology has the capability to help boost the profit margin of insurance companies and subsequently help improve insurance coverage in India.

17. Robotic Process Automation will generate nearly two lakh jobs in India by 2021, The Economic Times, 18 January 2018
18. RPA in India: The time is now, ET Tech, 24 May 2018
19. RPA and the Insurance Industry, Medium.com, 19 February 2018



Confluence of technologies and the role of start-ups in fostering inclusion

Emerging technologies such as AI, blockchain, big data and IoT all promise fundamental social and economic disruption. However, the true enabling factor for digital transformation emanates from the confluence of the aforementioned technologies into a high-performing system. Technologies feeding into each other create synergies which are capable of bringing new-found efficiencies into existing systems, while also creating entirely new ones – to tackle today's set of challenges.[01]

Therefore, as digital technologies continue to evolve and become more sophisticated, the focus is shifting towards designing solutions which integrate these technologies to provide holistic solutions to long standing challenges facing the society. Going forward, it is anticipated that these technologies would mesh together while significantly improving interoperability, towards creating an ecosystem which would be capable of adapting to the behaviour of users, anticipating their needs, providing solutions as well as implementing them – with minimal human intervention.[02]

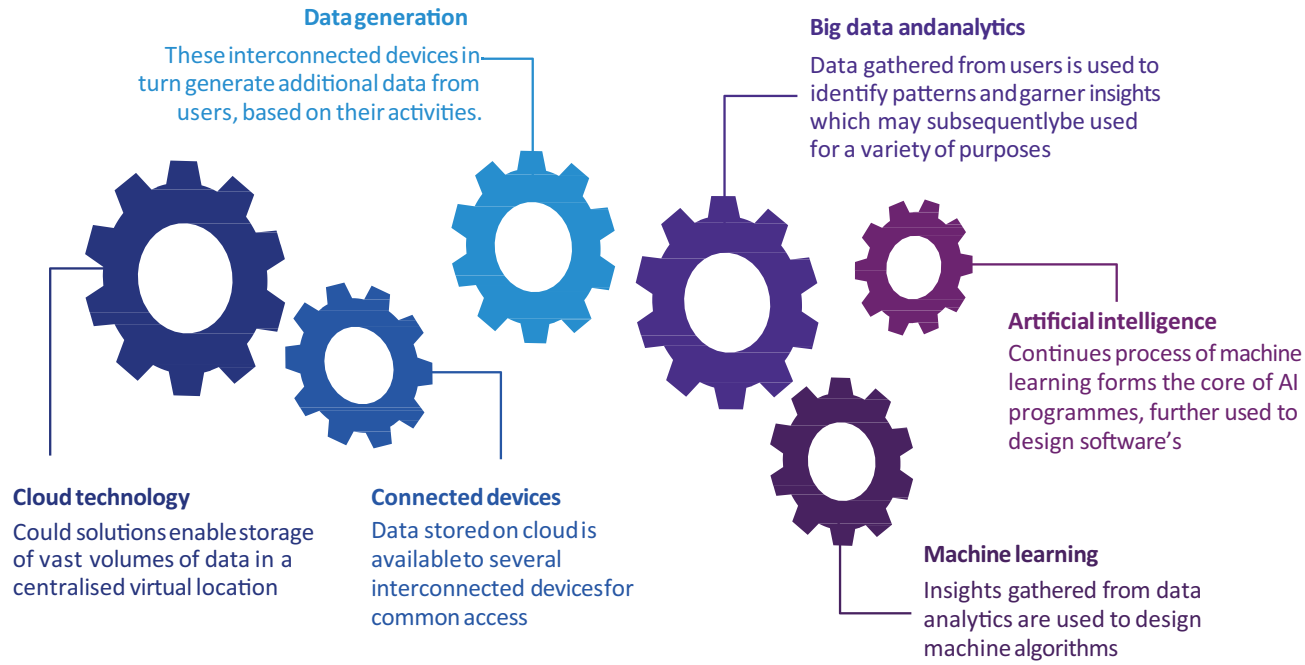
Digital technologies integrating with each other could be explained with the help of an example, wherein, the availability of cloud computing enables storage of vast volumes of data, that is accessible to several nodes - This in turn facilitates a network of interconnected devices (IoT) to generate large volumes of data – from which insights are gathered using data analytics. These insights are further utilised to design algorithms for machine learning and development of artificial intelligence programmes.[03,04]

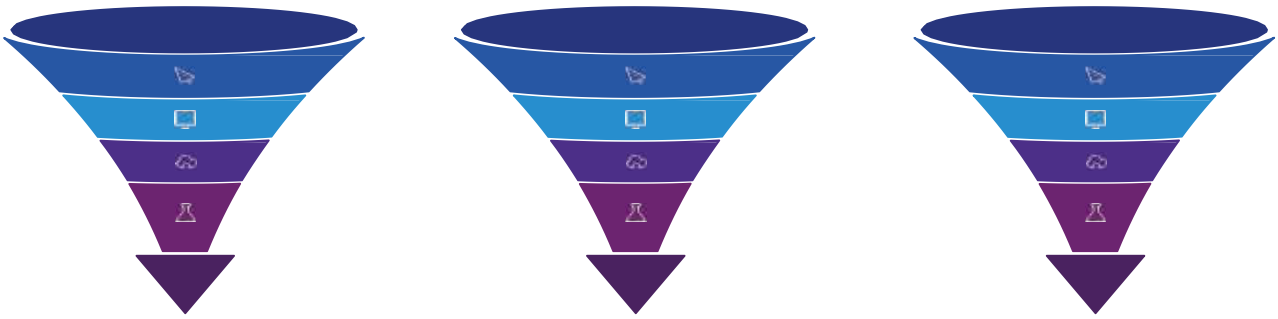
Such confluence of technologies is expected to become even more seamless in the future with the rolling out of ultra high-speed broadband in the form of 5G technology. The jump to 5G would not only increase data speed, but a corresponding decrease in latency as well. This increase in responsiveness is expected to enable altogether new applications, as connected devices and machines would be able to share data in real time.

With the advent of 5G, emerging technologies such as the internet of things, augmented reality, virtual reality, smart cities, drones and intelligent machines which have been in the concept phase for years, would finally be deployable for mass use.[05]

01. A Look at how Tech is Changing Society with Increased Accessibility, Edgylabs, 29 January 2018
02. AI, Blockchain, IoT, Cloud, RPA and 3D printing will be the game changers in 2018, ETCIO, 26 December 2017
03. ACHIEVING INCLUSIVE GROWTH IN THE FACE OF DIGITAL TRANSFORMATION AND THE FUTURE OF WORK, OECD report, 19 March 2018
04. The power of three: AI, IoT and blockchain, Livemint, 30 March 2018
05. Policy challenges of new technology, Livemint, 23 April 2018

The coming together of emerging technologies is bringing innovative solutions to social challenges in India



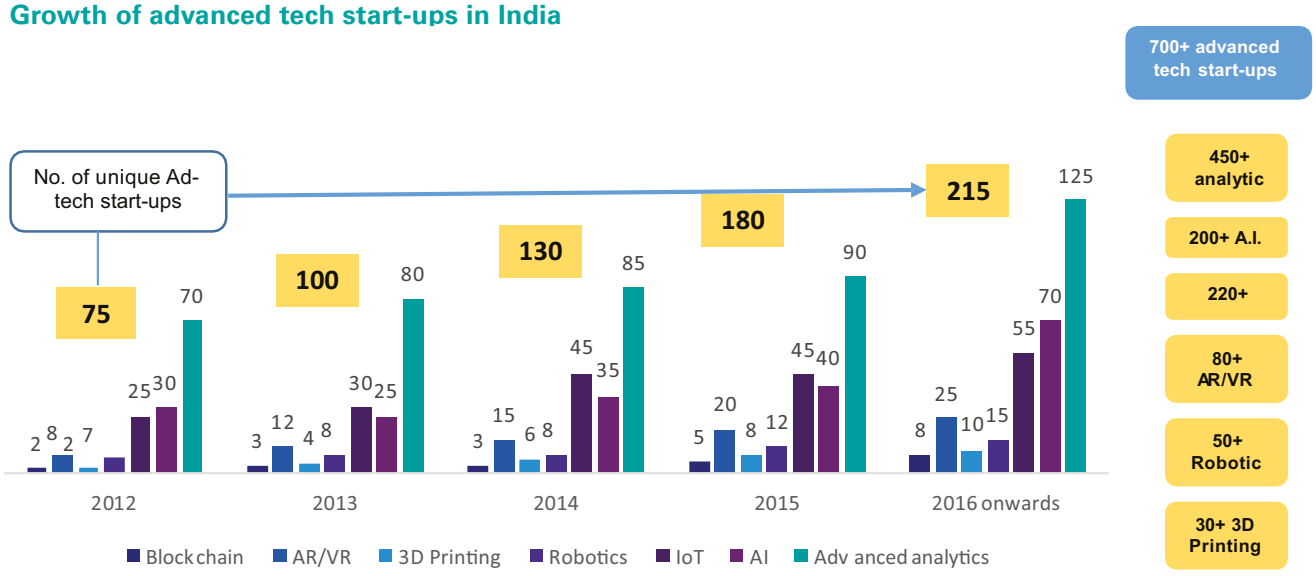


Role of start-ups in fostering inclusion via digital technology

The emerging trend of confluence of emerging technologies in India is to a large extent driven by a significant number of fast growing start-ups working within the 'deep tech' space.

Deep tech is a term used to describe start-ups or companies whose business is built around unique, differentiated — often protected or hard to reproduce — technological or scientific advances. The growth dynamics and advanced developments of emerging technologies—artificial intelligence (AI)/ML, blockchain, internet of things (IoT), big data, 3D printing and robotics, in the recent past have hit an inflection point, enabling deep tech start-ups to go mainstream in India.[06]

Growth of advanced tech start-ups in India



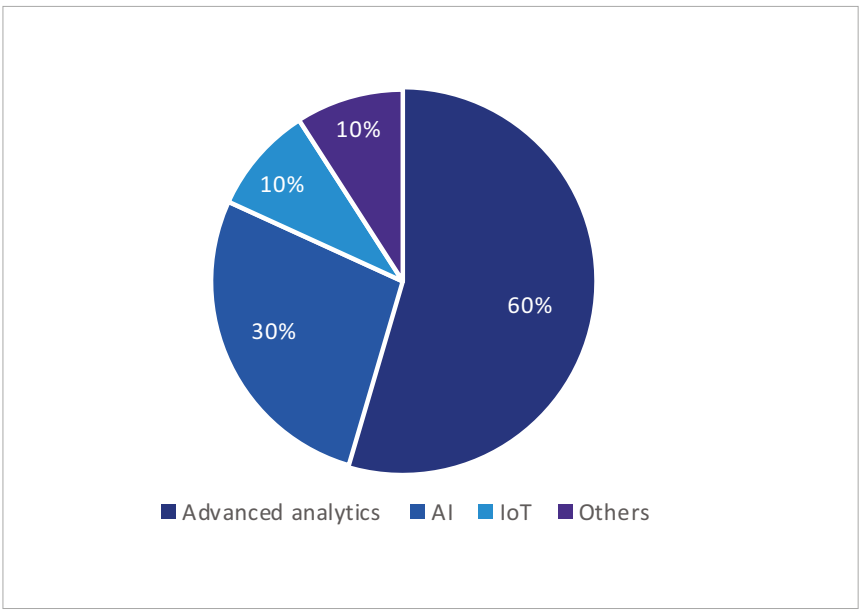
Source: Indian start-up ecosystem – Traversing the maturity cycle Edition 2017, NASSCOM, accessed on 14 August 2018

The emergence of 'deep tech' start-ups can be seen in the pattern of consistent growth in funding for such ventures. While previously, start-up's working in this domain did not garner much attention from investors, owing to long product gestation period, – this has now begun to change.

Advanced technology start-ups garnered USD340 million in funding in H12017, which constitutes an impressive 20+ per cent share of the overall funding during the period.

Enterprise product, fin-tech, health-tech, supply chain management and logistics and aggregators have emerged as the top verticals currently being disrupted by advanced technology (by funding).

Funding for deep tech start-ups's 100% = USD340 million, 1H17

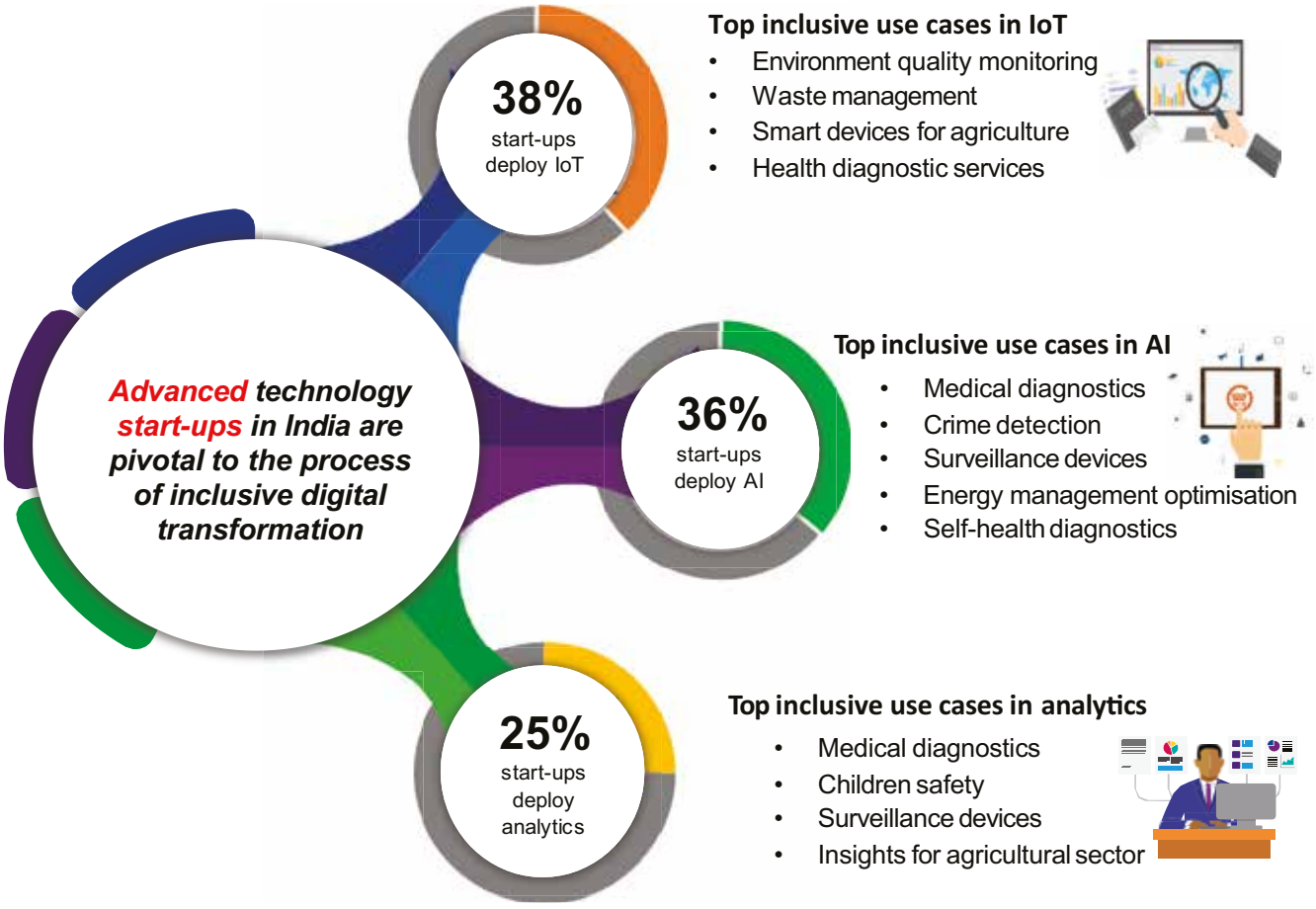


Source: Indian start-up ecosystem – Traversing the maturity cycle Edition 2017, NASSCOM, accessed on 14 August 2018

06. Emerging tech to get a boost in 2018, Livemint, 28 December 2017

A significant number of these advanced technology start-ups in India are working actively towards tackling social challenges. Currently there are an estimated 325 start-up's working towards solving social problems – out of which about 20 per cent are leveraging advanced technology at the back-end.

Some of the key verticals within the social segment which are leveraging advance technology extensively include - clean-tech, agri-tech, education inclusion, healthcare and crime prevention.[07]



Increased number of use cases for advance tech start-ups in the social sector, enhanced trend in funding for such start-ups and their increasing participation in tackling the social challenges of today – all point to their growing role in bringing technology to the people in a more inclusive and all pervasive manner than has ever been done before, in the Indian landscape.

In the future, deep technology start-up's are very much capable of bringing the change in terms of merging technologies and creating next generation solutions, while also significantly altering the ways in which technology interacts with the common man and influences their behaviour evolves.

07. Indian start-up ecosystem – Traversing the maturity cycle Edition 2017, NASSCOM, accessed on 14 August 2018

Transforming the digital economy of India – the role of industry and academia

While the government and start-ups remain key ingredients in the quest to foster greater inclusiveness in society - from a policy and innovation standpoint, the role of industry and academia stands as equally significant to the mission.

This is especially important from a skill development standpoint, in a time where there is a significant skill gap in the application of emerging technologies – which is hampering its growth prospects in India.

Industry  **Academia**

Building India's digital infrastructure

India Inc. has a prominent role to play in establishing the infrastructure necessary to make digitisation a success. The government has laid out ambitious targets in terms of laying optical fiber cables, establishing common service centers and achieving zero imports in the electronics sector by 2020, among others.

These tasks would require the significant expertise of global and Indian technology giants and they present a unique opportunity for India Inc. to be equal.

Providing skill training in disruptive technologies

Academic institutions in India can help bridge the significant demand deficit for skilled workers in emerging technologies.

Engineering colleges and other technical institutions could play a prominent role in imparting industry relevant content to students, which would enable them to adequately fulfill the demand for trained professions in a wide range of sectors.

Developing smarter solutions

Technology firms in India, have a key role to play in developing solutions using digital technologies which are aimed at solving the everyday challenges faced by the citizens of India.

Initiatives such as Smart cities and Digital India require the participation of India Inc. towards developing the technologies, which can facilitate modern day solutions in healthcare, education utilities management, waste management and safety and security.

R&D in emerging technologies

Institutions of academic excellence could explore options in collaborating with government departments as well as industries towards enhancing their research and development activities.

Academic institutions have access to a large pool of students and other facilities required to conduct in-depth research in the domain of emerging digital technologies and assist in developing of solutions.

Imparting training in disruptive technology application

Enterprises operating in the niche domain of disruptive technologies could play a leading role in training aspiring professionals in the application of these technologies and help bridge the significant skill gap that is currently hampering their adoption in the country.

Companies can provide their know-how in emerging technologies by conducting training programmes.

Design suitable curriculum for all levels

In addition to imparting content to students, educational institutions also have a major role to play in designing relevant content and curriculum regarding the application of disruptive digital technologies.

Academic experts, including subject matter experts could form a key component of think-tanks which can play an advisory role in the domain of content development.

Roadblocks and recommendations for digitising India

Government roadblocks

Hindrance in infrastructure development

One of the biggest challenges that the Digital India programme faces is the inadequacy of required infrastructure.

Telecom infrastructure

At the heart of this initiative, enabling government's multiple digital initiatives and programmes, is the telecom infrastructure. To ease telecom infrastructure roll-outs, the Government of India introduced the Right of Way (RoW) rules in November 2016.[01] However, due to lack of clarity and implementation hurdles, the RoW has brought in some big challenges for the telecom sector.

- Since some tower policies in states are not aligned with the RoW rules, there is considerable delay in deploying necessary infrastructure for telecom services
- The phase I of BharatNet was completed in December 2017, missing its revised deadline of March 2017 by nine months.[02]

Smart Cities mission

From about 3,000 Smart City projects under implementation phase[03] to providing billions in incentives, the government has taken numerous steps to cater to the growing urbanisation in India. However, the mission to transform everything from traditional version to a new smart version, though ambitious, is facing its own set of challenges:

- Lack of skilled manpower
- Absence of coordination between center and state
- Insufficient funds
- Nonexistent security framework

Low awareness about digital platforms

Lack of awareness about digital platforms could also dent the vision of the government's Digital India programme. Because of low awareness of internet banking and other digital services, cash continues to be the preferred mode of transaction for a majority of merchants across India.

The absence of internet in all the areas of the country, unavailability of digital services in local languages and a sizeable number of population with no computer or laptop, are among the key reasons why attaining widespread digital literacy is still a challenge.

Cyber security[04]

With the substantial amount of data generated by numerous Digital India programmes, data security has emerged as a critical challenge for the government. In 2017, about 3.2 million records, an increase of 783 per cent from 2016, were either lost, stolen or exposed in the country. In 2017, 29 major data breach incidents took place, among which, the second most prevalent breach was access to government data.

In May 2017, Aadhaar numbers of over

130 million

people and bank account details of about 100 million people were leaked through government portals

01. Right of Way rules: The effects of implementation delay on India's telecom industry, The Economic Times, 7 August 2017
02. Has BharatNet fulfilled its end task of providing functional internet, Live Mint, 17 March 2018
03. The IT-BPM Sector In India 2018: Amplify Digital, Nasscom, February 2018
04. Data theft increased by 783% in India in 2017, says study, Business Today, 28 May 2018

Roadblocks for the industry

Lack of trained professionals in emerging technologies

Currently, Indian firms operating in the emerging technology domain are hampered by the shortage of skilled workforce.[05,06]

According to the NITI Aayog National Strategy for AI, India will face a demand-supply gap of 200,000 data analytics professionals by 2020. Further, Gartner reported that by 2020, 60 per cent of Indian companies looking to advance their data and analytics maturity will cite non-availability of talent in these areas as the single biggest inhibitor of adoption and growth.[07,08]

Stringent capital market regulations

Accounting standards in several cases are unable to correctly value intangible assets such as networks and intellectual property – which presents a major challenge for venture capital investors, as capital markets and listing regulations impose restrictions on the listing of loss-making companies. This hampers firms investing in emerging technologies, from accessing the capital markets, despite making promising progress in in-depth research and proof of concept development.[09]

Lack of high quality data

Data is the fuel for emerging technologies such as big data analytics, AI and IoT – which is integral to developing technology solutions. Enterprises in India, however are faced with the challenge of relatively poor quality of data, which can be patchy and inconsistent. This is a major hindrance for companies seeking to deploy machine learning and AI for the purpose of developing new age solutions – as poor quality of data does not present an accurate picture of on-the-ground circumstances.

Lack of regulations around smart solutions in India

The lack of regulatory backing and absence of a legal framework around smart technologies is a major challenge for private enterprises developing such solutions. Regulatory uncertainty is a hindrance to firms seeking to develop and implement emerging technology backed solutions – especially in sectors of social importance such as healthcare, education and safety and security.

Roadblocks for academia

Lack of funding for digital technologies in higher education institutions

Institutes of higher education in India which are capable of imparting relevant education in digital technologies face a lack of funds from central authorities which impedes them from gaining the necessary equipment and expertise with which to impart learning to students. It also prevents institutions from procuring high-end equipment which is required for training students adequately.

Lack of autonomy for higher education institutions

Academic institutions in India are somewhat hindered by the presence of multiple regulatory bodies for multiple tasks. A multitude of laws under such regulatory bodies deny educational institutes the much needed autonomy – which is necessary for them to design and develop independent content while also having the ability to take their own decision .

05. Skill gaps make it difficult to attract right talent: Report, The Economic Times, 5 June 2018
06. The digital skill gap that may trip the IT juggernaut in days to come, Business Standard, 9 June 2018
07. Tech companies face talent crunch in cloud, data, The Times of India, 4 July 2018
08. Can India's AI Talent Gap Be Stemmed With Government Initiatives?, Analytics India, 20 February 2018
09. Policy challenges of new technology, Livemint, 23 April 2018

Key recommendations for the Government of India

Developing digital infrastructure

Governments must seek to geographically expand the spread of digital infrastructure such as optic fibre cables, telecom towers, Internet and Wi-Fi hotspots. To enable this, adequate policy reforms, incentives for private players, utilisation of existing infrastructure and ease of doing business needs to be established.

This is necessary to ensure equitable and inclusive digital growth between urban and rural India. Currently the rural internet penetration in India stands at a measly 20 per cent – which can only be bridged by expanding the digital infrastructure exponentially.

Ensuring data security

Governments store critical data and information on their servers. With the rising incidences of cyberattacks, it is crucial for the government to protect the data of citizens and reassure them of data security.

Also, the government must educate and inform citizens and institutions about the risks and good cyber security practices while conducting electronic transactions.

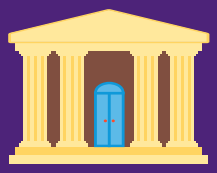
Robust policies and laws for data protection and privacy will help in mitigating data leaks and cyberattacks.

Upgrade academic curriculum

There is a need to introduce emerging technologies as a part of the course curriculum in technical institutes across the country and provide necessary practical exposure to students via dedicated innovation labs in colleges.

Currently, the curriculum in most academic institutions does not include topics pertaining to AI, data analytics, Internet of Things, robotics and blockchain. These topics must have a larger representation in academic curriculum in order to ensure that students are well versed with these subjects at a graduate level.

Need for clear regulatory guidelines



India Inc., various departments of the government and academia need to be active participants in the forming a policy framework around the development and application of digital technology based solutions – which can provide a clear direction to enterprises seeking to invest in technologies such as blockchain, AI, big data and 5G.

Within any regulatory framework, there is also a need to revisit certain accounting regulations pertaining to R&D expenses, in order to make them more flexible and friendly towards research activities being conducted by firms.

Greater autonomy for academic institutions

Academic institutions in India are somewhat hindered by the presence of multiple regulatory bodies for multiple tasks. A multitude of laws under such regulatory bodies denies educational institutes much needed autonomy – which is necessary for them to design and develop independent content while also having the ability to take their own decision.

Greater autonomy for technical institutes would give them more leeway to frame research guidelines, keep curriculum industry relevant and promote a culture of research in academics.

Source: KPMG in India analysis

About KPMG in India

KPMG in India, a professional services firm, is the Indian member firm affiliated with KPMG International and was established in September 1993. Our professionals leverage the global network of firms, providing detailed knowledge of local laws, regulations, markets and competition. KPMG has offices across India in Ahmedabad, Bengaluru, Chandigarh, Chennai, Gurugram, Hyderabad, Jaipur, Kochi, Kolkata, Mumbai, Noida, Pune, Vadodara and Vijayawada.

KPMG in India offers services to national and international clients in India across sectors. We strive to provide rapid, performance-based, industry-focussed and technology-enabled services, which reflect a shared knowledge of global and local industries and our experience of the Indian business environment.

KPMG.com/in

About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has around 9000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from around 265 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

As a developmental institution working towards India's overall growth with a special focus on India@75 in 2022, the CII theme for 2018-19, India RISE : Responsible. Inclusive. Sustainable. Entrepreneurial emphasizes Industry's role in partnering Government to accelerate India's growth and development. The focus will be on key enablers such as job creation; skill development; financing growth; promoting next gen manufacturing; sustainability; corporate social responsibility and governance and transparency.

With 65 offices, including 9 Centres of Excellence, in India, and 10 overseas offices in Australia, China, Egypt, France, Germany, Singapore, South Africa, UAE, UK, and USA, as well as institutional partnerships with 355 counterpart organizations in 126 countries, CII serves as a reference point for Indian industry and the international business community.

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