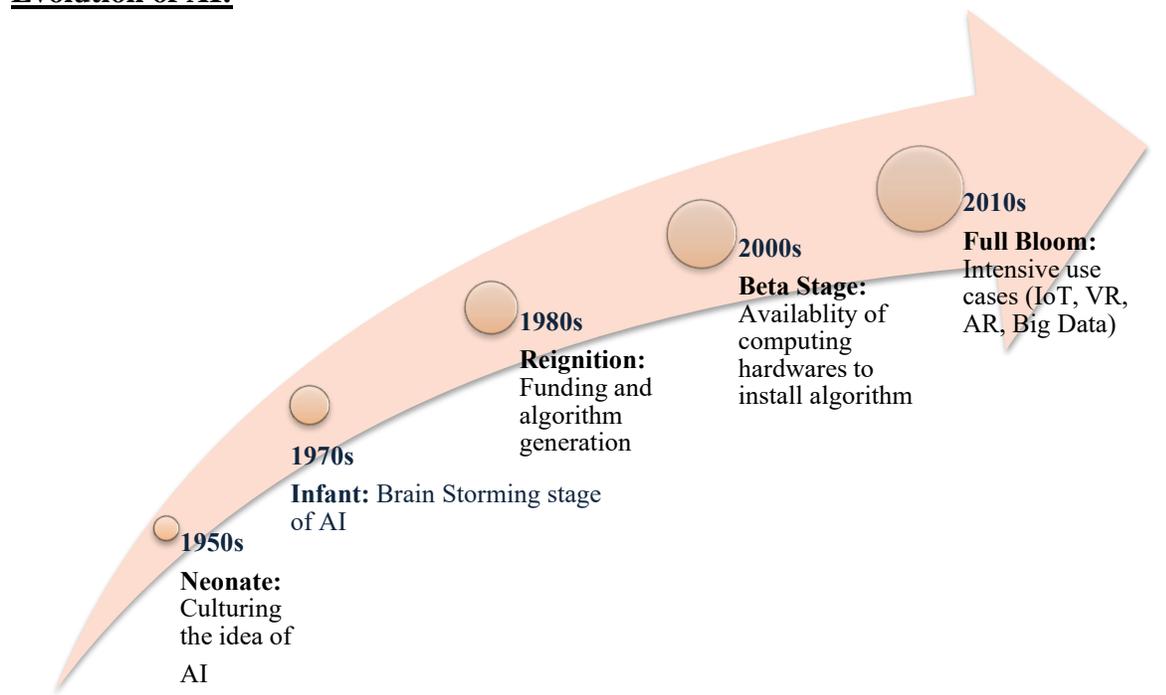


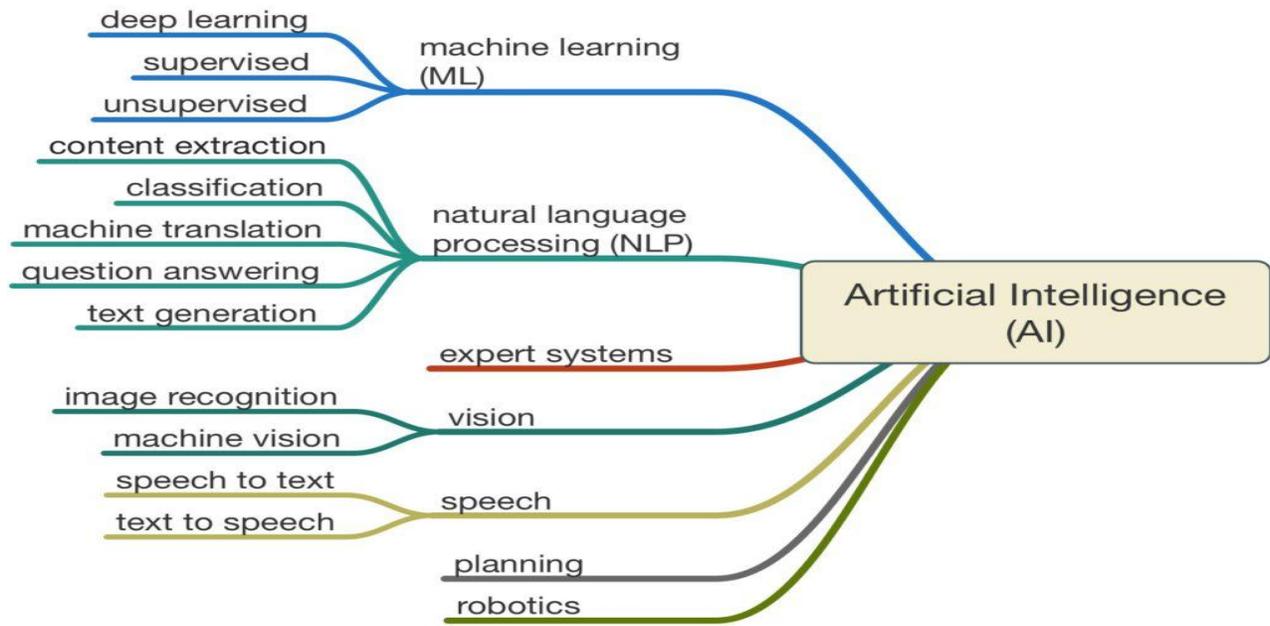
Artificial Intelligence in India

India's national strategy for artificial intelligence prepared by NITI Aayog has formulated the way forward to harness the power of Artificial Intelligence (AI) in various fields. Artificial Intelligence (AI) practices and efforts benefit India in addressing societal needs in areas such as healthcare, education, agriculture, smart cities and infrastructure, including smart mobility and transportation using such dynamic data. The dawn of the 21st century saw electronics becoming pervasive in almost every manufactured object in the world. There are now incredible advances in data collection, processing and in computation power. Intelligent systems can now be deployed in a variety of tasks and decision-making to enable better connectivity and enhance productivity. This article traces the development of AI; internationally its span of application and its evolution in India.

Evolution of AI:



What constitutes AI



Source: Stanford University

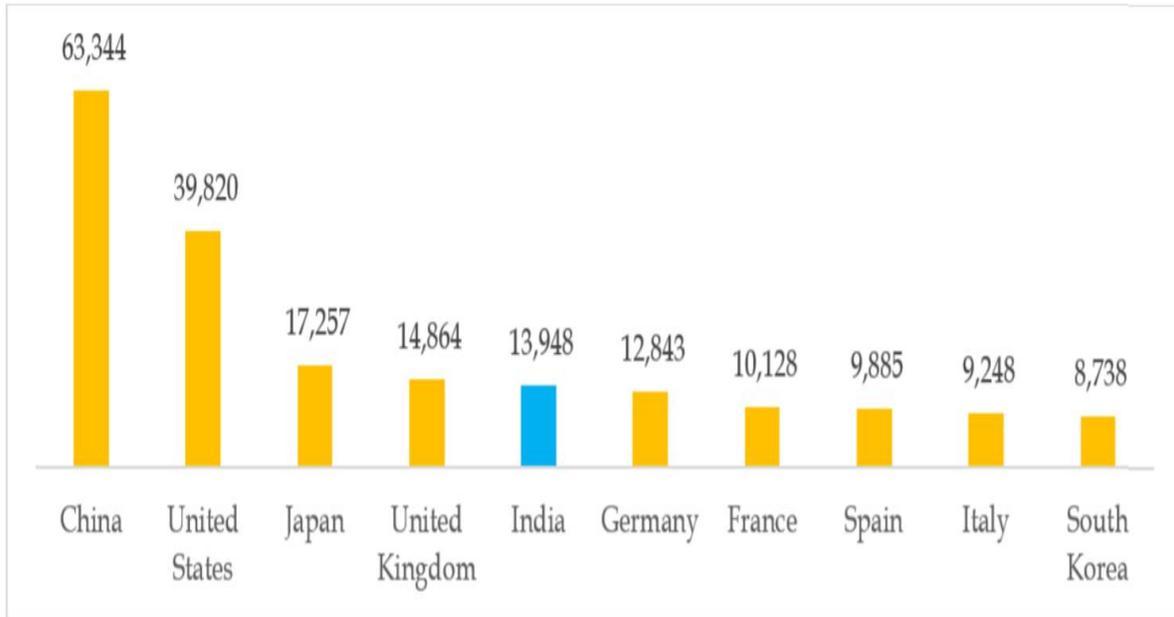
The field of AI has tremendously evolved since the introduction of sophisticated techniques and algorithms. Various AI-based algorithms were used for the purpose of clustering, regression, identification, classification detection, translation etc.

AI: International contributors

Before 1950's	1950's	1970's	2000's
<ul style="list-style-type: none"> • Alan Turing¹ • John von Neumann² • Norbert Wiener³ • Claude Shannon³ 	<ul style="list-style-type: none"> • John McCarthy⁴ • Marvin Minsky³ • Allen Newell⁵ • Herbert A. Simon⁵ 	<ul style="list-style-type: none"> • Edward Feigenbaum⁴ • Raj Reddy⁴ • Seymour Papert³ • Ray Solomonoff³ 	<ul style="list-style-type: none"> • Nick Bostrom⁶ • David Ferrucci⁷ • Andrew Ng⁴

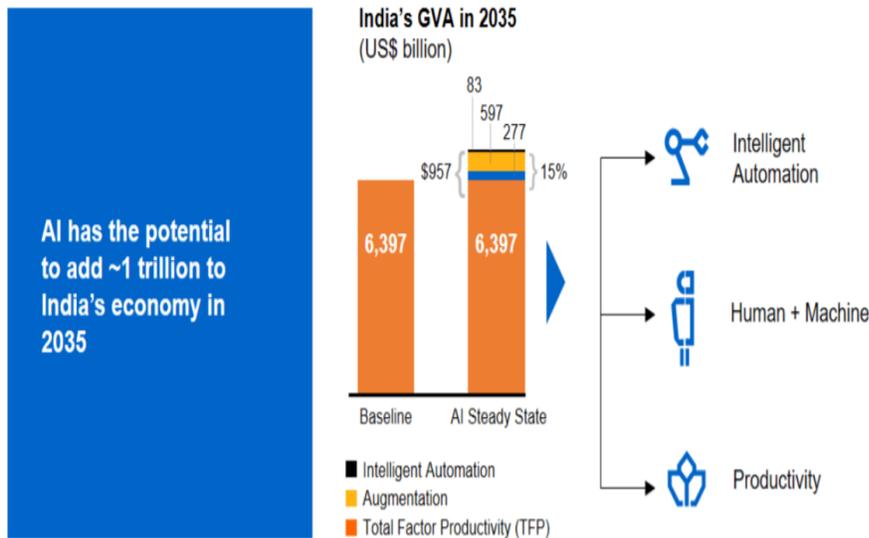
1. University of Manchester, 2. University of Berlin, 3. Massachusetts Institute of Technology, 4. Stanford University, 5. Carnegie Mellon University, Pittsburgh, 6. Oxford University, 7. International Business Machines Corporation (IBM), New York

India in AI related research and academics



Source: Scimago Journal & Country Rank (SJR)

AI has the potential to boost growth by unlocking innovations



Source: NITI Aayog & Accenture; GVA – Gross Value Added

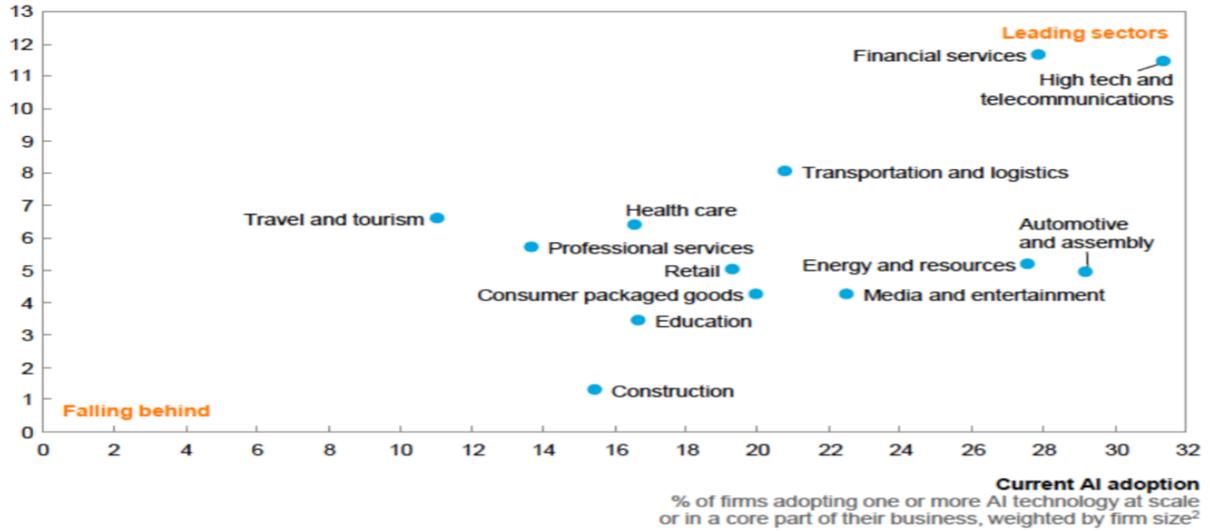
Accenture, in its recent AI research reports provides a framework for evaluating the economic impact of AI for select G20 countries and estimates AI to boost India's annual growth rate by 1.3 percentage points by 2035.

AI in India

AI adoption across sectors

Future AI demand trajectory¹

Average estimated % change in AI spending, next 3 years, weighted by firm size²

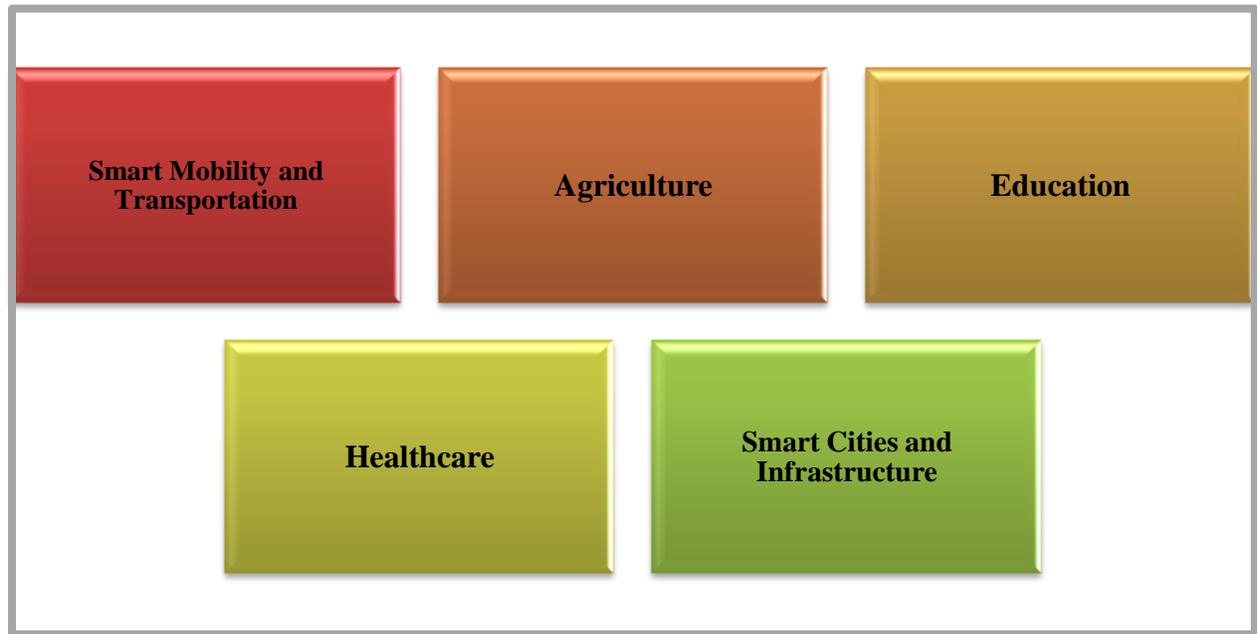


¹ Based on the midpoint of the range selected by the survey respondent.

² Results are weighted by firm size. See Appendix B for an explanation of the weighting methodology.

Source: NITI Aayog

Present Use cases of AI in India



India's AI research ecosystem and intelligence:

- ❖ India has 386 of a total of 22,000 PhD educated researchers worldwide and ranked 10th globally in research.
- ❖ India was ranked 13th globally, with 44 top-notch presenters at leading AI conferences globally.
- ❖ AI research concentrated mostly at institutes, like IITs, IIITs and IISc.

Framework for promoting Artificial Intelligence Research in India

Interdisciplinary Cyber Physical Systems (IM-ICPS) has suggested the following four-tier framework for promoting AI research:

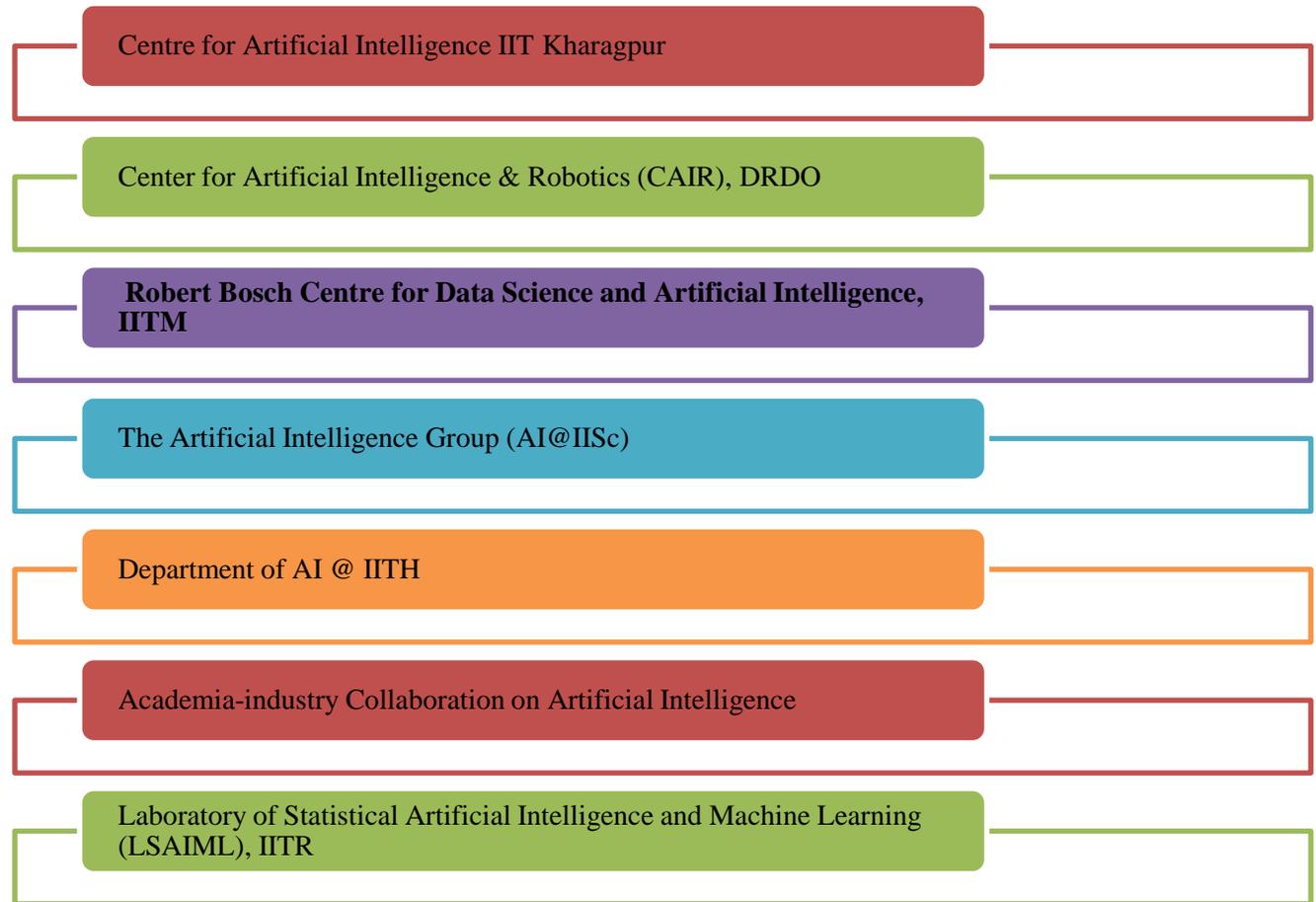
- a) ICON (International Centres of New Knowledge):
- b) CROSS (Centre for Research On Sub-Systems):
- c) CASTLE (Center for Advanced Studies, Translational research and Leadership): focusing on development and deployment of application based research
- d) CETIT (Centre of Excellence in Technology Innovation and Transfer)

AI Research in India

Two-tier integrated approach to boost both core and applied research in AI is proposed:

1. COREs (Centres of Research Excellence in Artificial Intelligence): COREs will focus on core research of AI, and will take on the mantle of executing the responsibilities of both ICON and CROSS as per the IM-ICPS framework.
2. ICTAI (International Centre for Transformational Artificial Intelligence): ICTAIs will provide the ecosystem for application based technology development and deployment, and will take on the mantle of executing the responsibilities of both CASTLE and CETIT as per the IM-ICPS framework

Academic Institutes and centres



AIRAWAT (AI research, analytics and knowledge assimilation platform)

Scope:

- AIRAWAT will be a cloud platform for Big Data Analytics and Assimilation, with a large, power-optimized AI Computing infrastructure using advanced AI processing.
- The proposed Infrastructure will be equipped with facilities for world's leading machine learning including deep learning, high performance high throughput supercomputing, infrastructure to store, process, simulate and analyze big data sets like images, video, text, sound, speech.
- AIRAWAT will support advancement of AI-based developments in image recognition, speech recognition, natural language processing for research, development and creation of varieties of new applications for the support of advancements in the fields of Agriculture & Healthcare.

AI in India: Opportunities

AI has the potential to drive growth through enabling:

- (a) Intelligent automation i.e. ability to automate complex physical world tasks that require adaptability and agility across industries,
- (b) Labor and capital augmentation: enabling humans to focus on parts of their role that add the most value, complementing human capabilities and improving capital efficiency
- (c) Innovation diffusion i.e. propelling innovations as it diffuses through the economy

Crucial factors determining the readiness of large scale AI adoption:

- Technical feasibility
- Availability of structured data
- Regulatory barriers
- Privacy considerations
- Ethical issues
- Preference for human relationship

Fostering AI among academia-industry can boost its research & application at national level. It will push technology frontiers through the creation of new knowledge and in developing applications.