



Disruptive Technologies that can Transform India





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Table of contents

Preface	
Embracing Digital Disruption	1
The wave of digital disruption	1
The core changes initiated by disruption	2
On the path to reshaping India	3
Digital Disruption: A Sectoral Perspective	4
Education sector: Making learning delightful	4
Healthcare sector: Making a niche for AI-enabled Internet of medical things (IoMT)	5
Automotive sector: Connected devices fuelling an AI-driven automotive revolution	6
Banking sector: Enhancing the consumer experience	7
Agricultural sector: Helping in sustainable agricultural practices	8
Retail and FMCG sector: Transforming supply chains and consumer experience	10
Government sector: On the path to a building a connected economy	12
Building a digitally empowered society and the way forward	14
Annexure	17



Preface

Change is imperative and in the last few years of the digital wave, new technologies and scientific breakthroughs have transpired on many fronts. While some technologies have come and gone, there have been a few which have created a wave of disruption and challenged the status quo. These technologies have changed how people live and work and consume goods and services.

India, needs to get ready to embrace a technology-driven future for which it needs to understand the impact value of these technologies to shape the Indian economy and society at large in the next few years. One of the first steps in this direction would have the government provisioning digital infrastructure in which businesses and citizens stay connected, prosper and grow even as emerging technologies disrupt their lives.

The advent of Industry 4.0 and eight megatrends¹ (artificial intelligence, Internet of things, blockchain, augmented reality, virtual reality, 3D printing, drones and robotics) has demonstrated the ability to bring about large-scale economic and social change. We believe that technological impacts and the power to disrupt are complementary to each other and are the focus of our research. Technology not only represents newer ways of doing things but also has the ability to create a lasting change, one of these being the rise of digital natives with rising aspirations and expectations. Over the past two decades, the gross domestic product (GDP) of India has risen by more than 1 trillion USD, resulting in the emergence of a new cohort we call the emerging middle class². By 2021, 900 million people would be associated with this segment. At the same time, a closer look at the population age reveals that the working age population (between 15 to 64 years) is almost 1 billion, surpassing China by 2030 and making India a young nation with rising aspirations and high expectations of the emerging middle class. Though India has started making progress, the fact remains that it would have to work towards increasing its GDP by 9% per year to become a U10 trillion USD economy over the next two decades. Anything less than 10 trillion USD would not secure India's future. This is a huge gap and is one of the biggest challenges that India needs to overcome. While there is a massive amount of opportunity in terms of the young workforce available, to win this market, companies need to work with a shift in mind-set to achieve new value propositions that can be delivered through new emerging technologies with the ability to transform the Indian landscape and put it on the path to non-linear growth. This would involve not restricting themselves to business model innovations but also leveraging emerging technologies that have the ability to change the status quo. With the existing scenario, the call for change comes from every corner of society. And the way societies operate and interact with each other today has drastically changed due to the advent of digital solutions that make life easier through instant access to information and communication.

As part of the research initiatives on contemporary themes, AIMA has collaborated with PwC in carrying out this research. In this research, an attempt has been made to highlight and focus on some technologies and digital-driven use cases that have the potential to impact and transform the Indian landscape, involving the government, business powerhouses and society at large. The report brings about different examples of how these disruptive trends and general purpose trends such as mobile, cloud, digital wallets and payments have the capability, individually and in combination, to impact people and businesses and its applications in bringing about a transformation across different sectors such as Education, Healthcare, Banking services, Retail and FMCG, Agriculture and Government. In addition, it seeks to estimate the benefit that these technologies could generate.

1. <http://www.pwc.com/techmegatrend>
2. pwc.in/thewinningleap

Embracing digital disruption

The wave of digital disruption

The impact of technology in the last decade has been so profound that it can raise the productivity levels of our workforce, transform the way businesses work today, and help re-imagine how essential services can be delivered to improve lives. It has become evident that the technology landscape of India is undergoing a rapid transformation with start-ups and innovation incubators coming into the equation and enabling innovative thinking, thus helping to solve real-world needs and derive revenue streams by exploring new business models.

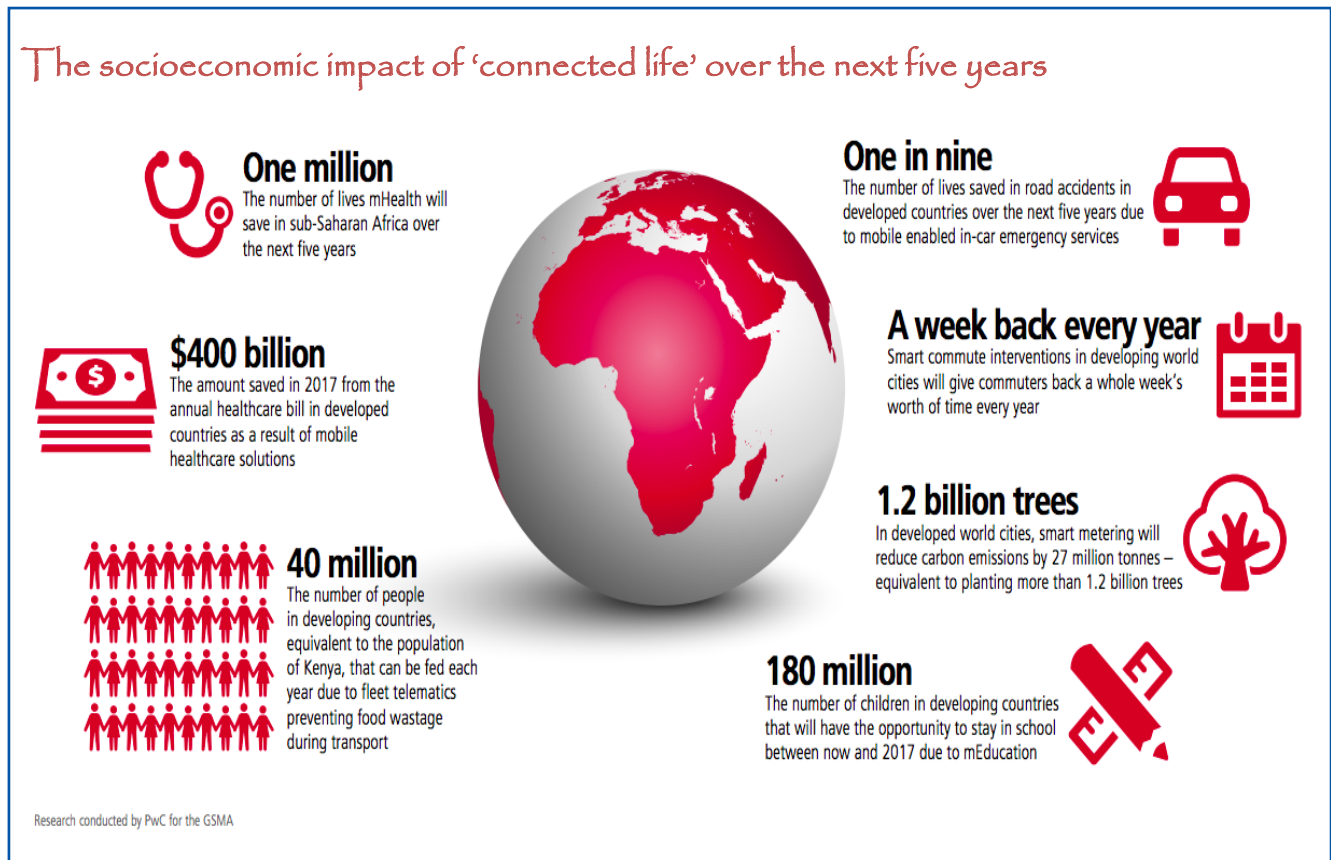
New technologies such as artificial intelligence, blockchain and augmented reality (AR) have taken the world by storm. This is indicative of the fact that there is a shift from the “consumption of information” to “consumption of experiences”, which is the true essence of a customer-centric approach. Speaking of customer perspective, exciting possibilities have opened up, such as bringing live in-stadium experiences to homes and interactive classroom teaching where students can actually experience history, rather than just reading it out of a textbook. From an industrial perspective, some technologies such as AR have been touted to usher in a new cognitive revolution. In today’s world, people and workers are increasingly multitasking and attention spans have begun to narrow—a phenomenon termed cognitive overload. The management science research firm Basex has estimated the cost of cognitive overload to be at least 900 million USD³ annually because of lowered employee productivity and reduced innovation. A basic investigation into the causes of such overload would lead to the not so obvious fact that our physical and digital worlds have been diverging from one another, siloed in their respective forms and representation. In such a scenario, AR, with its ability to bring about a convergence between our physical and digital worlds, seems to have just the prerequisites required to effect such a revolution.

Organisations across the world are today exploring different emerging technologies that can help them disrupt their market and change the way they look at business operations. A major aircraft manufacturing company has had remarkable success in increasing the performance of workers assembling a mock airplane wing. On similar lines, a leading multinational logistics firm showed a substantial improvement in the item selection process at their warehouse in the Netherlands. Such successes have led to organisations exploring the capital benefits of such solutions applied across the value chain. India can look at exploring this technology and look at adopting it and bringing it to mainstream operations. Indian business powerhouses have taken a cue from global organisations and started to embark on digital transformation journey.

Today, technology has become an intrinsic part of our daily lives. With an extremely amorphous socio-political system and economic reforms being carried out, it is encouraging to note that the government acknowledges the transformative power of technology and sees it as an enabler for the change that young aspiring India looks forward to. The Indian government has taken up many initiatives such as Digital India, Aadhaar, the Smart Cities initiative, GSTN, digital payments, and digitising education. All of these indicate that the Indian landscape is bound to get transformed, and this change is supported and driven by emerging technology that has the potential to disrupt and add value to businesses by opening up new revenue streams and transforming how they do business today, to stay relevant and stay ahead. With increased penetration of smartphones and the creation of connected devices, network companies have realised the potential of the

3. <https://www.emc.com/collateral/analyst-reports/idc-the-digital-universe-in-2020.pdf>

data explosion. They have started believing that 'data is the new oil' and have hence embarked on the digital transformation journey to monetise insights and gain benefits in the long run.



The core changes initiated by disruption

India has set out on a new path and has encouraged its young economy to adopt out-of-the-box thinking and look out for digital disruptors that can make life easy and transparent. Many companies have started taking this route and thus setting an example that the mind-set is changing and can be adopted across sectors. An excellent case in this direction has been set by the telecom industries, which just leapfrogged and saw massive uptake by consumers. One of the reasons is the convergence of changing consumer values driven by experience, the rise of digital natives who were ready to adopt technology and the simplicity of the technology itself that filled a need gap. Within a space of 20 years (1995–2014)⁴, the sector recorded 910 million mobile phone subscriptions— that is, 18 times the number of landline connections in 2006 (50 million), the year when landline subscriptions reached their peak.

Other sectors have also made forays into adopting technological disruptions and have witnessed sporadic success. Most of these developments generally happen through one of the approaches involving business operations and process change, technological intervention or market-driven innovation. Some robust case studies have been noted in each of these segments (for instance, the cost-efficient practices of a leading eye hospital in healthcare), and their ability to define a new business model of cross-subsidisation has set new standards for operational excellence, while the government's Aadhaar platform is an example of India setting

4. <https://telecom.economictimes.indiatimes.com/news/keysight-to-provide-5g-testing-solutions-at-iit-chennai-facility/64075470>

the pace for unifying citizens digitally. Marketing innovation is another concept that is brought to life when the ability to maintain a strong customer focus is achieved by marketing campaigns that have the ability to create incredible customer experience. One such example is of around a popular app that was acquired by a social network platform. This tool has provided a platform to the fashion industry with the ability to increase the depth of its storytelling and narratives, showcasing backstage photos and displaying pictures from the other side of the lens of make-up artists, photographers, etc., and has become popular among the fashion industry experts for quite some time. The resultant popularity has let the company forge a great number of partnerships. This was achieved with a small feature that was incorporated as a marketing innovation in the app. The “explore” function displays personalised results of channels users who are likely to be interested in; it also provides the Hyperlapse video recording features perfect for creating time-lapsed videos of hair of make-up routines. As a result, 86%⁵ of the top global brands are active on the platform, which is a powerful endorsement for the validity of the platform as a marketing and advertising channel.

As the private and government sectors make a conscious decision to shift to a more digitally oriented way of carrying out their business processes and day-to-day operations to leverage the benefit of technology either in the form of increasing efficiency, adding value, reducing costs or increasing profits, such transitions become a part of the digital transformation strategy and some digital transformation may even be disruptive in nature. However, the point that we need to keep in mind is that digital transformation is driven by some key variables such as innovative technology, customer behaviour, the market economics of demand and supply and other environmental factors. India needs to assess and view its socioeconomic challenges as opportunities. Different sectors and people who spearhead organisations need to challenge conventional ideologies and invest their energy into harnessing the skill available and further invest in innovative technologies and R&D to unlock vested interests.

On the path to reshaping India

Rapid digital transformation is happening in pockets for India as disruptive technologies reshape the different sectoral value chains and touch millions of lives on a daily basis. For example, when cloud technology was introduced, companies were reluctant to migrate, as they were uninformed about the benefits. Today, cloud is one of the most used terms in the business and technology world and has gained considerable momentum in the last decade. With storage and computing power becoming cheaper every passing day, the whole definition of infrastructure has changed over the years. Infrastructure understood as racks of computing units requiring constant maintenance have now begun to be viewed as pieces of code. The introduction of the container world in the cloud universe added a new set of wings. Over half of the world’s enterprises are transiting from a cloud-first to cloud-only model for keeping their game high. Thanks to cloud technology, the world is finally transforming into a completely connected system with an Omni channel and ubiquitous interface, making it possible for companies and individuals to derive insights from an immense amount of data available through cloud computing and converting the same into predictive and other forms of analytical data models. The enormous benefit of cloud services puts it at the centre for actions that the government can leverage to address different societal issues.

While we realise the potential of these technologies, we also need to be reminded of the barriers that India would have to evaluate regarding the infrastructure requirements and the costs associated with it. While the impact of technology is immense, people also need to consider the risks associated with them which raises questions on privacy and infringement of intellectual property rights. On one end, regulators and policymakers would have to look at these issues, and on the other hand, the business community and early adopters need to weigh their risks and opportunities to make sound decisions.

5. <https://www.linkdex.com/en-gb/inked/innovative-marketing-strategies-examples/>

Digital disruption: A Sectoral Perspective

Education sector

Making learning delightful

A sector that is getting impacted and also contributes to being a growth indicator is education. There is no doubt that the use of technology has changed the way training is delivered and consumed. It has created many new opportunities and avenues and also changed the learning process. The impact of technology is not just felt by students who are tech savvy but also by teachers whose initial uptake was gradual. However, with more teachers joining the wave of digital transformation, the benefits realised by both communities are immense.

In India, the majority of the students study in government schools, where poor and vulnerable students study for free until the age of 14. While enrolment rates have gone up, according to data released by the Ministry of Human Resource Development (MHRD), the national dropout rate at the primary level was 4.34% in 2014–15,⁶ and it was even higher at the secondary level, at 17.86%. This results in more than 70% of children never being able to complete their education. With the objective of preventing dropouts, the Government of Andhra Pradesh is working with teams to help identify the reasons and risks of dropping out with specially designed intervention programmes. The Andhra Pradesh government is applying machine learning and advanced visualisation techniques that consider multiple data points including a student's board exam performance, post-exam enrolments, school facilities, and teachers' abilities and skills.⁷ This solution has been taken to 10,000 government schools across Andhra Pradesh and has produced 6,00,000 predictions offering a 360-degree view of students, mapped using close to 100 variables. The interface also allows officers to counsel students accordingly. While few governments have understood that education is necessary to stay abreast of the global competition market, low-level skill development poses a challenge for India's economic growth. At the moment, about 1.2 crore youth need to be skilled, and by 2025, another 250 million youth are estimated to enter the Indian workforce.⁸ With regard to the skill development and vocational training programmes launched, the government understands that the learning outcomes are not up to the mark due to the variable quality of teaching and inadequate workforce. The only way to ensure that this gap gets covered is by leveraging emerging technologies. Technology applications supported through AI and machine learning can improve the quality of teaching and raise vocational attainment. High-quality courses can be launched through massive open online courses (MOOCs). Virtual classrooms and distant learning have seen massive adoption in the last few years, and online degrees have started getting recognised.

The way technology adoption has changed the conventional way of classroom teaching is something that we understand when we talk to millennials. Realising this, educational institutions are using technological means to enrich content by incorporating animation, images, audio and videos. Visualisation has become a fundamental way of imparting key concepts. Riding the wave of mobility apps, educational institutions have deployed chatbots (an artificial teaching computer program) as teaching assistants to troubleshoot and AI-

6. www.thehindu.com/news/national/Why-children-drop-out-from-primary-school/article16792949.ece

7. <https://www.hindustantimes.com/education/biggest-challenge-to-india-s-growth-low-skill-levels/story-kHQYRmpvDE63ukILOuowaP.html>

8. McKinsey Global Institute: Disruptive technologies: Advances that will transform life, business, and the global economy

driven engines to explain and answer student doubts. Disruptive technologies such as mobile Internet, cloud services, and automation through AI can help reshape India's education sector beyond any doubt. Adoption of other disruptive technologies such as digital payments and KYC will also enable transformation. While globally the passage to these techniques is at a fast pace, India is all set to reach the inflection point soon. Leveraging technology, India could have about 24 million more high school and college-educated workers and 18 million to 33 million more vocationally trained workers by 2025 due to the use of digital technologies in the education sector, with an estimated economic impact of \$60–\$90 billion per year by 2025⁹ from the higher productivity of more skilled workers.

Healthcare sector

Making a niche for AI-enabled Internet of medical things (IoMT)

The benefits of AI can be realised across various sectors. We are in the AI wave of disruption. Though this technology has been prevalent for a decade, the benefits and use cases have been getting defined in the last few years. So, what kind of impacts are companies and people expecting? One outcome has been the creation of an expanding market for AI solution and services. In December 2015, Bank of America Merrill Lynch (BAML)¹⁰ estimated that the robot and AI solutions market will surge to 153 billion USD a year by 2020, comprising 83 billion USD for robots and robotics and 70 billion USD for AI-based analytics. BAML added that adoption of robots and AI could boost productivity by 30% in many industries over the coming decade while cutting manufacturing labour costs ranging from 18% to 33%.

As AI continues to evolve, the benefits will transform the way businesses operate and how people engage in every aspect of life. The key behind an enriched AI system is data which forms the basic unit standing on three critical pillars: 'collecting and leveraging data', 'training the data' and 'drawing inferences from the data'. This brings us to the concept of "AI as umbrella". What business leaders and people generally mean is that AI as a technology has the ability to encompass a wide variety of algorithms and approaches which includes many technologies like machine learning, AR and IoT, resulting in multiple use cases getting resolved to improve the quality of life. From a technology perspective, since the field of AI is moving rapidly and many data sets, algorithms and tools fit well as per the definition of "intelligence", it makes sense to include all of them together under a single umbrella.

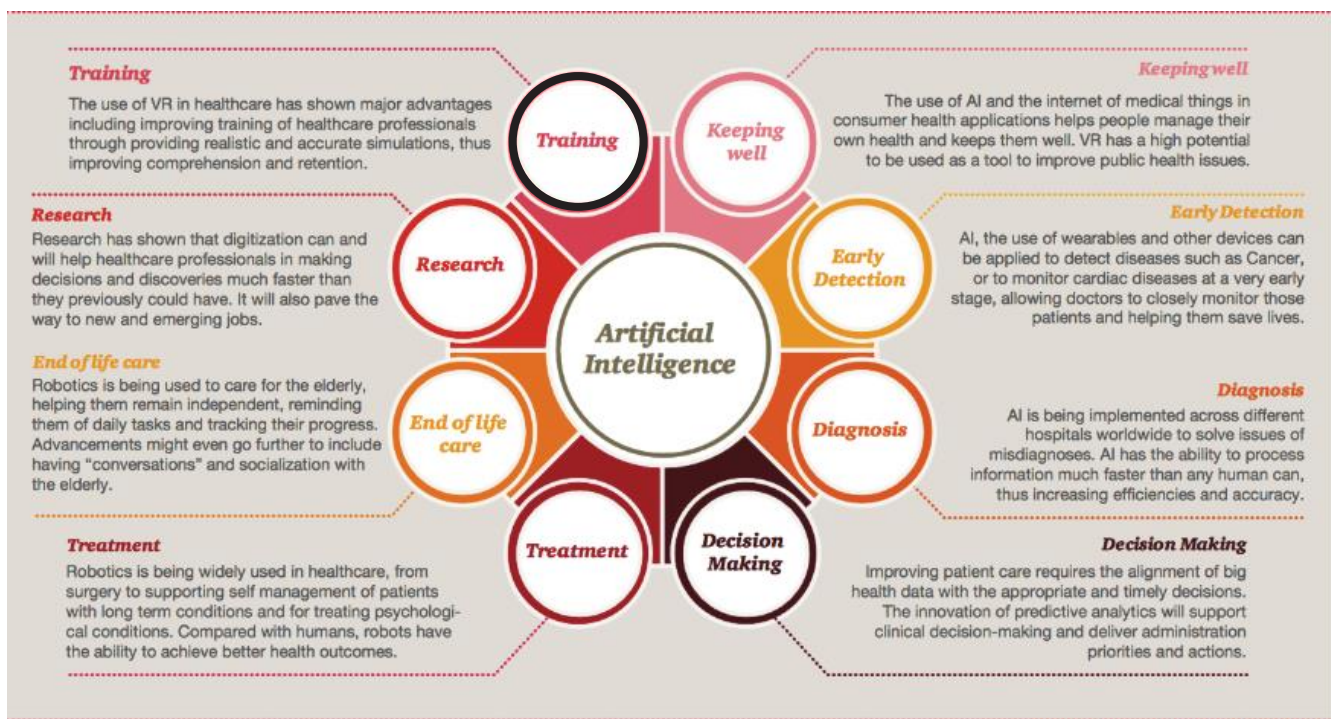
For the Indian landscape, the AI technology is set to do wonders across different sectors. It is being leveraged to counter heart diseases by a well-known healthcare chain, in partnership with a technology company. Heart disease is a silent killer and has killed 1.7 million Indians¹¹ and is responsible for to 17.8% of all deaths. The global burden of Health report draws significant attention to the risk of heart disease. However, not all is lost and by leveraging AI technology, a leading multispecialty hospital chain¹² in collaboration with a renowned technology partner, as a part of their Healthcare Next programme, has looked at co-developing an India-specific heart risk scoring to predict cardiac susceptibility in the Indian population. The team has already developed an AI-powered Cardio API platform which would enable patients to come to the hospital and determine their heart risk score without a detailed health check-up. Such pilots are going to be game changers. According to the International Congestive Heart Failure (INTERCHF) study, India accounts for 23% heart failure deaths in the world. An AI-enabled heart risk scoring system can go a long way in averting cardiac-related death. Fig 2: Applications of AI in healthcare

9. www.mckinsey.com/mgi

10. <https://www.pwc.com/gx/en/industries/tmt/publications/ai-and-iot.html>

11. <https://qz.com/india/1129834/heart-attacks-and-related-diseases-are-killing-more-indians-than-ever-before/>

12. <https://cio.economictimes.indiatimes.com/news/strategy-and-management/heres-how-apollo-hospitals-is-leveraging-ai-to-predict-heart-disease/63874473>



source pwc via @mikequindazzi

Fig 2: Applications of AI in healthcare

The other challenge that AI can also solve from a healthcare perspective is the accessibility problem to healthcare specialists. The scarcity of specialists in tier 2 and 3 cities is a known fact. But AI and machine learning enabled remote healthcare delivery solutions can bridge the gap by providing better accessibility, promoting continuity of care and also maintaining the same levels of quality and clinical outcomes.

Automotive sector

Driving towards a digital future

The auto industry has been at the forefront for technological innovation and manufacturing excellence from over a century now. With the breakthrough of an efficient assembly line, auto manufacturers have embedded manufacturing, designing and engineering related innovations as a part of their business ethos. This fuels their ability to build cars that are successively better, safer and cleaner.

Keeping up with the pace of digital disruptions that have touched other industries, the auto industry is grappling with the emergence of connected cars and autonomous vehicles. Business leaders predict that autonomous vehicles will become the norm of the day in future and their possibilities would become closer to reality due to the collaboration of different sectors and technological innovations on many fronts. The expectation with AV is for the car to handle all situations and traffic conditions such that the outcomes in terms of accidents and erroneous driving leading to deaths due to accidents while driving would come down. The vision is to have a car that makes life easier and convenient for all. A subset of the concept of the autonomous vehicle is assisted driving which has seen more traction in terms of the availability of this technology for the common man. The goal of auto manufacturers is to make this feature mainstream and readily available in less expensive models. It is anticipated that assisted-driving technology will be so effective that as per an insurance start-up, metromile, they would save consumers 1,000 USD in car insurance every year and, most

importantly, more than 900,00 lives¹³. In the Indian context where 17 lives an hour are lost due to road traffic accidents¹⁴, better driving emerges as a panacea. As an AI-based initiative 'driving data' is a key requirement which involves the collection of scenarios around vehicles, road conditions, traffic lights, etc. In an attempt to take this thought process further, the Karnataka government's 'automotive safety innovation project with industry collaboration is one such case which offers citizens the opportunity to drive value out of such a partnership and develop innovations specific to India.

While AV technology and assisted driving seem to be a future reality that shall come true, simple digital interventions such as AR and virtual reality have made car buying related decisions less stressful. Car buying has always been a source of stress with a series of discussions, calls and follow-ups between the car salesperson and the buyer. With the Internet making information readily available, the search for information and making comparisons to get the best deals have become easier. A luxury car brand in its London-based showroom has taken this experience to the next level by leveraging digital technology and converted its actual showroom into a digital market place, with big screens displaying relevant buying information and giving its stream of visitors a peek inside-out and allowing them to hear authentic sound effects of the car.

Another important aspect that the automotive industry looks forward to tackling is to automate its supply chain related functions. Just like other industries are using digital transformation to personalise consumer experience, the automotive sector is no different. Strides to develop a connected supply chain network is being worked out which would essentially bring down the cost and effectively engage the consumer. To create a collaborative ecosystem with its distributors, retailers and consumer supply chain solutions empowered by blockchain are being explored.

Another concept that has emerged in the automotive sector is the concept of the "smart factory". A smart factory uses advanced algorithms and AI to perform tasks such as managing the assembly line, purchase orders, inventory and workflow. Some industries have also integrated social media platforms in their manufacturing shop floor to enable innovation based on feedback. The impact from these connected technologies is immense and further to this, digitisation has dropped defect rates to below 12 per million, and output has increased 8.5 times¹⁵.

Given these trends, India can play a major role in putting the automotive industry on the fast track to becoming a global destination. For example, companies can set up their plants in India and being the archetype for emerging markets with a burgeoning consumer class, the domestic market can be tapped. The sheer size of the industry has attracted a lot of new players; as a result, the incumbents need to acknowledge the digital disruptions and respond by adopting these technologies as well as adjusting their operating models to work closely with non-traditional organisations.

Banking sector

Enhancing the consumer experience

The banking sector is one of the few industries which has taken quantum jumps on the technology front. It has constantly endeavoured to enhance customer experience and improve process efficiency within banking operations. The onset of the digital wave has opened up multiple avenues for interaction with customers,

13. https://www.accenture.com/t20170116T084448__w_/us-en/_acnmedia/Accenture/Conversion-Assets/WEF/PDF/Accenture-Automotive-Industry.pdf

14. <https://indianexpress.com/article/india/road-accidents-in-india-2016-17-deaths-on-roads-every-hour-chennai-and-delhi-most-dangerous-4837832/>

15. https://www.accenture.com/t20170116T084448__w_/us-en/_acnmedia/Accenture/Conversion-Assets/WEF/PDF/Accenture-Automotive-Industry.pdf

giving the industry an opportunity to interact in order to improve the reach and quality of service offerings. Online platforms have replaced the traditional method of going to the bank and withdrawing cash or ordering a chequebook. With many channels getting introduced day by day, the rules of engagement have changed which also brings up the challenge of delivering quality customer experience consistently.

For banking institutions, growing its customer base has always been a challenge; however, with the availability of data at lower costs,¹⁶ banks are leveraging big data analytics to not only reach out to its customers but also measure the likelihood of lead conversion, thus saving time, cost and effort. This has been one of the relevant outcomes of digital boom wherein using powerful analytics tools banks can go beyond the traditional demographic and financial data sources to utilise social data while profiling customers better to understand their individual requirements.

The banking industry has also seen exponential growth on the uptake of payment solutions. This has been possible with the proliferation of smartphones and the reduction the median prices of smartphones. The government regulatory bodies have also been supportive and have aided through policy, frameworks and guidelines to further promote digital payments which aligns with the government's vision of a digital India. In a way, the payment wallets have disrupted the cash transactions space. India has a much higher level of adoption to payment wallets as compared to developed markets like the US and UK, where consumers predominantly use cards. According to GlobalData,¹⁷ mobile wallet transactions grew manifold in last five years, rising from 24 billion INR in 2013 to 955 billion INR in 2017, and will surpass the 1 trillion INR mark in early 2018. In this regard, demonetisation in November 2016 was a catalyst where people were compelled to use digital transaction routes and realised the benefits. Today mobile wallets are considered to be important mode of e-commerce payment tool and have become widely accepted for day-to-day transactions at supermarkets, grocery stores, street vendors, tea stalls, fuel stations, and even inside taxis and auto-rickshaws.

While the banking industry has embraced digital transformation fully with respect to streamlining its internal functions such as document management, trade lifecycle, etc., it is also exploring disruptive technologies such as AI and blockchain which would continue to disrupt this space, giving it a cutting edge for differentiation. Some of the examples are around banks exploring to leverage blockchain technology in the field of trade finance. Proof of concept has been carried out between different banks and their partners in exploring uses cases around trade finance such as letters of credit, bill of lading and e-invoicing to enable smooth banking operations and reducing banking-related fraud.

Agricultural sector

Helping in sustainable agricultural practices

On one hand India is the largest IT sourcing destination accounting for approximately 67% of the 124–130 billion USD and has witnessed technological developments that have transformed many lives on the other hand these opportunities have not benefited the agriculture sector in a significant way. With the emergence of agricultural technologies integrated with a robust information and communication technology (ICT) framework that is still evolving in India, there is tremendous potential to positively impact agricultural performance and enhance farmer's income that is still unmet.

In India, agriculture is the primary source of livelihood for about 58%¹⁸ of India's population and is

16. [cii-banking-tech-summit-banks-taking-quantum-leap-through-digital](#).

17. <https://www.globaldata.com/mobile-wallet-gradually-displacing-cash-india-says-globaldata/>

18. <https://www.ibef.org/industry/agriculture-india.aspx>

unquestionably the largest livelihood provider in India, more so in the vast rural areas. It also contributes almost 16% to GDP and forms over 10% of our exports. However, changing weather patterns have resulted in millions of farmers facing an uncertain future due to crop failure. As a result, they are seeking technological advances that can bring out desired outcomes and enhance their socioeconomic status. One such example¹⁹ of agriculture meets technology is being leveraged by the International Crop Research Station for Semi-Arid Tropics (ICRISAT), a United Nations agency, to analyse volumes of data on weather forecasts, local rainfall and soil conditions. This data collected gets analysed to develop a 'sowing date' application that tells farmers the right sowing date to maximise their yield. Access to this platform is further simplified by providing information to farmers via SMSes in regional languages.

As the global market for precision agriculture is expected to grow at an annual growth rate of 13.09% to reach a market size of over 6.34 billion USD by 2022 the fastest growth is projected for India and China, which are expected to see an annual growth rate of 18.29% until 2022.²⁰ With a scope of opportunities so vast for innovation and business expansion the Indian agricultural sector has attracted conglomerates, young start-ups, leading IT companies and venture capitalists.

Among the prominent ventures is a noted venture by a leading Indian conglomerate creating an E-choupal, a comprehensive a comprehensive digital knowledge hub for farmers, which has 6,100 installations covering over 35,000 villages and serving over 4 million farmers,²¹ while others are creating a ripple by the "uberization of the tractor sector" through a mobility app called "Trringo" which enables farmers to rent tractors. This is a unique example of leveraging technology to help farmers use machinery without having to make the large investment (7,500 USD) of buying tractors.²² On the other side of spectrum we are seeing new entrants making waves indicating that the Indian agriculture is not about big box solutions only. Some leading start-ups have been providing dairy farm optimization and monitoring services with a special focus on small- and medium-herd farms with the help of tools that leverage the Internet of things, big data, the cloud, mobility, and data analytics to improve milk production, milk procurement, and the cold chain, and to boost animal insurance and farmer payments.

Increased pressure on maintaining the profitability of farming and agricultural business activities is forcing the farm sector to become an early adopter of new technologies so that it may improve the productivity and profitability of the industry. Availability of real-time data seems to be one of the most significant opportunities for technological innovation. Also, drones are fast becoming a real green-tech tool. Global research also shows that AI farming will be the main enabling factor in increasing the world's agricultural production capacity to meet the demands of the growing population.

In an industry that has been heavily subsidised²³ uptake of technologies at market price seems to be challenging, but the farmer community seems to understand and identify what works for them and are ready to do investments for it. The agricultural sector has understood and seen the potential of digital disruptors that offer the potential to achieve the necessary conditions for scale, with provisioning of low-cost and customised delivery, creating a unique opportunity for farmers and innovation to thrive. The challenge that India faces now is to balance "high growth" with "inclusive growth" and making technology affordable and accessible to all.

19. <https://yourstory.com/2016/10/digital-transformation-in-india/>

20. http://www.techmahindra.com/sites/ResourceCenter/White%20Papers/New_Gen_Services/PrecisionAgriculturePotentialMarket-India.pdf.

21. <http://www.itcportal.com/businesses/agribusiness/agri-commodities-and-rural-services.aspx>,

22. <https://www.trringo.com/about-us/>, accessed 11 February 2017.

23. http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2017-chapter5.pdf

Retail and FMCG sector

Transforming supply chains and consumer experience

India has emerged as one of the most attractive investment destinations in the world and retail, FMCG and eCommerce have been among the key contributors in this growth. This sector has undergone major transformation and there has been a shift towards organised retail as a result of multiple policy advocacies. The Indian retail sector is estimated to grow to 1 trillion USD with a compounded annual growth rate of 15%. The e-commerce market is projected to rise to 125 billion USD in terms of gross merchandise value (GMV) by 2020, growing at the rate of 31%. The packaged consumer goods sector is estimated to grow at a pace of 18% and cross the 100 billion mark USD.²⁴ Today while technology is affecting every aspect of our lives and businesses, most view technology as a back-end support. This mind-set is about to change. With the market cap of new age companies coming into picture the importance of the new role played by technology in disrupting long-held business models is now being acknowledged. A new challenge that has risen is the “changing consumer expectation” driven by increasing incomes, the younger profile of consumers, growing access to the internet accompanied by the greatly increased use of smartphones, consciousness concerns about health and the environment, technological innovations and the rising complexity of decision-making due to the proliferation of products and points of sale. In this sense technology has time and again proven that it can serve the rising customer segments in unimaginable ways. From mobility, analytics, 3D to machine learning, technology is bringing about revolutionary changes in creation, delivery and consumption of products.

An area that is undergoing severe transformation here is the supply chain network of companies. With regulations and directives coming from different regulatory bodies such as the Food Safety and Standards Authority of India (FSSAI), US Food and Drug Administration (FDA), Companies in India in the Pharmaceutical, Consumer retail, FMCG, Electronics sectors, etc., are looking to adopt technologies that enable the compliance needed to remain relevant. Indian and foreign supply chains have become a complex network of different participants interwoven into an ecosystem fostering symbiotic relationships. Blockchain as a technology has had a good start in the track and trace use cases for supply chain, but a few other exciting and straightforward developments like smart beacons and AR/virtual reality (VR) have changed the appeal the retail sector holds for its customers. Beacon technology is an intelligent way to get customers and can take targeted marketing to a whole new level. It also allows for immediate data collection to determine the marketing effectiveness for a particular product.

The other hurdle for making the online shopping experience seamless can be eliminated using AR and VR technology. Both help close the gap for companies from a ‘consumer experience’ perspective. While many consumers lack access to VR and AR technology, it’s clear that the technology as such has tremendous potential, especially for those who attach importance to the look and feel aspect and live far away. As with any industry, retailers also have to embrace change, given the rising consumer expectations.

24. <https://www.pwc.in/assets/pdfs/publications/2016/shaping-consumer-trends.pdf>

Case study:

Bringing blockchain to the coffee cup

Coffee is one of the most traded commodity in the world after crude oil making the supply chain associated with it complicated, disparate and non-transparent. With far-flung suppliers around the world and complicated supply chains involving wholesale markets and regional distributors, it becomes an ideal use case for conglomerates and companies to develop a supply chain that can be tracked, making the ecosystem transparent and robust for all.

What is the problem?

1. **Unfair trade:** Middlemen populate the coffee value chain, dominating the last-mile connectivity between coffee brands and the farmers producing the coffee beans. Valuation of coffee beans is based on visual perception. Visual perception is subjective, and this has allowed intermediaries to decide on the grade of the coffee arbitrarily. Thus, coffee producers end up with the wrong end of the stick and lose out on their rightful income, earning just a fraction of the final selling price.
2. **Provenance:** A newly developing trend in the food-processing industry is the requirement of provenance. Consumers are becoming increasingly conscious of the origins of what they ingest. Taking cognisance of this, industry majors have also shown increased willingness to demonstrate the source of their ingredients and have linked it to their brand value. But as supply chains become more complex, with multiple operators and organisations forming a part of them, it becomes challenging to prove the provenance of their ingredients.
3. **Lack of transparency:** Big coffee houses make big claims regarding the fraction of their revenues that goes towards the upliftment and development of the indigenous communities that produce the coffee. But proof of the same is complicated to obtain.
4. **Financial inclusivity:** In places such as sub-Saharan Africa where the coverage of the financial sector is minimal, especially in the last mile, farmers are forced to depend on intermediaries. It also means delayed payment.

How can the problem be solved?

While there exist institutions and standards that monitor the valuation of the grades of the coffee beans, their reach is limited. Hence, there is a need to bridge the gap between regulatory standards and the actual valuation process, which is currently controlled by middlemen. Such a scenario would require either a trusted third party to regulate the last-mile services offered by middlemen or eliminate their activity. Tracking provenance across multiple complex supply chains needs a single source of the truth to be available across stakeholders and customers. To verify claims made by companies, a trustless system will need to be put in place to track all transactions, thereby allowing the public at large to check them independently. While many organisations are trying to provide last-mile financial inclusion for the various coffee-producing communities living in remote areas, we feel that the use of digital payments would not only solve the problem of financial inclusion but also empower such communities and accelerate their economic development.

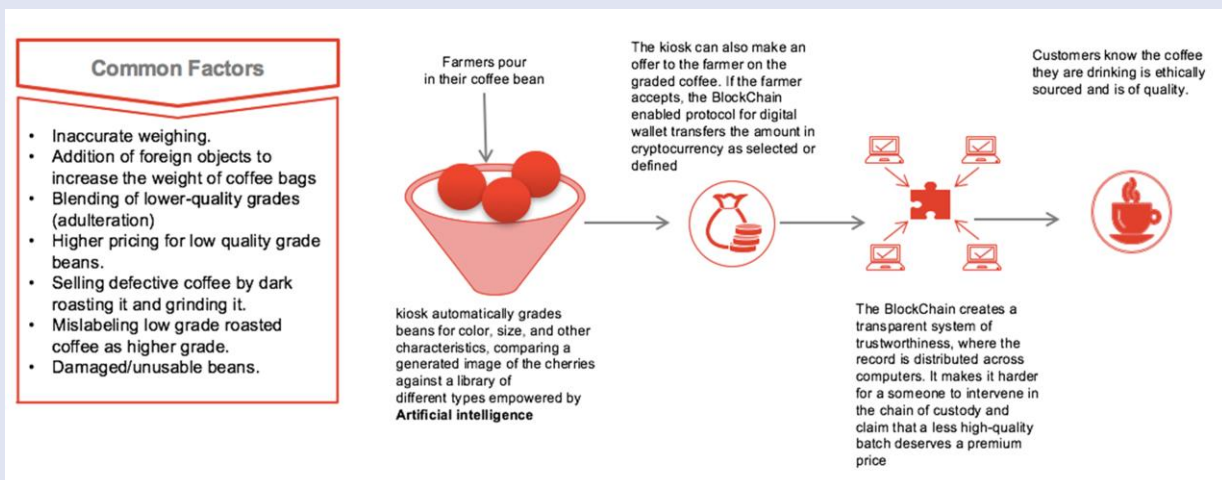
A solution like the one represented in the diagram below, would look to disintermediate the coffee trade industry, helping it become more transparent and empowering the various stakeholders. Massive data sets containing coffee bean sizes, shapes, colours, and the corresponding grades are available with the various organisations and institutions regulating the coffee trade. Machine learning algorithms could be leveraged to create an AI programme that would be able to predict the grades of the coffee beans based on high-resolution imaging. Such a system would enable the following:

- Instant decisions regarding the grade and price of the coffee;
- Producers get a fair value for their produce as the grade is decided based on data from the regulatory authorities;
- Instant payments to farmers through digital means such as m-wallets or cryptocurrencies.

The system would also record details of the transaction along with the exact details of the coffee beans on to the blockchain, thereby creating a single immutable version of the truth.

The benefits:

- The ideals of fair trade get ensured – producers get their fair share and get it instantaneously.
- Provenance can be accurately tracked because of the immutable nature of the blockchain, thereby empowering the increasingly conscious consumer.
- Increased financial inclusivity through the permeation of digital payments across the value chain.
- Coffee-producing communities are positively impacted due to enhanced financial inclusivity and fair trade. Impact on producers can also be ensured because of the blockchain, which provides a clear audit trail.



Government sector:

On the path to a building a connected economy

Over the years there has been a shift in the mind-set towards (Information technology) IT. A decade ago, digital transformation was associated with IT infrastructure. But today digital is associated with a lot of other technologies including mobile, cloud, social media platforms, analytics, artificial intelligence blockchain, augmented reality etc. digital has touched our lives in nearly all aspects of our lives, be it health, transport, education etc. The global population is forecast to increase by over a billion people in the next 13 years to reach 8.6 billion in 2030.²⁵ India's population is expected to reach 1.35 billion by 2020. Emerging economies are expected to contribute a majority of the increase in global population. By 2020, a full generation, Generation C (for connected), would have grown up in a digital world of texting, social networks, mobile devices and apps and the Internet.²⁶ The increasing digital awareness calls for significant changes in the way cities are run and governed and public services delivered to people. Citizens now anticipate more personalised, connected experiences with the government. This is where the role of digital becomes all the more vital and expectations with the government to rise up to the occasion to build a connected economy comes in.

The expectation of a young India is rising and the government needs to respond to the new aspirations and work towards the transformation of public service delivery, primarily in areas of health, education, government records and other social benefits. Towards this both the private sector and the government have also been searching for technology solutions. The current government has emphasised on digital technology to bridge the rural and urban gap. The journey of a grand vision for the Digital India initiative has begun. Though the efforts in this journey has started through enhancement of service delivery portals, apps, helpdesks, online payments and connectivity personalisation of services still remains a challenge.

The idea set forth is to close the loop through engaging citizens through omnichannels and getting feedback; this has started with first steps towards providing infrastructure that every citizen would need to stay connected and informed about and transform the country into a connected economy. While many of the initiatives at the moment are in silos the thought process is to eventually integrate all of them together to bring about transformative impact. One of the initiatives in this direction is the MyGov portal, which aims to collate the thoughts and ideas put forward by 'We the people of India'. This initiative enables a citizen to create his/her profile and meet and talk to people who think alike and believe strongly in a particular cause. An outcome of this is the formation of the NITI Aayog project.

Apart from the Aadhaar project and the BHIM UPI app, the government has also ideated on the creation of digital lockers to enable its citizens and lower bureaucracy. From the compliance and regulatory perspective, it is also exploring new age solutions that can allow transparency and immutability. The government of Andhra Pradesh has taken a leap in this regard and started to look at land survey, allocation and registration done on the blockchain bringing transparency.

One key outcome of a digital India is going to be a more empowered and informed citizen for which the government is urging people to join the campaign. The vision is centred around three main areas of digital infrastructure, governance and services on demand and digital empowerment of citizens. In this journey a number of global companies have also come forward and provided the needed technological capability. As a

25. United Nations. (2017). World Population Prospects – The 2017 Revision. Retrieved https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf

26. Strategy&. (2017). The Digitization megatrend. Retrieved from <https://www.strategyand.pwc.com/global/home/what-we-think/digitization/megatrend>

country with a favourable demographic dividend and a vast number of young people entering the workforce, emerging technology can empower such individuals to improve productivity and disrupt existing business models and uncover new ones to enable them to improve their standard of life. The growth of network infrastructure (such as broadband highways and the introduction of 5G) and the smartphone revolution will unlock the potential of existing technology and open doors for the nationwide adoption of others. This paper covers just a few instances in education, agriculture, healthcare, automotive, supply chains and government that demonstrate the immense amount of opportunities available with the adoption of new age technologies that have disruptive capabilities. Closely tied to the disruptive power of these technologies is the human element of it all—digital transformation will be genuinely possible when all the citizens are included in reaping its benefits. Society as a whole will get redefined by the new digital divide—digital haves and digital have-nots. Digital transformation will have genuinely achieved its stated goals when it can pull in a majority of Indian citizens, making it possible for India as an emerging country to start taking the leapfrog route toward economic development.

Building a digitally empowered society and the way forward

One aspect that has become more evident is that as a young country with rising aspirations, India needs to understand that no single silver bullet would traverse the different sectors and issues and serve as a one-point solution. Every digital disruption has its way of resolving the pain points. Hence, why do we need a solution that combines different technologies to create a differentiating experience for the customer?

Each of the technologies presented in the previous section provides an opportunity to create a lasting impression on the customer. But each technology also provides the scope for incorporating other technologies, enabling organisations to derive maximum benefits from their digital investments. Most of the path-breaking and revolutionary digital interventions in the market today, such as smart connected cars, AI-based music composition, machine learning powered personal healthcare look to combine the strengths of various digital technologies innovatively. This potential shall lead to the creation of compelling experiences for the customer as well as for public bodies such as governments and civic organisations looking towards digital transformation to help them deliver better services.

At this point, we would like to reiterate the importance of putting the end user (customer or employee) at the heart of every digital transformation activity. To accomplish this goal, organisations will need to gain an in-depth understanding of their customers. Every digital channel offers mountains of data regarding the customer, which is waiting to be mined and get converted into actionable information. Towards this end, organisations today are looking to power statistical tools to analyse the data and derive knowledge regarding customer choices and preferences, and gain a holistic understanding of their customers. Thus, data analytics will need to be backed up by the digital technology solution to complete the loop.

The success of a digital India would be marked by the emergence of India on the socio-economic front creating inclusive growth for all. The focus has to be on bridging the rural –urban divide by fostering tailor-made service in an efficient manner. With recent investment by the government into digital transformation and governance steps in the right direction have been taken. Some of the key recommendations going forward for an empowered society would be

1. Digital infrastructure setup: We need to look at enabling the Digital infrastructure such as optic fibre cables, telecom towers, Internet and Wi-Fi hotspots. Private players need to be incentivised and existing infrastructure should be well utilised.
2. Leveraging an omnichannel approach: services can be delivered through mobile as well as bank branches and websites to promote better experience. Transparency can be brought in by leveraging technologies such as blockchain as well.
3. Data security: Government and businesses alike need to look at the risks of cyber security attacks and be ready with counter measures ensuring citizens, employees and customers of data security and privacy.
4. Geolocation/tagging: the next leap would be looking at utilising geo location, fencing and tagging service for an immersive experience. Such as traffic signals, traffic routes, gas and power registration payments, connections etc.

5. Skill development: For India to succeed skill development is important. This needs to start at the grass root level and technology should be leveraged to ensure inclusivity of students from all socio-economic status. Literacy and capacity building programmes should be carried out in all rural and semi-urban regions and digital quotient should be enhanced for inclusiveness.

AIMA and PwC are proud to be a committed partner to the Government of India, the industry and the social sector in driving the transformative change that the country is experiencing. The synergies of these two organisations can support India's digital transformation and impact the lives of over a billion people positively.

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Annexure

1. Technology enablers of Digital India:

Governments and businesses are leveraging technologies such as the cloud, big data analytics, machine learning and AI. The adoption rate of these technologies in countries such as Estonia and Singapore is very high, with almost every government application using some cutting-edge technology.

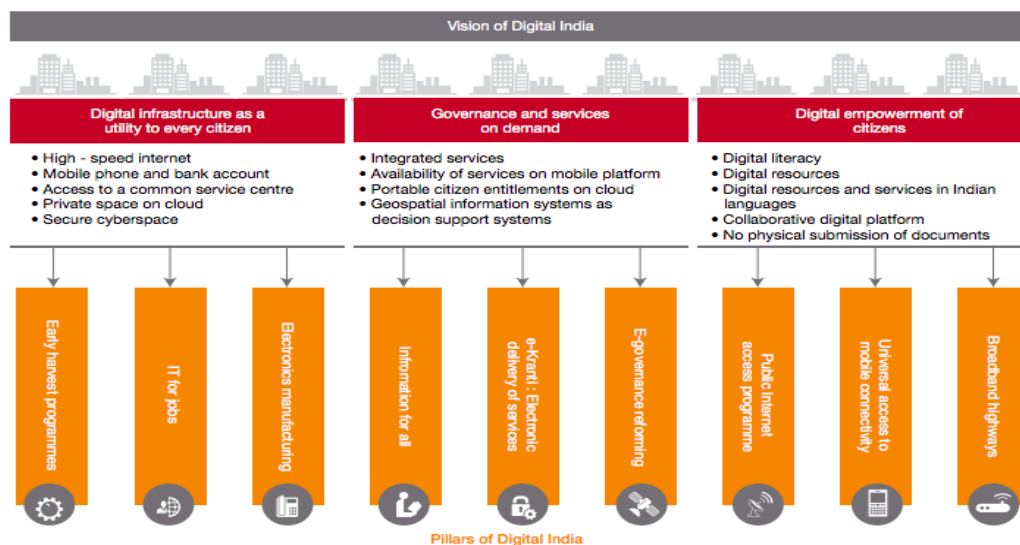
2. Cloud computing:

One of the earliest technological breakthroughs, caught the eye of many private players. Despite many concerns about data security and integrity in the beginning, along with private players, governments are also embracing the cloud to transform their systems and make them efficient and responsive. Keeping this concern in mind, international companies have developed customised cloud offerings and dedicated data centres with enhanced security measures.

3. Blockchain:

The blockchain is a distributed ledger which can record behind this feat. Transactions between multiple parties in a verifiable and permanent manner. Developers of the blockchain across the world have come up with innovative solutions and new use cases to push its the adoption in the government sector. One of the major applications of the blockchain is in the banking sector. Maintenance of records is an important function of the blockchain system which can be leveraged across different sectors.

Case in point: Government of Estonia: The Government of Estonia is a perfect example of how the blockchain has been utilised to provide seamless service to citizens. One of the first initiatives was the movement of all health records to a blockchain-driven system.²⁷ The Government of Estonia



27. Guest author. (7 March 2017). How Estonia brought blockchain closer to citizens: GovTech case studies. The Cointelegraph. Retrieved from <https://cointelegraph.com/news/how-estonia-brought-blockchain-closer-to-citizens-govtech-case-studies>

also pioneered a secure real-time authentication service called KSI Blockchain for digital assets²⁸. The Estonian government started testing the blockchain in the year 2008. Since then, it has devised custom solutions for all its citizen services across domains such as judiciary and public health. Its secure technologies are even being used by the United States Department of Defence and European Union Information Systems²⁹.

Vision of digital India³⁰

4. Connected device fuelling the AI revolution:

The other aspect that we would like to highlight and that presents a tremendous opportunity is the intersection of IoT and AI. The ongoing developments in the AI field are going to have a further impact, leading to the convergence of AI and IoT solutions eventually becoming indispensable. The core components of IoT—connectivity, sensor data and robotics—will ultimately require almost all ‘dumb’ devices to become intelligent, resulting in the necessity of AI. As this convergence continues along the ongoing growth of IoT, arguably, the most powerful factor is the advent of big data and cloud/fog computing. IoT’s growth will, in turn, drive an exponential rise in the volumes of data being generated, with International Data Corporation (IDC) estimating that the number of devices connected to the Internet will surge from 11 billion in 2016 to 80 billion in 2025—generating 180 zettabytes of data every year, up from 4.4 zettabytes in 2013 and 44 zettabytes in 2020.³¹ These statistics also put into perspective the importance of high data transfer rates, low latency and improved area under network coverage for the achievement of convergence, such as autonomous cars. Autonomous or self-driven cars have surely taken the automotive industry by storm. While AI has been available since the 1950’s, it has become more relevant now because of the explosion of data available. With the help of connected devices, data collection has become easier, fuelling the AI revolution. According to the market research report ‘Automotive Artificial Intelligence Market shall Offer (Hardware, Software), Technology (Deep Learning, Machine Learning, Computer Vision, Context Awareness and Natural Language Processing), Process, Application and Region’, the automotive AI market is expected to reach 10,573.3 million USD by 2025, at a CAGR of 38.46% between 2017 and 2025.³²

A much-needed catalyst in this direction is 5G, a technological innovation that has the potential to make this a reality in India. With the projected roll-out of the 5G spectrum in the near future, IoT and AI have the potential to impact all significant industries such as manufacturing and defence. The 5G technology holds tremendous opportunity, and India needs to be on the top of such an essential technology through industry partnerships. The Department of Telecom has taken steps in the right direction by setting up an open testbed in collaboration with IIT Madras. With a union budget allocation of 224 crore INR and the present government confident of a roll-out by 2020,³³ India seems to be taking steps in the right direction.

Accelerated advancement in sensor technology has added a whole new dimension to the world of mobile devices and the Internet. With radio communication over long distances becoming more efficient, reliable and cheaper, an ecosystem has been created as interconnectedness has grown at a steady rate between devices and human. The potential of this interconnected network has soon been realised to be one-point access

28. Guardtime. (n.d.). eGovernment. Retrieved from <https://guardtime.com/solutions/egovernment>

29. e-Estonia website: <https://e-estonia.com/> (last accessed on 6 October 2017)

30. fig: Digital India - Targeting inclusive growth

31. <https://www.pwc.com/gx/en/industries/tmt/publications/ai-and-iot.html>

32. <https://www.marketsandmarkets.com/PressReleases/automotive-artificial-intelligence.asp>

33. <http://www.newindianexpress.com/states/tamil-nadu/2018/feb/02/coming-up-5g-test-bed-at-iit-madras-1767079.html>

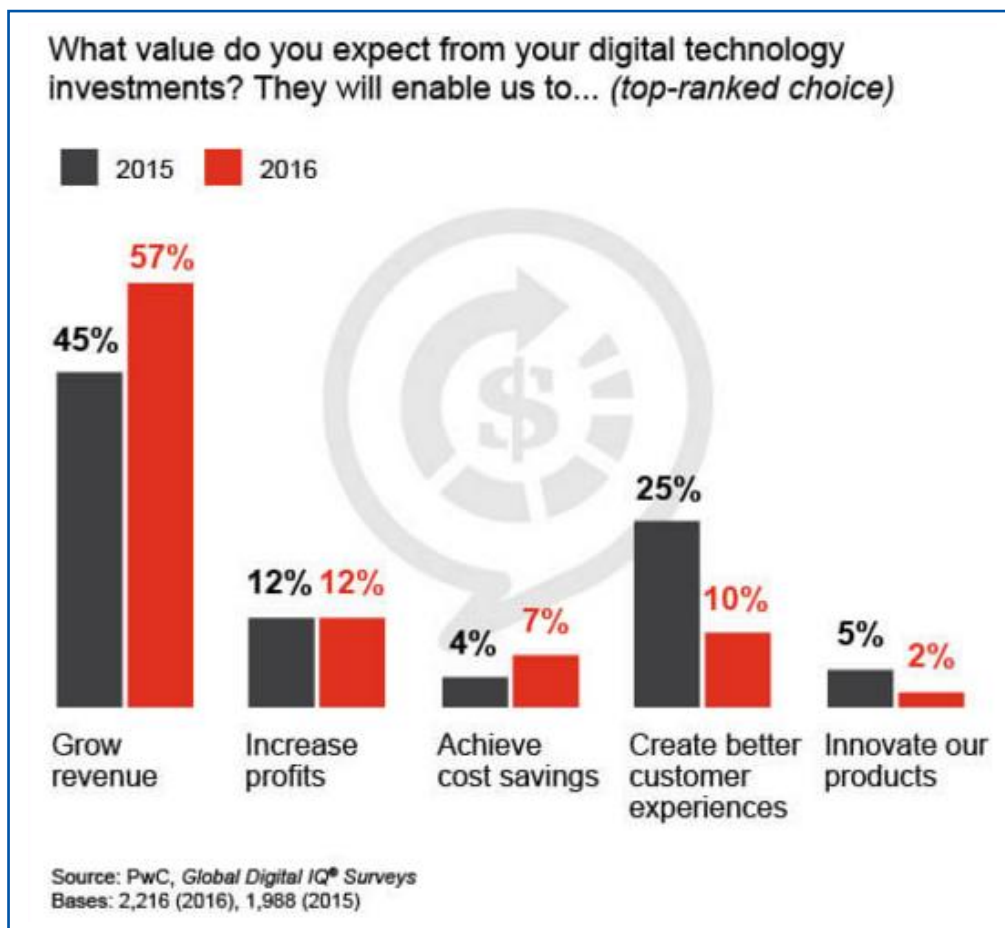
for data gathering, real-time monitoring and single-click actuation. Corporate and technology visionaries are looking at IoT beyond just a super-connected network of devices. The ultimate goal through IoT would be to have a super-transparent self-governing ecosystem which would adapt and change according to the ongoing trends with almost zero human interference. Today, technology is more than capable of enabling this idea and helping organisations reap the benefits for an organised and efficient tomorrow. IoT goes beyond connecting various systems, manipulating the same and collection of data. It brings in the idea of a zero-human-interference system. It aims to develop a completely automated system which adapts to constantly changing market trends and volatile business opportunities, thereby maintaining agility and profitability in organisations.

When all the interconnected devices churn out holistic technological solutions in important segments such as the automotive industry, vision computing, health diagnosis and connected homes, the quality of life and the way we are used to doing things would get transformed. Another area which is debatable but has shown results through the convergence of AI and IoT is the autonomous driving segment.

Facts and figures:

- In India, we see industrial companies planning to dramatically increase their overall level of digitisation. While just 27% of the Indian respondents rate their company as advanced today, 65% expect their company to reach this stage by 2020.
- Digital is now a priority for most CEOs of industrial companies in India. More than a quarter (27%) of the industrial companies in our survey have rated their level of digitisation as high, and this value is expected to rise to 65% within the next five years.
- 9 out of 10 companies expect to expand their product portfolio with digital offerings.
- In order for industrial companies to leverage the full value of Industry 4.0, they need to overcome key challenges. These include lack of a clear digital operations vision from the leadership (45%), lack of skills in data analytics capabilities (53%) and fostering a strong digital culture (41%). Operational disruption from cyber security breaches is another top concern for Indian industrial companies. Overcoming these challenges will enable them to reach their potential and objectives of digitisation by 2020.
- About 30% of the industrial companies surveyed in India believed their vertical value chains and their product development and engineering functions were already benefitting from an advanced level of digitisation and integration.
- Currently, India (27%) is slightly behind the global average (33%) and Asia-Pacific (36%) in terms of level of digitisation. While advanced digitisation and integration of horizontal value chain (i.e. with suppliers, customers and other value chain partners), digital business models and customer channels are progressing a little slowly, big advances are expected in five years' time.
- Most Indian companies expect to reach a digitisation level of around 65% in five years as against 67% in Asia Pacific.
- Around 53% of the industrial companies in India are already using data analytics and 90% expect data to have a significant impact on their decision-making in five years.
- Indian industrial companies are willing to invest heavily in digitisation technologies such as sensors or connectivity devices as well as software and applications such as manufacturing execution systems.

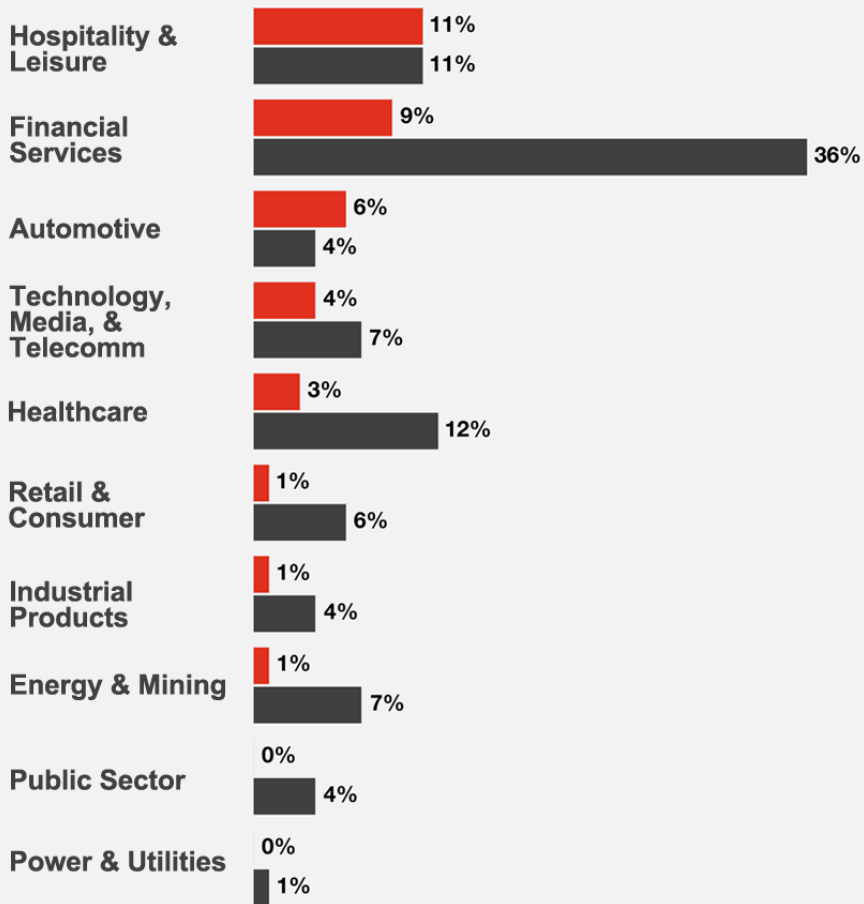
- According to the survey, 39% of the companies plan to invest more than 8% of their annual revenues in digital programmes in the next five years, which reflects their commitment to the vision of Industry 4.0.
- The survey suggests that the average amount the companies are seeking to invest in the next five years is 5.1% of their annual revenue. Companies are fast realising that being the first mover can provide them with a substantial competitive advantage over other players who have not been investing in digitisation programmes.
- Annual digital revenue increases of 2.9% on average – and a significant minority that expect total increases of more than 50% over five years. That adds up to 493 billion USD in increased annual revenues for the next five years across the industrial sectors we surveyed.



Blockchain investment by industry

Which technologies are you making substantial investments in?

■ Today ■ In 3 years



Source: PwC, 2017 Global Digital IQ® Survey

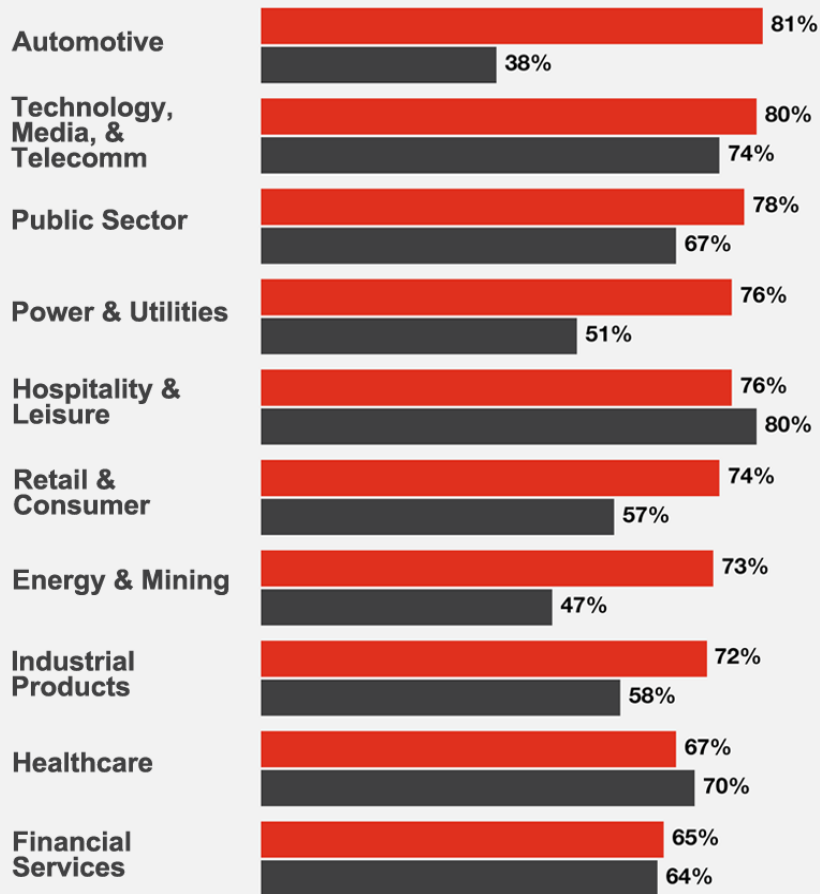
Bases: Automotive: 72; Energy & Mining: 135; Financial Services: 332; Healthcare: 237; Hospitality & Leisure: 75; Industrial Products: 375; Power & Utilities: 131; Public Sector: 156; Retail & Consumer: 217; Technology, Media & Telecommunications: 433

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Internet of things investment by industry

Which technologies are you making substantial investments in?

■ Today ■ In 3 years



Source: PwC, 2017 Global Digital IQ® Survey

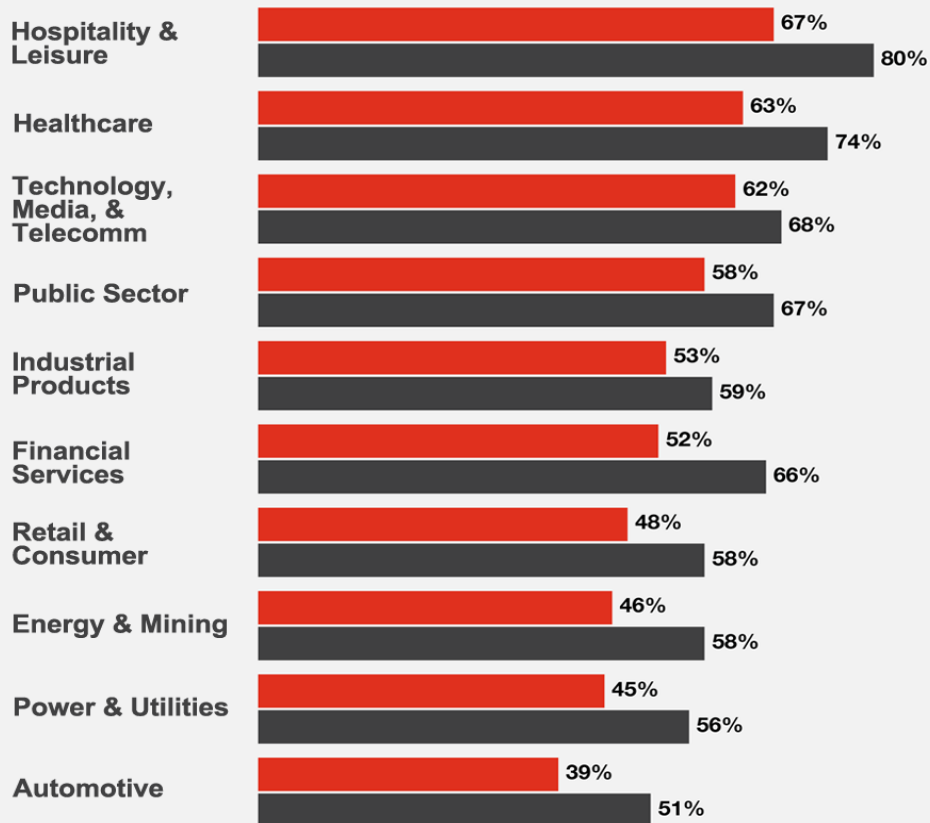
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Artificial intelligence investment by industry

Which technologies are you making substantial investments in?

■ Today ■ In 3 years



Source: PwC, 2017 Global Digital IQ® Survey

Bases: Automotive: 72; Energy & Mining: 135; Financial Services: 332; Healthcare: 237; Hospitality & Leisure: 75; Industrial Products: 375; Power & Utilities: 131; Public Sector: 156; Retail & Consumer: 217; Technology, Media & Telecommunications: 433

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All India Management Association (AIMA) is the national apex body of the management profession in India. Over the last six decades, AIMA has contributed immensely to the enhancement of management capability in the country.

AIMA has a broad base of 67 Local Management Associations including two cooperating LMAs abroad, with a membership crossing 30,000 in number. AIMA is a non-lobbying organisation, working closely with Industry, Government, Academia and students to further the cause of the management profession in India. AIMA is represented on the Boards of India's premier Business Institutions like Indian Institute of Management – IIMs. AIMA is also represented on Boards of Government bodies including the All India Council for Technical Education, National Board of Accreditation, National Productivity Council to name a few.

AIMA makes a salutary contribution to management learning and practice in the country by offering various services in the areas of testing, distance education, research, training & consultancy, publications and management development programmes.

AIMA brings to the Indian managers, the best management practices and techniques through numerous foreign collaborations with professional bodies and institutions. AIMA is a member of the Asian Association of Management Organisations (AAMO) and works closely with several international management institutions like Robert H Smith School of Business at the University of Maryland, St Gallen Foundation etc. in organising international conferences and management development programmes.

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