



**Artificial intelligence**  
Augmenting human intelligence



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# Foreword from Deloitte



**Ashvin Vellody**  
Partner  
Deloitte India

Artificial intelligence (AI) is expected to drive the next wave of economic expansion across the globe in today's digital age. This technology is transforming the way we interact with the world. Numerous nations are taking initiatives and drafting strategies to embrace AI. India also has a sense of optimism that AI will contribute to the country's broader growth agenda.

The technology has the potential to touch every sphere of life and make a positive impact on various fields, such as retail, healthcare, education, and manufacturing. If implemented effectively, it can create more jobs and new categories of work, design innovative ways to manage everyday tasks, reshape the business landscape, and make meaningful contribution to the society. There is growing realisation among companies that the successful adoption of AI is crucial for their success. This depends on how well companies are augmenting human intelligence with AI.

Concerns related to unavailability of good quality data, legacy technology debt, and the complexity of AI technologies need to be addressed to accelerate the adoption of AI technologies. We should learn from the AI adoption journey of global players and identify which aspects of AI technologies would be best suited to us. In this context, identifying the

right areas for AI implementation within organisations will play a key role in delivering maximum impact. Companies need to re-skill, train, and acquire relevant talent to bridge the skill gap and integrate AI technologies in their business processes. As a first step, developing a comprehensive strategy to implement AI, in combination with other technologies (such as machine learning and Internet of things), harness the maximum potential, and address the challenges, would be ideal.

The growth prospects of the technology in the country are bright. This report sheds light on the progress made so far in AI in India and across the globe, and the way forward. It also gives a glimpse of the technology's potential impact on industries, and the emerging AI landscape across the private and public sectors. The report discusses benefits AI offers in the field of social and economic welfare. It also provides recommendations to address the key challenges, such as transcending cultural barriers and building a talent pool, which organisations can implement to ensure the smooth adoption of AI technologies.

We hope you find this report insightful and enriching.

Happy reading!

# Foreword from CII



**Vinod Sood**  
Chairman  
CII Artificial Intelligence Conclave'19

Artificial intelligence (AI) has opened up new markets and opportunities in critical areas, such as health, agriculture, education, energy, manufacturing, and the environment. The past few years have witnessed the significant growth of AI and its applications in a wide range of fields. Interest in AI, combined with pattern recognition techniques, has been increasing as it can be used to build learning models to address complicated problems in different fields and accelerate progress towards India's national programme on AI.

Rapid progress in the field of AI will continue. AI will continue to contribute to economic growth and will be a valuable tool for improving the world, as long as industry, civil society, and government work together to develop the positive aspects of the technology, manage its risks and challenges, and ensure that everyone has the opportunity to help build an AI-enhanced society and obtain its benefits.

AI technologies are being applied to various vertical industries, such as

enterprise, transport and logistics, fast moving consumer goods, and retail. Companies use AI to augment human capabilities, enhance productivity, and optimise resource use.

One reason for AI's powerful growth is its convergence with other technologies. We see a massive increase in AI's integration with Internet of Things (IoT) and edge computing, a strategy designed to increase performance by moving data centres closer to local devices. Another important trend is the development of specialised processors engineered to optimise AI performance. Other important trends driving the growth of AI include computer vision, voice assistants, and a push for more standardisation and ethics.

As AI's capabilities increase and it is deployed in different capacities, we expect that many problems plaguing government, schools, and corporations will be solved. AI will also be able to help improve our judicial system, social issues, economy, governance, and other aspects of the society.

# Artificial intelligence - Augmenting human intelligence

In 1950 at the dawn of computing, Alan Turing posed a question, "Can machines think?" in his seminar paper titled "Computing Machinery and Intelligence".<sup>1</sup> This was the earliest substantial work in the field of artificial intelligence (AI). Since then, with technological advancement, increased computing capacity, and generation of massive amounts of data, using AI has become simpler and affordable. AI was conceived to mimic human intelligence. However, it has taken off on its own and branched into different areas, such as machine learning (ML), deep learning, natural language processing, computer vision, speech recognition, and robotics. At present, AI has the potential to perform complex tasks ranging from driving car, playing

chess, and detecting life threatening diseases to taking preventive actions on customer churn. It performs these tasks at a level that is often equal to or surpasses the most talented humans in terms of scale and consistency.

AI is a complex field with many shapes and forms. In this report, we have tried to shed some light on the following questions: how we have embraced AI so far globally, what are the different applications of AI across the retail and consumer packaged goods (CPG) sectors, how our social and economic well-being is being improved through AI, and how these advancements pose multiple challenges (which we can overcome to make our lives better and meaningful).

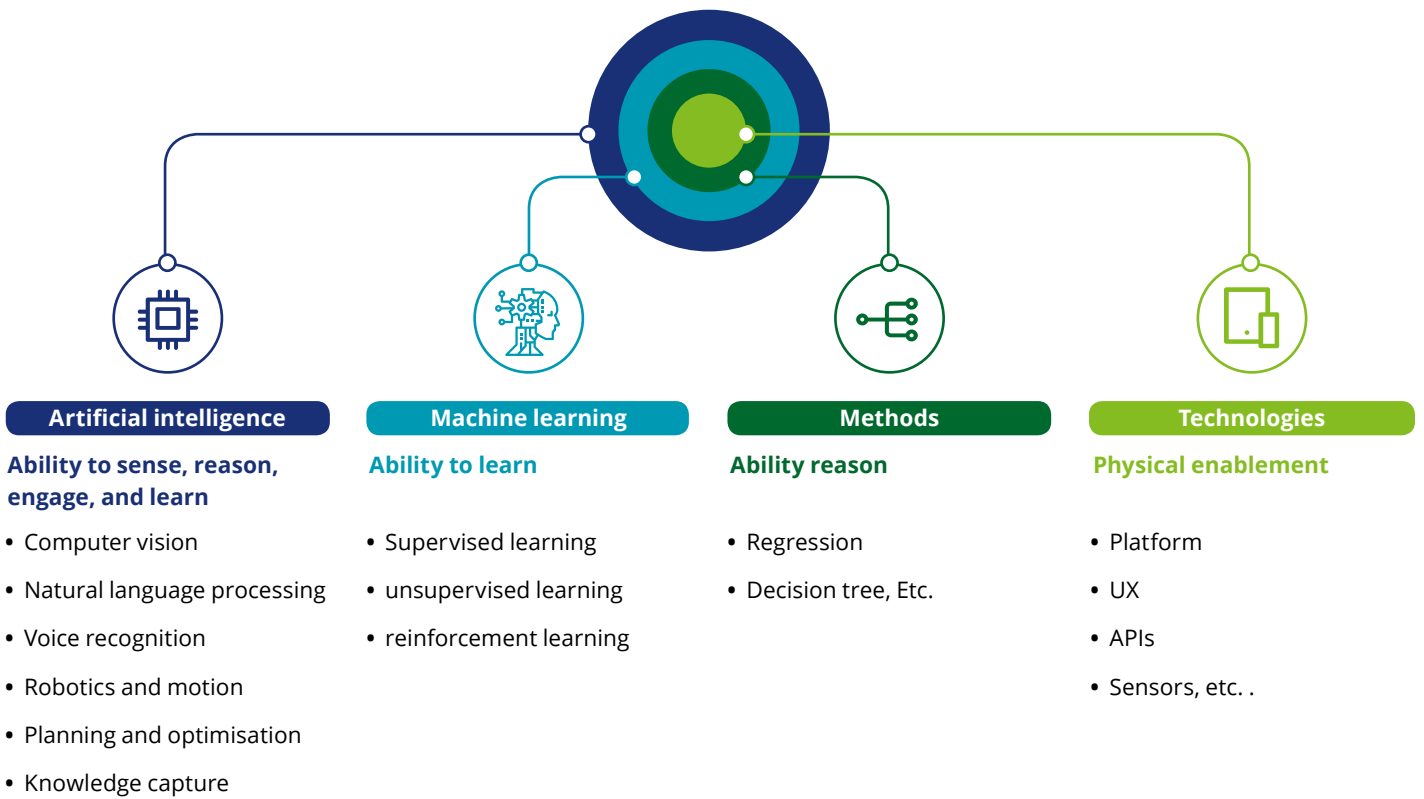


<sup>1</sup> Paper: A. M. Turing (1950) Computing Machinery and Intelligence. Mind 49: 433-460.

# AI story so far

AI refers to not only the field of computer science, but also psychology, philosophy, linguistics, and other areas. It involves carrying out tasks through computers that usually require human intelligence. John McCarthy, the father of AI, defines, "AI is the science and engineering of

making intelligent machines, especially intelligent computer programmes."<sup>2</sup> Thus, the concept of AI refers to the ability to plan, reason, learn sense, build perception about knowledge, and communicate in a natural language.

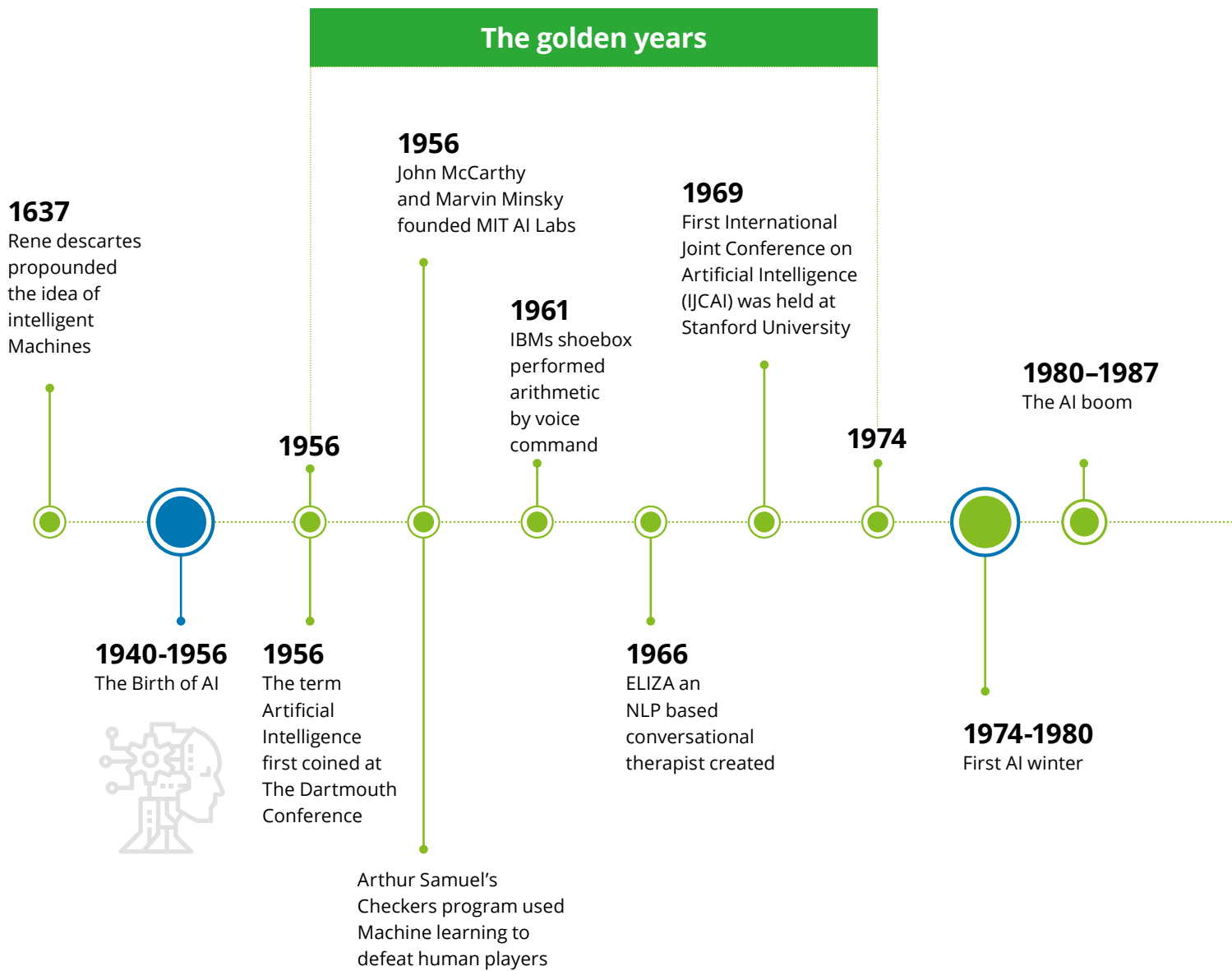


Source: Deloitte Internal Research

<sup>2</sup> Paper: What is Artificial Intelligence? John McCarthy, Stanford University.

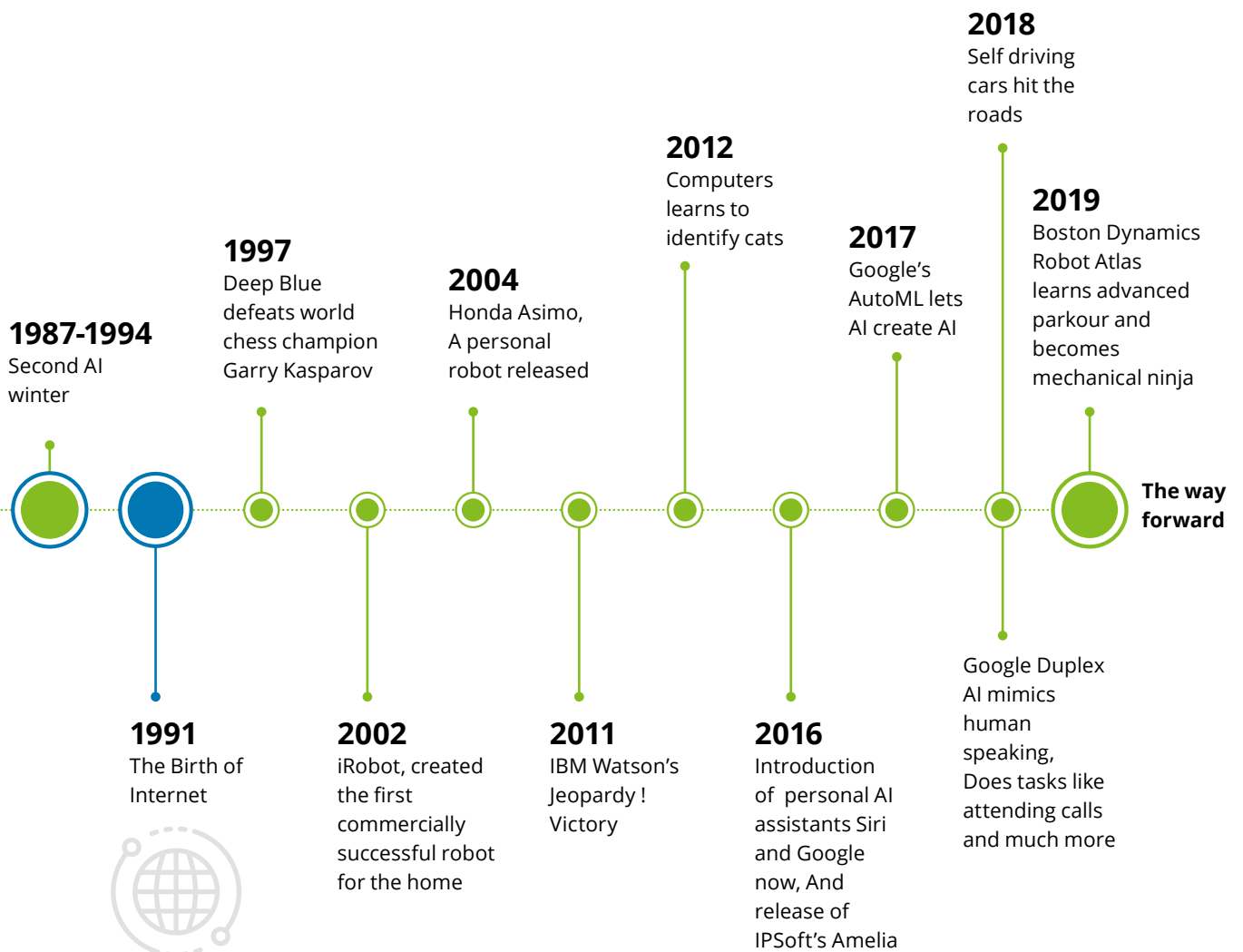
AI is currently performing numerous tasks to make this world a better place. Most of the major universities across the world now offer courses in AI and ML. This indicates increasing awareness about AI. With the belief that “data is the new oil”, a huge number of professionals, researchers, and students express interest in AI. While the future of AI is promising, one must also know how we got where we are today.

## AI: The story so far<sup>3</sup>



<sup>3</sup> Source: Internet Research





Since the conception of the idea of an intelligent machine, the field of AI has seen many major developments. The tasks that needed lots of human efforts can be easily done using AI. In addition to changing people's lives, AI is revolutionizing industries across the globe.

Countries are becoming increasingly aware of AI's economic and social benefits. If applied wisely, AI has the potential to become a national asset and a source of global competitive advantage. Numerous governments are investing in national AI strategies, involving both the public and private sectors. While Germany has earmarked US\$ 3.4 billion for AI, France plans to spend US\$ 1.8 billion on its AI national strategy<sup>2</sup>. Other nations, such as South Korea, China, Canada, Japan, Singapore, and India, have also developed national AI strategies (as shown in the map).

### Country national AI strategies

**UK:**

The UK government unveiled an AI sector deal worth more than \$1.3 billion in planned investments in May 2018. The deal aims to use government-industry partnerships for a wider adoption of AI.

**Canada:**

The Canadian government launched the five-year Pan-Canadian Artificial Intelligence Strategy in its 2017 budget.

**US:**

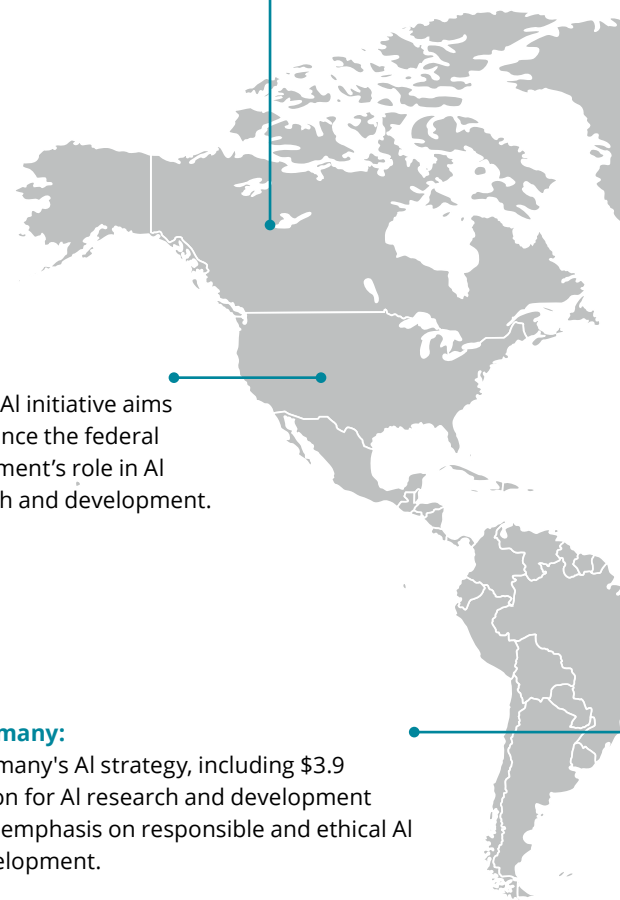
The US AI initiative aims to enhance the federal government's role in AI research and development.

**Germany:**

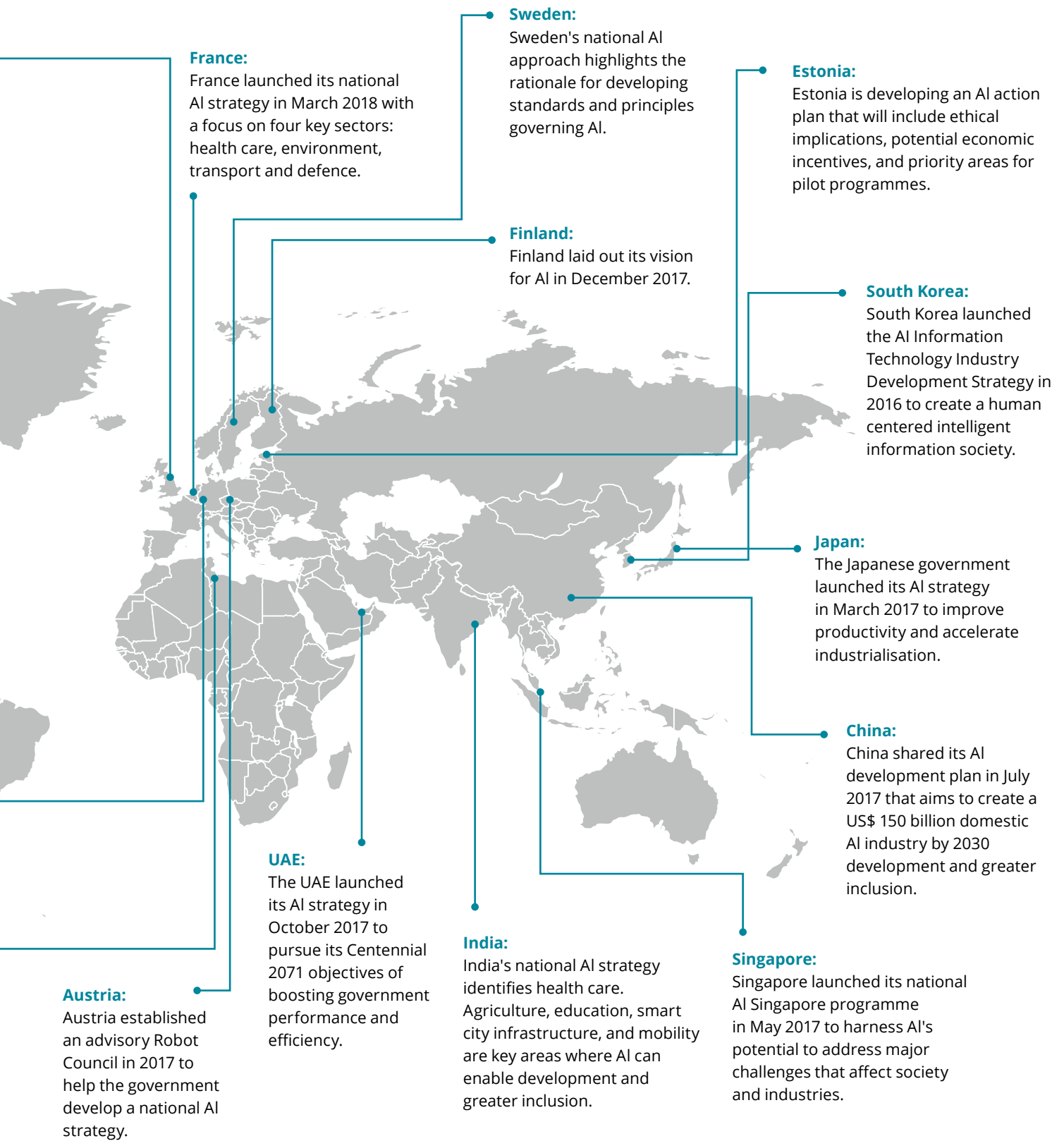
Germany's AI strategy, including \$3.9 billion for AI research and development lays emphasis on responsible and ethical AI development.

**Tunisia:**

Tunisia has created a task force and steering committee to develop its national AI strategy.



Source: Deloitte Internal Research  
Note: All currency amounts are given in US dollars.



AI has already started revolutionizing businesses in India as more companies are adopting the technology. The government sector can be a focus area where cognitive technologies can help reimagine and redesign the nature of work to make the most of both human and machine skills.

# Evolving AI landscape across business enterprises

## AI: A potential game-changer for the retail and CPG industries

Pressure on retailers to optimize sales, provide enhanced customer experience, and maintain their inventory accuracy, is increasing. Such targets can only be met with the judicious use of AI. The use of AI will help predict customers' demand and also get them to buy more.

AI can help enterprises make recommendations to customers based on their own preferences and buying history. This can transform user experience, making it easier to sell and buy online. AI also has applications in the area of object recognition and visual search, which allows business users to interact with a range of retail solutions and select the one suitable for them. This has created new insights into customer preferences and unlocked analytics from visuals that were previously inaccessible to businesses. Another application is to enhance customers' satisfaction

by quickly responding to their queries through online chatting. This will simplify their user journey, improve satisfaction, and help boost efficiency in their customer service operations.

## AI's expanding footprint to hold the key to transforming the manufacturing industry

Studies shows that companies might gain US\$ 1.3-2 trillion a year by integrating AI in their supply chain and manufacturing.<sup>4</sup> Following the recent impetus given by the Government of India, manufacturing is expected to emerge as one of the high growth sectors in India. The application of AI will offer several benefits, such as quality control, shortened design time, reduced materials waste, improved production reuse, and predictive maintenance. The rise of computer vision technology has given machines the ability to process images and think about the next steps from a logical perspective

From monitoring plants, predicting when factory equipment will need maintenance, and improving efficiencies, to monitoring machine fleets for service purpose, AI systems can draw conclusions regarding a machine's condition and detect irregularities to make predictive maintenance possible.



<sup>4</sup> Source: SourceToday (<https://www.sourcetoday.com/supply-chain/what-artificial-intelligence-s-role-supply-chain>)

# Social and economic welfare through AI

## AI transforming education and skill development

With the ever-increasing population and dearth of teachers, only AI can bring the much needed educational revolution. It will make education more accessible and inclusive, and help students and teachers to keep up with the current trends. Thus, AI will change the way teachers and other faculty work, and improve the way an individual engages and learns.

Automating processes such as grading, progress report generation, and other routine administrative tasks will significantly decrease teachers' workload, thus making room for other meaningful activities. AI can help grade students together by grouping similar student responses (avoiding grading for each question one by one). It can also provide essential statistics on which questions students found most difficulty, etc., to give insights to instructors on how students are engaging with study material.

Using adaptive learning can enhance students' problem-solving ability. Each student has a different learning rate (based on performance in previous assignments). AI algorithms can produce a more personalised learning path. Real-time feedback, and customised textbooks and materials can be a game changer.

## AI reshaping treatment of multifactorial diseases

As the health care industry begins to use new technologies (such as AI and predictive analytics), government health

agencies, doctors, and primary health care providers must be aware of risks of using these technologies, and would need to agree on standards. Despite advancements in medical research in the past few years, the medicines available in the market are imprecise. About 80% patients are non-responders to top 20 prescription drugs in the US.<sup>5</sup>

The recent research advancements in the field of sequencing and precision medicines may turnaround the situation. Some patients do not respond to a particular treatment because medicines are designed for a larger population with similar symptoms. A treatment that cures cough in some patients might not work on others. Precision medicine takes into account individual variability in genes, environment, and lifestyle for each person for disease treatment and prevention. With the use of AI, the complete sequencing of a patient's genome can be done faster at an affordable cost.

## AI enables farmers to grow more while wasting less

We need 50% more food by 2050, but only 4% of the land will come under cultivation.<sup>6</sup> Slow agricultural growth is a major concern and prevailing agricultural practices are neither economical nor environmentally sustainable. Along with the problem of low productivity, India is witnessing the increasing number of farmer suicides. AI can help resolve problems that need innovative approaches.

<sup>5</sup> Source: Microsoft Hanover Project. (<https://www.microsoft.com/en-us/research/project/project-hanover/>)

<sup>6</sup> Source: India Today (<https://www.indiatoday.in/india/story/world-will-more-food-by-2050-food-security-india-1597783-2019-09-11>)

### **Improve crop productivity**

Farmers can no longer rely on their traditional agricultural wisdom, due to the changing weather conditions and pest attacks. Using predictive analysis, we can determine what, when, where, and how to sow based on climatic data, historical conditions, etc. Taking better decisions at the right time increases output and reduces cost. International Crops Research Institute for the semi-arid tropics with Microsoft (location - Andhra Pradesh, India) developed a sowing application powered by AI that resulted in a 30% higher average in yield per hectare.<sup>7</sup> Seeing the success of this app, more farmers are approaching the institute.

### **AI-driven optimisation of pest and weed management**

Predicting behaviour of pests can lead to efficient pest management, and lower crop and environmental damage. The AI system can distinguish weed from crop and hence, potentially reduce the application of weedicide on areas that do not require treatment. Satellites can be used to monitor crop health and warn against pest attacks. In a project to evaluate the effectiveness of AI-

supported weed controlling technology, a US company came up with the "See & Spray" technology, which successfully reduced expenditure on weedicides by 90%.

### **ML to improve irrigation and water management**

Considering the current water crisis, the efficient use of water is crucial. India has 4% of the world's total freshwater and the agricultural sector consumes about 80% of this.<sup>8</sup> The traditional irrigation system supplies the same amount of water to all plants even though each plant retains water differently. One can use thermal imaging to see if crops are getting adequate amount of water. Thus, optimised water usage improves yield production, reduces manual intervention, and decreases the instances of crop diseases.

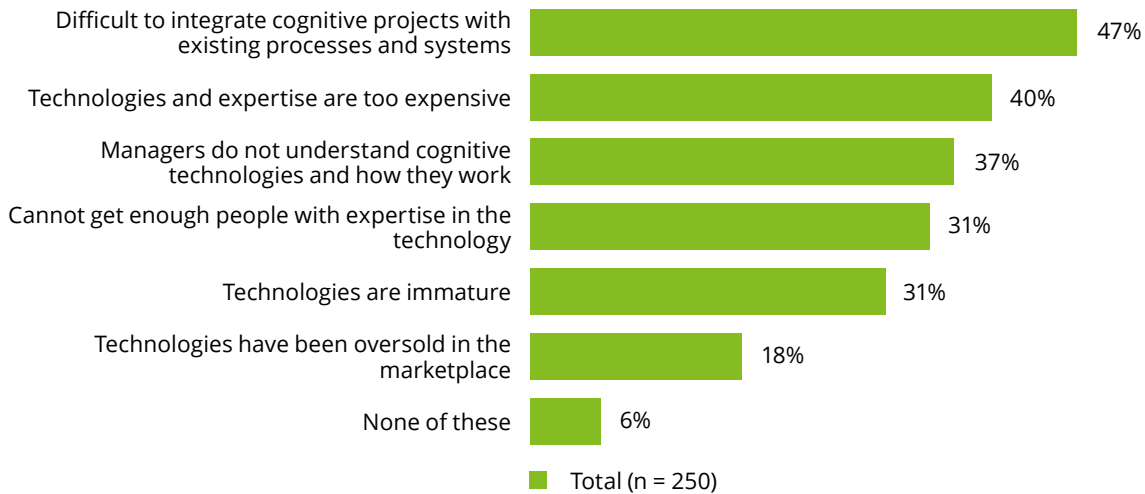
Different applications of AI and technological initiatives are being seen globally. The use of AI will increase produce and reduce wastage, and help farmers increase their income. This will also put in place a better price control without adversely affecting the environment.

<sup>7</sup> Source: Microsoft News Centre: Article titled "Digital Agriculture: Farmers in India are using AI to increase crop yields" (<https://news.microsoft.com/en-in/features/ai-agriculture-icrisat-upl-india/>)

<sup>8</sup> Paper: Water and Agriculture in India Background 2017 ([https://www.oav.de/fileadmin/user\\_upload/5\\_Publikationen/5\\_Studien/170118\\_Study\\_Water\\_Agriculture\\_India.pdf](https://www.oav.de/fileadmin/user_upload/5_Publikationen/5_Studien/170118_Study_Water_Agriculture_India.pdf))

# Key challenges in AI implementation and possible solutions<sup>9</sup>

## What are the top challenges with cognitive technology?



Source: Deloitte State of Cognitive Survey, August 2017

### Overcoming cultural barriers in AI implementation

It is usually hard for humans to adapt to changes in the field of technology. Humans resist changing their habits, and often do not like to adopt new methods of doing something. They need persuasion to see gains that AI will inevitably bring as lack of knowledge about the technology poses challenges to its adoption. The perception that AI is not needed in the work they do and low awareness, people resist using AI in their work and handing over control to a machine. Global business leaders believe their organizations must successfully deploy AI solutions in the next five years. However, an overwhelming majority of these leaders agree that internal resistance to change poses main challenges in the implementation of AI technologies at their workplaces.

We believe one way to overcome this barrier is to bring awareness among employees about AI and its implementation. Employees can be made aware of how AI can assist them in their profession, and ultimately increase efficiency and reduce cost. Organizations must recognize their learning paths. They need to increase their understanding of AI, identify which use cases to adopt, what technological investments they need to do, etc. With collaborative efforts, organizations will be better able to exploit benefits of AI.

### Bridging skill gap for an AI-driven future

Skill gap is one of the biggest barriers to AI adoption. Due to a shortage of technology professionals with experience in big data, ML, and deep learning, statistics organisations are unable to

<sup>9</sup> Source: Deloitte State of Cognitive Survey, August 2017 (<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/deloitte-analytics/us-da-2017-deloitte-state-of-cognitive-survey.pdf>)

capitalise on growth offered by AI. Many companies are also looking beyond technical expertise, citing the need for business leaders who are able to interpret AI results and make decisions, and take actions based on them.

Although organisations may believe that seeking the best talent will provide an advantage, training their current workforce should not be overlooked. Business leaders should invest in such courses to upgrade their human capital and thus, gain competitive advantage. There are learning tracks for people looking to improve their AI skills.

#### Outlining strategic approach for efficient adoption of AI across industries

Most industries are looking to implement AI in their operations. However, implementing this technology is often not easy because of lack of a strategic approach. Any major investment in technology by an enterprise should follow a thorough strategy where expectations, objectives, and plans are laid out. However, in the race of adopting AI before the competition to gain an edge in the market, enterprises often end up choosing the most obvious implementation areas. Although these implementations may deliver desirable results, they may not align well with the organisation's long-term goals. Thus, identifying how the AI initiative aligns with the organisation's long-term goals is the key to ensuring an effective implementation.

A well-thought-out strategy to implement AI can also enable a smoother transition towards AI-driven processes. To do this, organisations should know where and how AI can be implemented to their problems. This can help obtain best returns for investment in AI. Putting in place the right strategy can help overcome the hurdles in the adoption of AI.

#### Ensuring data quality for a reliable AI

The use of good quality data makes analysis more accurate and processes more efficient. This information can be effectively collated and used to identify further opportunities to increase profits, gain efficiencies, reduce cost, etc. AI solutions are built and driven by data. Thus, the quality of any decision that an AI solution makes significantly depends on the quality and quantity of the data used.

AI tools are available in the market that help organisations overcome the data quality issue using ML technology.

#### Although the cost of AI computation is decreasing, it needs to fall at a higher rate to be affordable worldwide

Most of AI use cases end with a proof of concept and are not able to see successful implementation or rollout. The need for high capital expenditure and lack of computation power of existing infrastructure pose challenges in implementation.

The solution is to develop the next generation of computing infrastructure, such as quantum computing or cloud infrastructure, which provides the pay as you use model. As the volume increases exponentially, computation speed requirements will grow, making it imperative for organisations to develop next-generation computational infrastructure solutions.

#### Eliminating ethical dilemma associated with AI

Organisations across the globe have recognised the importance and impact of AI. Yet about a third of executives in a recent Deloitte survey named ethical risks as one of the top three potential concerns. Some key ethical risks include lack of transparency of AI decisions, poor accountability structures, potential bias and discrimination in AI decision making, use of personal data without consent and workforce displacement, and transitions due to automation.

Some AI technology vendors create ethics related guidelines, establish AI governance teams, and launch tools to mitigate these risks. Many universities are researching on these issues and setting up AI ethics courses. Several organisations have started integrating emerging tools to detect bias in AI data and algorithms, and develop remedial measures. AI adopters should also be proactive in addressing the ethical aspects of their AI initiatives. They should engage with the board and stakeholders to establish the governance of AI initiatives and interact with regulators to help shape regulations.



Deloitte Global predicts that in 2019, among companies that adopt AI technology, 70 percent will obtain AI capabilities through cloud-based enterprise software, and 65 percent will create AI applications using cloud-based development services.<sup>10</sup>

<sup>10</sup> Source: Deloitte Global (<https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/technology/deloitte-uk-tech-trends-2019-chapter2-ai-fuelled.pdf>)



# Concluding remarks

Due to rapid advancements in the field of AI, the technology has the potential to bring revolutionary transformation across the globe to industries, including education, health care, agriculture, and retail. As AI is able to perform various tasks on its own, it acts as a helping hand for workforce (increase people's efficiency, not replacing them).

Understanding and adapting AI is a journey, subject to the headwinds and tailwinds of economic, social, and political changes. The future of businesses lies in their ability to fully benefit from new technologies. AI is one such new technology that will transform front and back office operations, and create major shifts across various industries. There is a growing realisation of AI's importance, including its ability to provide competitive advantage and change work for the better. A majority of global early adopters believe that AI technologies are especially important for the success of their businesses today. A majority also stated that they use AI technologies to move ahead of competition and empower their workforce.

We will leave you with this thought. Although AI has a promising future, there are still a lot of hurdles and challenges on the way. With collaborative efforts, industries across the world can overcome these hurdles and achieve business goals.

## The top five benefits of AI

The percentage of survey respondents who rated each benefit for their companies



Source: Deloitte Consulting LLP. State of AI in the Enterprise, 2nd Edition, October 22, 2018. Deloitte Insights, [deloitte.com/insights](https://deloitte.com/insights)





# About Deloitte

All the facts and figures that talk to our size and diversity and years of experiences, as notable and important as they may be, are secondary to the truest measure of Deloitte: the impact we make in the world. So, when people ask, “what’s different about Deloitte?” the answer resides in the many specific examples of where we have helped Deloitte member firm clients, our people, and sections of society to achieve remarkable goals, solve

complex problems or make meaningful progress. Deeper still, it’s in the beliefs, behaviors and fundamental sense of purpose that underpin all that we do. Deloitte globally has grown in scale and diversity—more than 312,000 people in 150 countries, providing multidisciplinary services yet our shared culture remains the same.

# About Confederation of India Industry

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 276 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.

India is now set to become a US\$ 5 trillion economy in the next five years and Indian industry will remain the principal growth engine for achieving this target. With the theme for 2019-20 as 'Competitiveness of India Inc - India@75: Forging Ahead', CII will focus on five priority areas which would enable the country to stay on a solid growth track. These are - employment generation, rural-urban connect, energy security, environmental sustainability and governance.

With 66 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.

# Contacts

## Deloitte

### Ashvin Vellody

Partner  
Deloitte India  
ashvinv@deloitte.com

### Saurabh Kumar

Partner  
Deloitte India  
sakumar@deloitte.com

### Varun Rastogi

Associate Director  
Deloitte India  
varastogi@deloitte.com

### Prathyusha Atmakur

Associate Director  
Deloitte India  
pratmakur@deloitte.com

## Confederation of Indian Industry

### Deepak Sidha

Deputy Director  
deepak.sidha@cii.in

## Deloitte

7th Floor, Building 10, Tower B,  
DLF Cyber City Complex,  
DLF City Phase-II,  
Gurgaon-122 002, India  
Tel: +91 124 679 2000  
Website: [www.deloitte.com/in](http://www.deloitte.com/in)

## Confederation of Indian Industry

(Northern Region) – Sub-Regional Office  
Plot No 249 –F, Sector-18, Udyog Vihar  
Phase IV, Gurugram - 122 015 (Haryana)  
Tel: +91 0124 401 40760 - 67  
Fax: +91 0124 401 4062  
Email : [ciinr@cii.in](mailto:ciinr@cii.in)  
Website: [www.cii.in](http://www.cii.in)





## Confederation of Indian Industry

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