Artificial Intelligence in India: Prospects and Difficulties

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Abstract

Artificial Intelligence (AI) is one of the most transformative technologies of the 21st century, reshaping how we live, work, and interact with the world. At its core, AI involves the development of computer systems capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, perception, language understanding, and interaction.

AI rapidly transforms industries and economies worldwide, and India is no exception. As one of the fastest-growing economies, India presents a unique landscape for adopting and developing AI technologies. This paper explores the prospects and difficulties associated with AI in India.

Key Words: Artificial Intelligence (AI), Human intelligence, India, 21st century.

Introduction of Artificial Intelligence (AI)

Artificial Intelligence (AI) is a branch of computer science that aims to create machines capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, perception, and language understanding. The concept of AI has evolved over decades, progressing from theoretical foundations to practical applications that impact various aspects of everyday life.

The term "Artificial Intelligence" was first coined in *1956* by *John McCarthy* during the Dartmouth Conference, which is considered the birth of AI as a field of study. Early AI research focused on problem-solving and symbolic methods. The 1970s and 1980s saw the development of expert systems, which are programs designed to mimic the decision-making abilities of human experts.
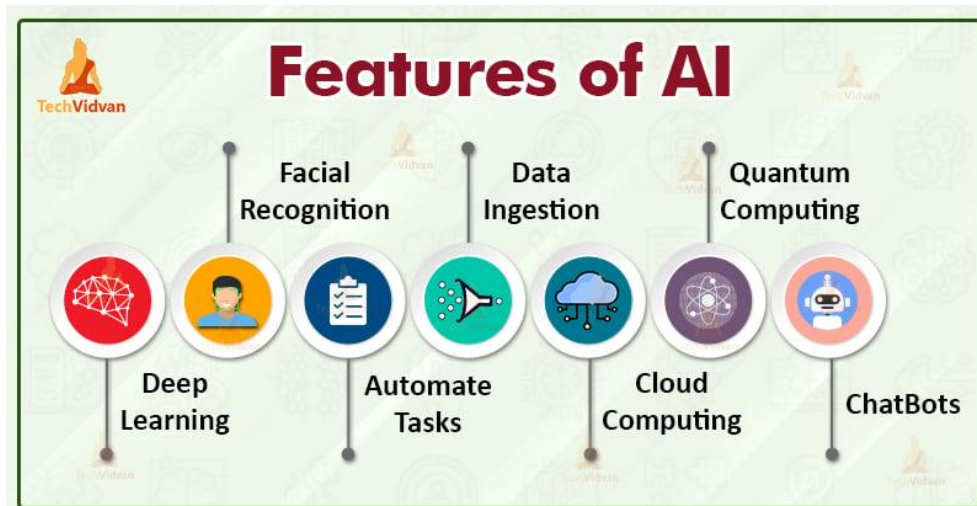
What is artificial intelligence?
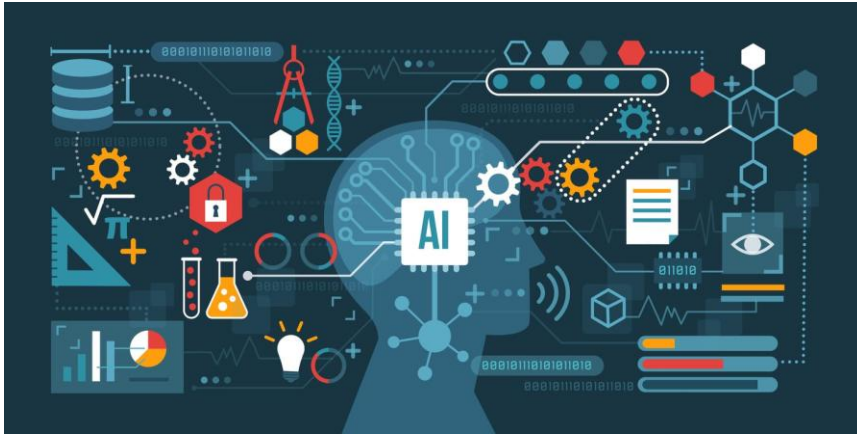
AI might just be the single largest technology revolution of our lifetime, with the potential to disrupt almost all aspects of human existence. Andrew Ng, Co-founder of Coursera and formerly head of Baidu AI Group / Google Brain, compares the transformational impact of AI to that of electricity 100 years back. With many industries aggressively investing in cognitive and AI solutions, global investments are forecast to achieve a compound annual growth rate (CAGR) of 50.1% to reach USD57.6 billion in 20211.

AI is not a new phenomenon, with much of its theoretical and technological underpinning developed over the past 70 years by computer scientists such as Alan Turing, Marvin Minsky and John McCarthy. AI has already existed to some degree in many industries and governments. Now, thanks to virtually unlimited computing power and the decreasing costs of data storage, we are on the cusp of the exponential age of AI as organisations learn to unlock the value trapped in vast volumes of data.
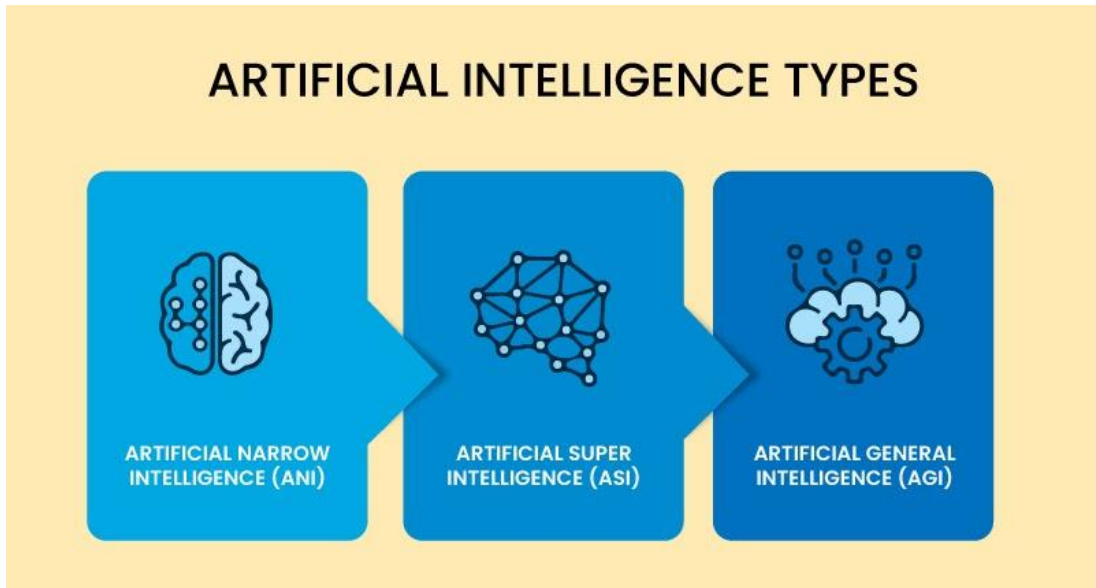
AI is a constellation of technologies that enable machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act. Thus, computer vision and audio processing can actively perceive the world around them by acquiring and processing images, sound and speech. The natural language processing and inference engines can enable AI systems to analyse and understand the information collected. An AI system can also take action through technologies such as expert systems and inference engines or undertake actions in the physical world. These human capabilities are augmented by the ability to learn from experience and keep adapting over time. AI systems are finding ever-wider applications to supplement these capabilities across enterprises as they grow in sophistication.

Irrespective of the type of AI being used, however, every application begins with large amounts of training data. In the past, this kind of performance was driven by rules-based data analytics programs, statistical regressions, and early "expert systems." But the explosion of powerful deep neural networks now gives AI something a mere program doesn't have: the ability to do the unexpected.[1]

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[1] Worldwide Semi-annual Cognitive Artificial Intelligence Systems Spending Guide from International Data Corp. (IDC), 2017

AI can be broadly classified into two categories:

ARTIFICIAL INTELLIGENCE TYPES

ARTIFICIAL NARROW INTELLIGENCE (ANI)

ARTIFICIAL SUPER INTELLIGENCE (ASI)

ARTIFICIAL GENERAL INTELLIGENCE (AGI)

1.   Narrow AI (Weak AI):

Narrow AI is designed and trained for a specific task. Examples include virtual personal assistants like Siri and Alexa, recommendation systems used by streaming services, and autonomous vehicles. These systems operate under a limited set of constraints and contexts, without possessing general intelligence or awareness.

2.   General AI (Strong AI):

General AI refers to systems that possess the ability to understand, learn, and apply intelligence broadly, similar to human cognition. This type of AI can perform any intellectual task that a human can do. However, general AI is largely theoretical at this stage, and its realization remains a long-term goal in AI research.

Key Concepts And Technologies
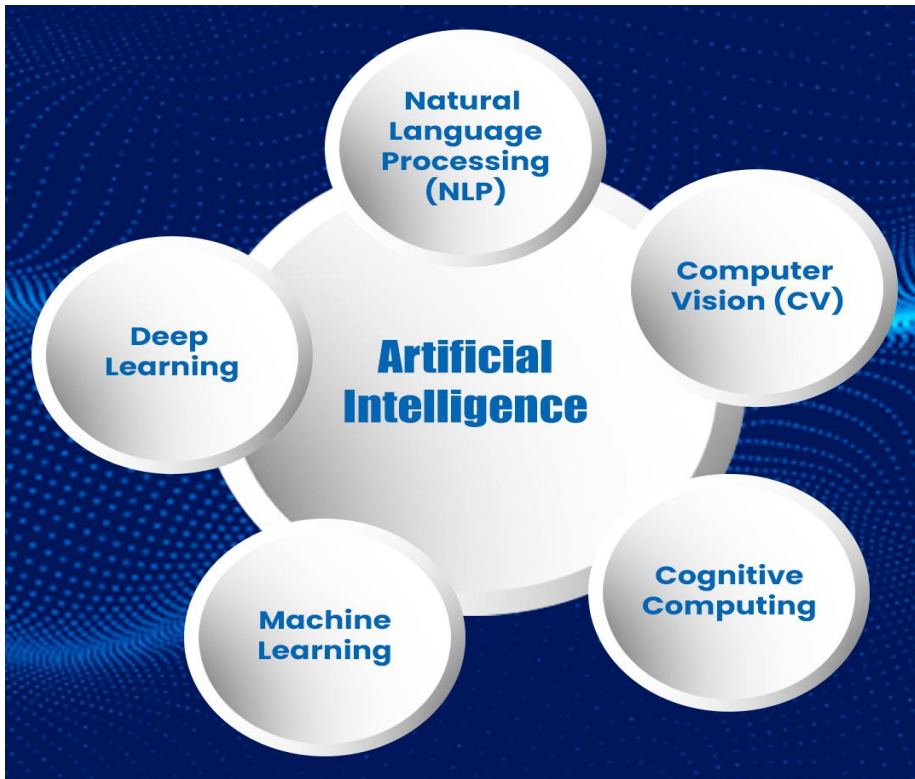
- **Machine Learning (ML):** A subset of AI involves the development of algorithms that allow computers to learn from and make predictions or decisions based on data. Techniques include supervised learning, unsupervised learning, and reinforcement learning.

- **Deep Learning:** A specialized form of machine learning using neural networks with many layers (hence "deep"). It is particularly effective in tasks such as image and speech recognition, where it can achieve high accuracy.

- **Neural Networks:** Computational models inspired by the human brain, consist of layers of interconnected nodes (neurons) that process information. Deep learning, a branch of ML, uses neural networks with many layers to analyze complex data.

- **Natural Language Processing (NLP):** The ability of a computer to understand, interpret, and generate human language. It is used in various applications like speech recognition, translation services, and chatbots. NLP focuses on the interaction between computers and human language. It enables machines to understand, interpret, and respond to human language in a valuable way. Applications also include language translation, sentiment analysis etc.

- **Computer Vision:** The field of AI enables machines to interpret and understand visual information from the world. Applications include image recognition, autonomous vehicles, and medical imaging.

- **Robotics:** Robotics involves designing and using robots for various tasks, often integrating AI to enable robots to perform complex tasks autonomously. The design and creation of robots that can perform tasks autonomously or semi-autonomously. AI plays a crucial role in enabling robots to navigate environments, manipulate objects, and interact with humans.

Applications of AI

AI technologies are being integrated into various sectors, revolutionizing industries and improving efficiency and productivity. Some prominent applications include:

- **Healthcare:** AI is used for diagnostic tools, personalized medicine, and robotic surgery.

- **Finance:** AI algorithms help detect fraud, risk management, and automated trading.

- **Transportation:** Autonomous vehicles and traffic management systems rely heavily on AI.

- **Retail:** AI enhances customer experiences through personalized recommendations and inventory management.

- **Manufacturing:** AI-driven automation and predictive maintenance improve operational efficiency.

- **Education:** AI personalizes learning, automates grading, and provides intelligent tutoring systems.

Prospects of AI In India

- **Economic Growth and Productivity:** AI has the potential to significantly boost India's GDP by enhancing productivity across various sectors such as agriculture, manufacturing, and services. According to a report by McKinsey, AI could add $957 billion to India's economy by 2035.

- **Healthcare:** AI applications in healthcare can improve diagnostics, treatment plans, and patient monitoring. Indian startups like Niramai are leveraging AI for early detection of breast cancer, which can revolutionize preventive healthcare.

- **Agriculture:** AI can address challenges in agriculture by providing predictive analytics for crop yield, soil health monitoring, and precision farming. AI-powered solutions can help farmers make informed decisions, increasing productivity and reducing waste.

- **Education:** AI can personalize learning experiences and provide support through intelligent tutoring systems. Companies like BYJU's are already integrating AI to offer customized learning paths for students.

- **Government Initiatives:** The Indian government has recognized the potential of AI and launched the National AI Strategy, focusing on areas like healthcare, agriculture, education, and smart cities. The establishment of centers of excellence and AI research institutions is a positive step toward fostering innovation.

  Over the last few years, AI has evolved to become a key driver of Industrial Revolution 4.0. India has a significant stake in the development of AI, with its potential being progressively unleashed in terms of investments, talent, and growing market size.

Recent Data on AI

AIM research Published on December 27, 2022:

https://analyticsindiamag.com/the-state-of-ai-in-india-2022/

This report presents a comprehensive overview of the State of AI in India. Along with the usual metrics like the overall size of the AI market and its projected growth rate, a key highlight in this report is the state of AI adoption across sectors in India. The report also includes the extent to which different AI capabilities and use cases have been adopted in India. Additionally, the report talks about the AI talent scenario in India, focusing on the skillset, experience and job opportunities available for AI professionals.

1. Indian AI Market

In this section, we present an overview of the Indian AI market — its present size, sectoral composition, growth rate and projection for the near future.

1.1 Indian AI Market Projection
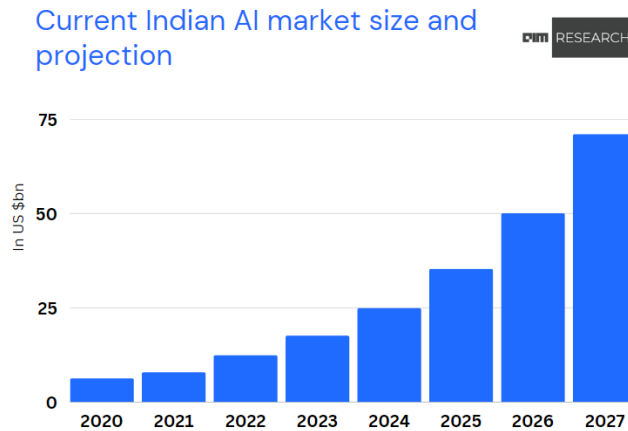
12.3 bn AI-generated revenue in India in 2023 stands at USD 12.3 billion in 2022.

42%

Indian AI market size is predicted to grow at a CAGR of 42% in 2022.

71.0 bn

AI market size in India is expected to grow to USD 71.0 bn by 2027.

The AI market is steadily increasing in India, driven by strong IT infrastructure, a rich data economy and the large-scale investments that government and corporates have been making towards digitalisation.

In the years to come, the AI market is all set to grow further, driven by the increasing use of cloud-based applications and ever-expanding benefits being realised from AI-driven decision-making.

1.2 Market size by type of sector
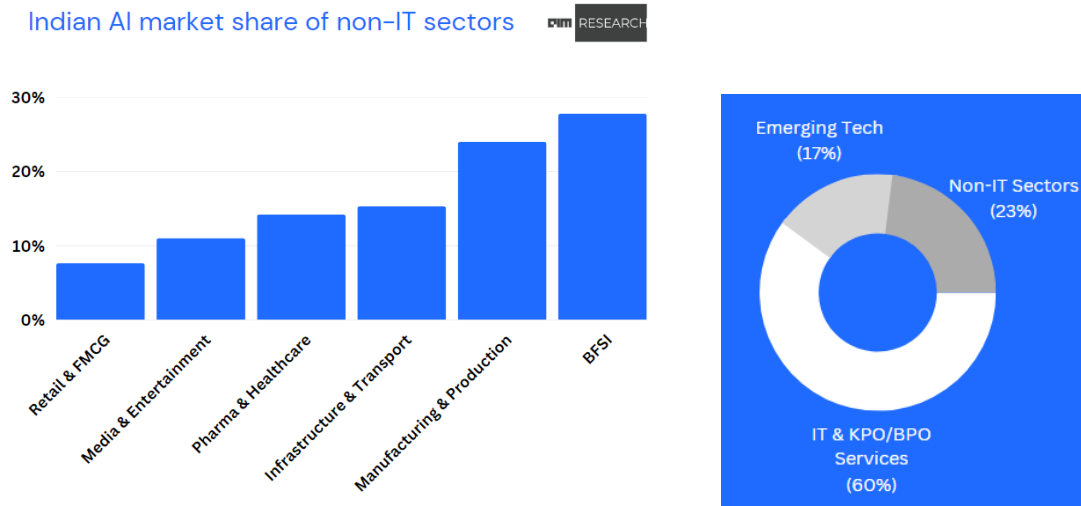
3/5

Big IT companies or KPO/BPO service providers make up 3/5th (60.0%) of the total AI market in India.

23%

Non-IT sectors make up 23% of the total AI market share in India.

28%

BFSI holds a market share of 28% among all the non-IT sectors in India.

Consumer companies are increasingly adopting AI across different verticals, driven by the unleashing potential of various applications and use cases.

In the Manufacturing sector, robots are at the forefront of assembly lines to ensure the proper functioning of the entire production value chain. In addition, automated image recognition systems conduct quality checks, thereby enabling precision manufacturing.

1.3 Market size by company type
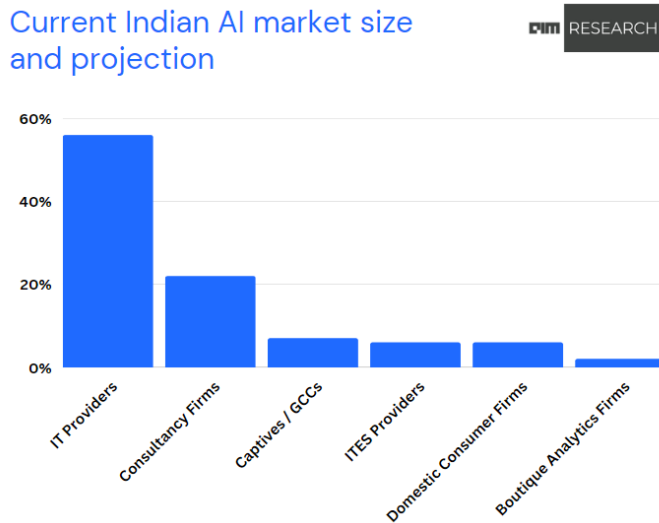
56%

56% of the AI market share in India is held by IT service providers.

22%

Consultancy firms account for 22% of the Indian AI market share.

IT providers continue to garner the first-mover advantage in terms of occupying the highest market share.

However, with the growth of low-code no-code platforms and increasing availability of analytics and business intelligence platforms, and a focus on building in-house capabilities, other players, like consultancy firms, GCCs, and domestic consumer firms, are likely to catch up to increase their share in the overall AI market.
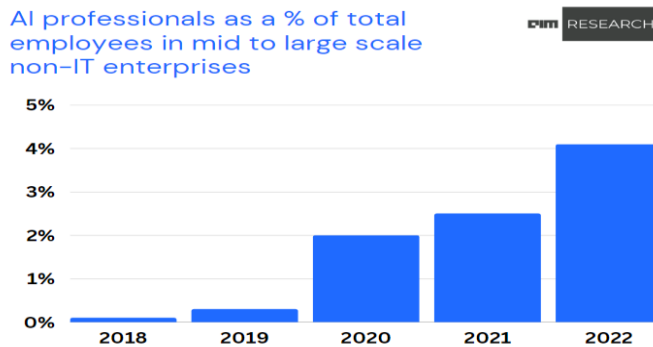
1.4 Niche AI players in India across sectors

2. AI Adoption among Indian enterprises

The section presents the adoption of AI and its use cases across sectors in India — the share of AI professionals across Indian enterprises, the extent and the stage of AI adoption by different sectors.

2.1 Share of AI professionals among Indian enterprises

4.1%

In 2022 the share of AI professionals in mid to large Indian enterprises stands at an average of 4.1%

1.6pp

In 2022, the share of AI professionals as a percentage of total employees in mid to large-size companies increased by 1.6 percentage points.

One in eight (12.8%) of mid-to-large size organisations in India have employed a tenth of their workforce with AI professionals.

The share of AI professionals in non-IT Indian enterprises has been increasing steadily as these firms are hiring more and more AI professionals in-house to leverage AI in their operations and businesses in the backdrop of data becoming more central to strategic decision-making.

## 2.2 Share of AI professionals across sectors
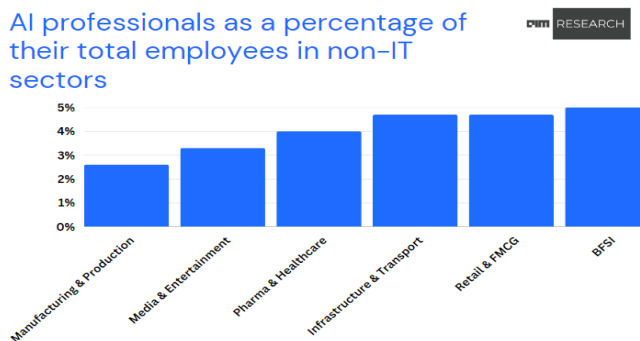
5%

AI professionals account for 5.0% of the workforce strength in BFSI.

3%

In the Media & Manufacturing sectors, 3% of employees are AI professionals.

A high demand for automation combined with emerging technologies like IoT, digital twins, etc., that enable it has led traditional industries like Manufacturing & Production and Infrastructure & Transport to invest significant budgets in AI.

2.3 AI adoption across sectors
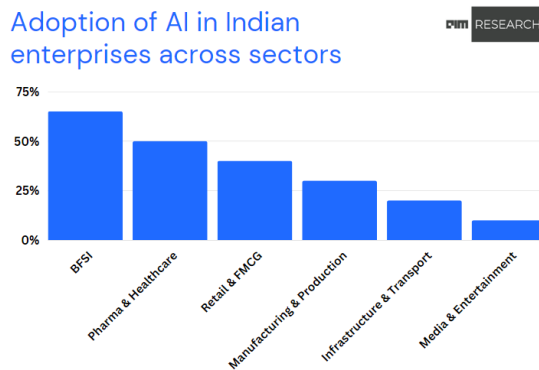
65%

At 65%, the BFSI sector shows the highest rate of AI adoption.

50%

Pharma & Healthcare accounts for 50% of AI adoption.

40%

The Retail & FMCG sector accounts for 40% of AI adoption.

With increasing digitisation, the risks of fraud in the BFSI sector have increased, and so have the concerns regarding data security and privacy. Apart from offering solutions for better customer experience and reduced operational costs, AI holds huge potential to address issues of fraud detection and data safety.

The adoption of AI in the Pharma & Healthcare sector is predominantly driven by the focus on preventive healthcare, drug discovery, and precision medicine.

2.4 Stage of AI adoption across sectors
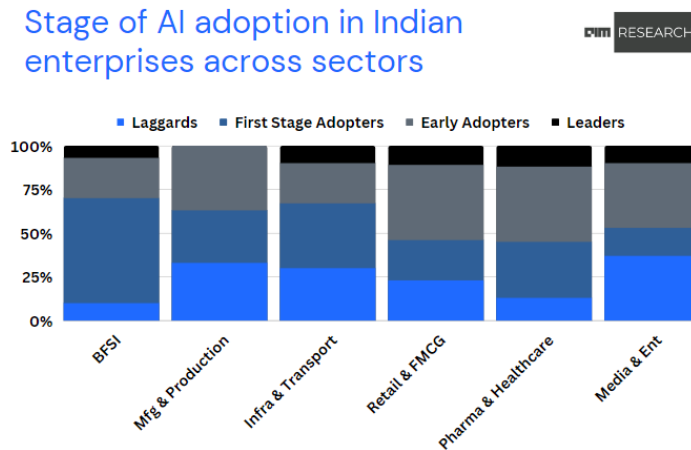
Laggards

Enterprises that do not have any definite AI strategy but are currently hiring standalone (or no) AI professionals.

First stage adopters

Enterprises that have built a distinct AI vertical and deployed AI in at least one use case.

Early adopters

Enterprises that have a distinct AI vertical in place and have deployed AI in multiple use cases.

Leaders

Enterprises that have a holistic AI strategy that forms the core component of their business strategy.

Sectors such as Pharma & Healthcare and Retail & FMCG have a high share of Leaders and Early Stage adopters due to the existing digitisation within the ecosystem. This has enabled them to develop state-of-the-art applications that are able to solve complex real-world problems.

The share of BFSI First-stage adopters is high despite the digitisation as public-sector banks are catching up slowly on the AI hype.

2.5 AI capabilities among Indian enterprises

Percentage of AI enterprises that have adopted AI capabilities
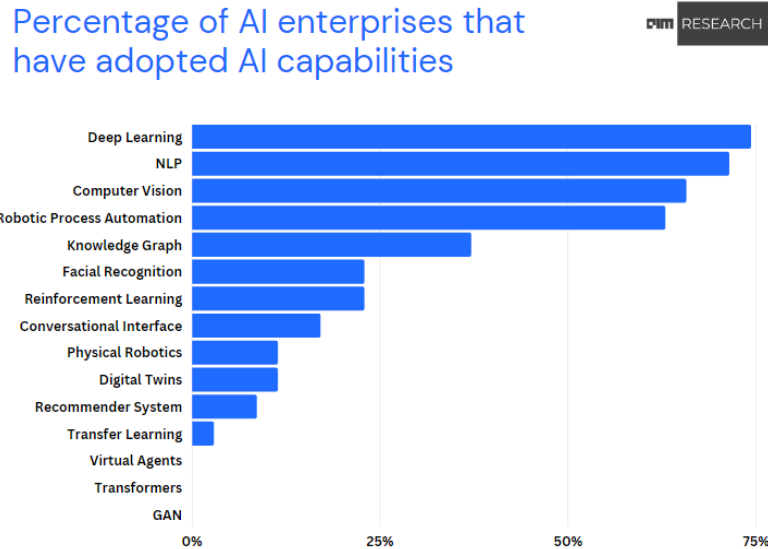
74%

More than 74% of Indian AI enterprises have adopted Deep Learning.

65%

Computer vision and RPA have been adopted by more than 60% of AI enterprises.

37%

37% of AI enterprises in India adopted knowledge graphs in their businesses.

The immense popularity of deep learning among AI enterprises is due to its ability to reveal hidden properties, patterns, and relationships within data that might not even be apparent to humans.

It has immense potential to execute multiple tasks with various data sources while reducing human interference. With the gradual unfolding of its efficiency, DL is set to penetrate further among all enterprises.

2.6 Adoption of AI use cases

Percentage of AI enterprises adopting different use cases

RESEARCH
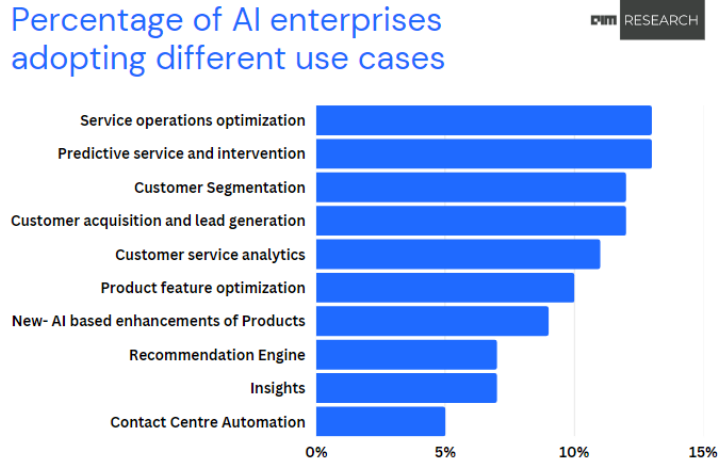
13%

Service operations optimization is the most commonly adopted use case by enterprises.

12%

12% of enterprises have adopted AI for customer segmentation and customer acquisition.

10%

10% of enterprises are using AI for optimizing product features.

Among all use cases, Service operations optimisation is most popular among AI enterprises due to the immense business value it generates by enabling firms to strike the right balance between retaining customers while at the same time optimising resources and maximising productivity.

3. Human Resource

This section deals with the overall AI talent scenario in India — skillset and experience that AI professionals possess, jobs available for them based on experience, geography and sector, and median salaries of AI professionals

3.1 Top skills AI professionals possess
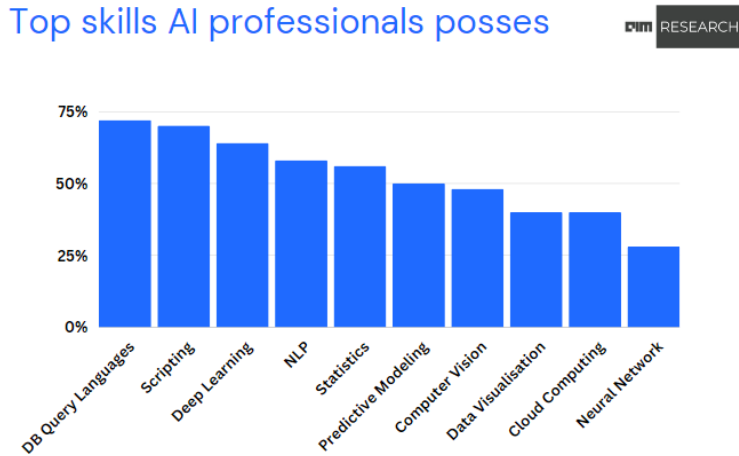
72%

72% of AI professionals can interface with databases through basic query languages like SQL

2/3

Almost two in three (64.0%) AI professionals can work on or have a good understanding of Deep Learning

2/5

Two in five or 40% of AI professionals are skilled in Cloud Computing and Big Data

As the focus on scalable ML applications grows, the line between the roles of data professionals and software engineers will grow thinner. This will lead to more AI professionals that are able to use scripting languages.

A higher share of AI professionals will be proficient in building complex ML solutions like NLP, DL, CV, etc. An ability to build Conventional ML models like regression, decision trees, SVMs, etc., will become a must-have skill for a career in AI.

3.2 Share of AI professionals by years of experience
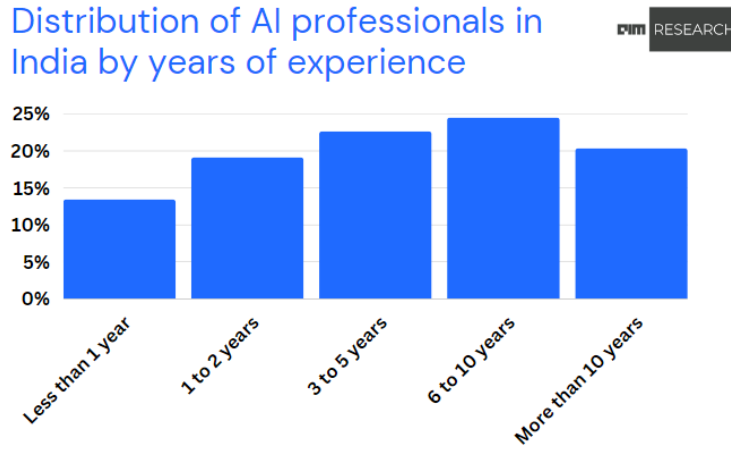
24%

AI professionals with 6-10 years of experience account for 24% of the AI workforce.

22%

AI professionals with 3-5 years of experience account for 22% of the AI workforce.

The formalisation of data science programmes leading to specialised UG/PG courses in Data Science is enabling younger professionals to take up careers in AI.

3.3 Share of open AI jobs across cities
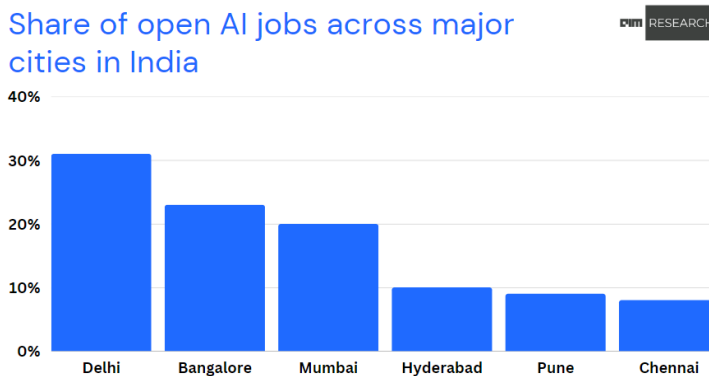
31%

At 31%, Delhi holds the maximum share of jobs for AI professionals.

23%

Bangalore continues to bring more opportunities for technologists with 23% of open AI jobs hiring for roles based out of the city

Delhi is slowly becoming the hub for niche technology startups. MNCs are also opting to set up captives in the NCR region.

Good infrastructure, an efficient transport system, and proximity to the central government is attracting investment leading to a higher share of open AI jobs.

3.4 Share of open AI jobs across years of experience
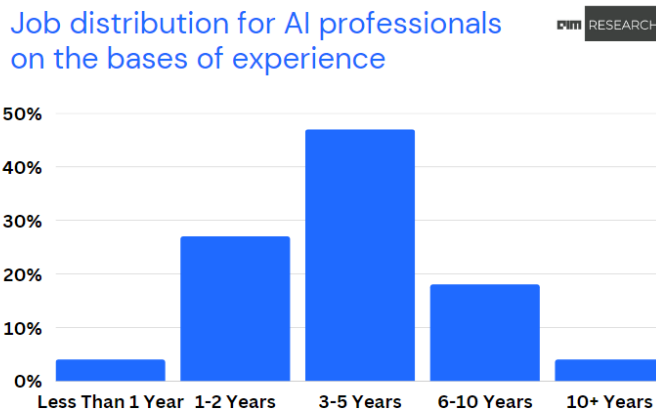
47%

47% of jobs are posted for AI professionals who have 3-5 years of experience.

27%

27% of AI Jobs available are for those who have 1-2 years of experience.

18%

Interestingly, only 18% of the available jobs require AI professionals with 6+ years of experience.

While younger professionals are choosing AI careers, enterprises still prefer experienced folks, since the cost of upskilling and inducting freshers into teams remains high.

3.5 Share of open AI jobs across sectors
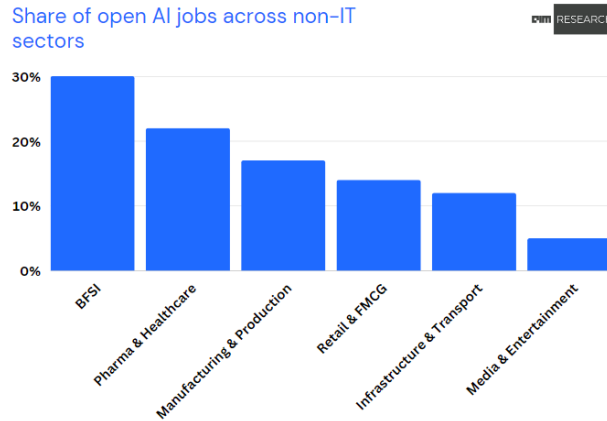
30%

BFSI accounts for 30% of the market share for open AI jobs across sectors.

22%

Health & Pharma accounts for 22% of the market share for the open AI jobs.
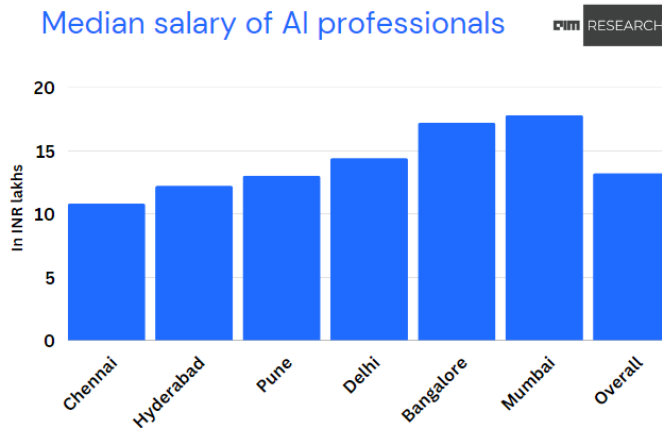
17%

17% of AI jobs currently open are in Manufacturing & Production.

A significant portion of BFSI enterprises, especially public sector banks, are in the early stages of AI adoption. This is leading to more jobs in the sector and demands professionals with good domain knowledge.
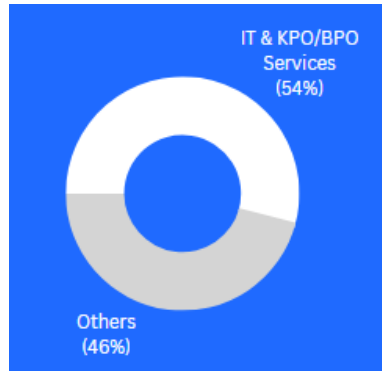
3.6 Median Salary of AI professionals across cities

City-wise median salary Mumbai (at a median of 17.8 lakhs per annum) pays the highest salaries to their AI employees.

Overall, AI professionals in India command a median salary of INR 13.2 lakhs per annum.

A higher cost of living keeps Mumbai at the top as AI professionals in the city command the highest salary at INR 17.8 lakhs per annum.

Difficulties of AI In India

Data Privacy and Security: With the increasing use of AI, concerns around data privacy and security have become prominent. India lacks comprehensive data protection laws, which raises concerns about the misuse of personal data.

Infrastructure and Resources: The development and deployment of AI require robust digital infrastructure, including high-speed internet and advanced computing resources. Many parts of India, particularly rural areas, still lack the necessary infrastructure.

Skill Gap: There is a significant shortage of skilled professionals in AI and related fields. Bridging this skill gap requires substantial investment in education and training programs to develop a workforce capable of supporting AI innovation.

Ethical and Social Implications: The integration of AI into various sectors brings ethical and social challenges, including job displacement and bias in AI algorithms. Addressing these issues requires a balanced approach to ensure AI benefits are equitably distributed.

Regulatory and Policy Framework: The absence of clear regulatory guidelines for AI development and deployment can hinder progress. Establishing a robust policy framework is essential to address ethical concerns, promote innovation, and ensure compliance with international standards.

Ethical And Societal Considerations

While AI presents numerous opportunities, it also poses significant challenges and ethical questions:

- **Bias and Fairness:** AI systems can perpetuate or even amplify biases present in training data, leading to unfair outcomes.

- **Privacy and Security:** The collection and use of large amounts of data raise concerns about privacy and data protection

As AI continues to advance, it brings forth ethical and societal challenges. These include concerns about job displacement due to automation, data privacy issues, and biases in AI algorithms. Ensuring that AI development aligns with ethical principles and benefits society as a whole is a critical aspect of its ongoing evolution.

Conclusion

Artificial Intelligence represents one of the most significant technological advancements of our time. Its ability to simulate human intelligence and perform complex tasks opens up endless possibilities for innovation and improvement across various domains. As AI continues to evolve, it is crucial to address its associated challenges to ensure it serves humanity positively and equitably.

The prospects for AI in India are immense, with the potential to transform key sectors and drive economic growth. However, the successful adoption of AI hinges on addressing significant challenges related to data privacy, infrastructure, skill development, and ethical considerations. By fostering a supportive environment through government initiatives, investment in education, and the development of a comprehensive regulatory framework, India can harness the full potential of AI and emerge as a global leader in this transformative technology.

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