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Artificial Intelligence in India: its growth, projects, and future

Dr. N. Subbu Krishna Sastry[1], Dr. V. Basil Hans[2*]

[1]MBA (HRM), MBA (MKT), MPhil, PhD, and PDF Assistant Professor at CMR University's School of Management. Bengaluru.

[2]Research professor at Srinivas University in Mangalore.

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Abstract: AI is becoming a powerful force in India that is changing industries, government, and everyday life. This article looks at how AI has changed in India over time, from early research projects to the use of cutting-edge technologies in all areas of life. It looks at important government and business sector projects, like NITI Aayog's National Strategy for AI, the creation of Centres of Excellence, and policy frameworks that focus on AI. The article also talks about India's expanding AI ecosystem, which includes businesses, university research, and partnerships with other countries. Finally, it talks about the future of AI in India, looking at chances in healthcare, farming, education, and smart governance, as well as problems with ethics, data protection, and skill development. The article ends by stressing the importance of a balanced and open-minded approach to using AI to promote fair and long-term progress in India.

Keywords: Artificial Intelligence (AI), India, AI Policy Initiatives, Technology Evolution, Future Prospects.

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Introduction

Artificial Intelligence (AI) has quickly become a global force for change, changing economies, businesses, and society. India is using AI's promise to boost innovation, productivity, and solve social and economic problems. This chapter looks at how AI is leading the way in changing India by looking at its effects on different sectors, the government's participation, and what the future holds.

AI is the ability of machines to think and learn like people do. It includes a lot of different technologies, such as robotics, machine learning, natural language processing, and computer vision. These technologies let machines do things that normally need human intellect, such spotting patterns, making choices, and figuring things out.

India has a large population and a wide range of social and economic conditions, which make it a unique place for AI to be used. AI is growing because the country has a tech-savvy workforce, a growing startup ecosystem, and government laws that encourage it. As AI gets better, it could change India's future by making living better, improving the economy, and solving important problems.

V. B. Hans (2024) wrote a book that talks about the different aspects of Artificial Intelligence (AI) in an age of rapid technological progress and how they affect India's economy and society. The chapters in this edited book talk about the pros and cons of AI and how to give stakeholders more authority. The book also talks about the problems that come with using AI.

How AI has changed in India

In the past

India has been doing AI research and development since the 1960s. At first, the concentration was on academic research and theoretical studies. The Indian Statistical Institute (ISI) and the Tata Institute of Fundamental Research (TIFR) were two of the first places to study AI. These organisations did groundbreaking work in fields including pattern recognition, data analysis, and statistical modelling.

AI research in India grew in the 1980s and 1990s when major institutions started offering computer science degrees. Researchers started looking into neural networks, expert systems, and machine learning techniques. Indian scientists made important contributions to the global AI community even though they didn't have a lot of money. They published important articles and came up with new ways to solve problems.

Professor H.N. Mahabala at IIT Madras worked on pattern recognition, and Professor P.V.S. Rao at TIFR worked on robotics and AI applications in industrial automation. These were two important people in early Indian AI research. Their groundbreaking work set the stage for the rise of AI research in India.

***Corresponding Author**

Dr. V. Basil Hans*

Email: vhans2011@gmail.com.

The Current Landscape

India is already a global centre for AI development, with big contributions from both the government and businesses. The country has a strong startup ecosystem, world-class research institutions, and strong government support, all of which help AI technology move forward quickly. Infosys, TCS, and Wipro are some of the companies that are leading the way in AI innovation. They are making solutions for a wide range of fields, such as healthcare, finance, and retail.

A number of Indian firms are also creating a name for themselves in the AI field. For example, AI-powered chatbots are changing the way firms like Haptik and Niki.ai do customer support, and SigTuple is using AI to help doctors make diagnoses. The presence of big tech companies like Google, Microsoft, and IBM in India makes the AI ecosystem even stronger by encouraging people to work together and share information.

The part that schools and research institutions play

Indian universities and colleges have been very important in moving AI research forward. The Indian Institutes of Technology (IITs), the Indian Institutes of Science Education and Research (IISERs), and the Indian Institute of Science (IISc) are all doing important research in AI and machine learning. These schools offer specialised AI courses and programs that train people to work with AI problems.

There has also been a rise in research projects that involve both academia and industry. For instance, the IITs often work with tech businesses on AI initiatives, which leads to new ideas and cutting-edge research. The Robert Bosch Centre for Data Science and AI at IIT Madras is one of many AI research centres that have opened in India. This shows how important AI research is becoming in the country.

Policies and Initiatives of the Government

The National AI Plan

The Indian government has seen the promise of AI and created the National AI Strategy to make India a world leader in AI innovation. NITI Aayog started this plan, which lists important areas of focus like research, talent development, and using AI in a moral way. The plan is to use AI to help address problems in society, enhance economic growth, and make government better.

The National AI Strategy has some important parts:

Research and Development: Funding, partnerships, and the creation of centres of excellence are all ways to encourage AI research.

Skilling and Reskilling: Building a culture of lifelong learning and creating AI talent through education and training initiatives.

Ethical AI is making sure that AI is used in a responsible and moral way by creating rules and frameworks for data privacy, security, and justice.

AI for Social Good: Using AI to help solve important social problems including healthcare, farming, and education.

The plan stresses the importance of working together with government, business, and academia to push AI forward. It also stresses how important it is for the people to be aware of and involved in AI adoption in order to create a good environment for it.

Digital India: AI for Everyone

The goal of the "Digital India" program is to use AI to close the digital gap and encourage growth that includes everyone. The government wants to use AI to improve service delivery, governance, and economic possibilities for all citizens. The project is centred on three main areas: digital infrastructure, digital services, and digital empowerment.

Digital India has started a number of AI-powered projects, such as:

Aadhaar is the world's largest biometric identification system. It employs AI to make sure that more than a billion Indians can quickly and safely prove their identity.

UMANG is a single mobile app for all government services. It uses AI to give users personalised and easy access to a wide range of services, such as healthcare, education, and money.

BharatNet is a big initiative that intends to connect all of India's villages to high-speed internet. It hopes to provide the groundwork for AI-powered apps in rural areas.

The Digital India program also includes building digital platforms for e-governance, teaching people how to use technology, and programs to encourage entrepreneurship and new ideas in the digital world.

AI in Important Areas

Health care

AI is changing healthcare in India by making it possible to diagnose diseases early, give patients personalised care, and deliver healthcare more quickly. AI-powered tools and apps are being used to look at medical data, guess when diseases will break out, and help with consultations from afar.

Early Diagnosis: AI systems look at medical imagery like X-rays and MRIs to find diseases early on. For instance, Qure.ai, a firm from India, has built AI-powered tools that can accurately diagnose diseases like tuberculosis and breast cancer.

AI algorithms look at patient data and suggest personalised treatment plans. AI helps clinicians give each patient the right care by taking into account things like their genetics, lifestyle, and medical history.

Remote Consultations: AI-powered telemedicine solutions let people in rural and remote places get healthcare without having to go see a doctor in person. AI is being used by companies like Practo and mfine to connect patients with doctors and keep an eye on their health in real time.

Case Study: AI in COVID-19 Management AI was very important in managing the COVID-19 outbreak. The Indian government produced the Aarogya Setu app, which uses AI to keep track of and control the spread of the virus. The app's AI algorithms looked at user data to give users real-time information on places where infections were most likely to happen and where they might be at danger of getting sick. The program made contact tracking, risk assessment, and public health communication easier by using AI. This helped India a lot in their reaction to COVID-19.

AI in Farming

AI tools are very important for increasing agricultural yields, making better use of resources, and managing the supply chain better in agriculture. New technologies like precision farming, predictive analytics, and automated machinery are changing the way farmers do things, which is good for millions of farmers in India.

1. Precision Farming: Sensors and drones powered by AI are changing the way we gather and analyse information on soil health, weather, and crop development. These tools collect a lot of data, which AI systems then interpret to give farmers useful information. For example, farmers get advice on the best times to plant, the best times to water their crops, and the best ways to get rid of pests. This accurate and timely information helps farmers get the most out of their crops while using the least amount of resources.

2. Predictive Analytics: AI algorithms can anticipate crop yields and market demand with amazing precision. These algorithms help farmers decide what crops to sow, when to plant them, and when to harvest by looking at past data and current patterns. CropIn and other companies like it are leading the way in this new technology, which gives farmers real-time information about the health and yield of their crops. With this information, farmers may improve how they take care of their crops, which will lead to higher yields and profits.

3. Automated Machinery: The rise of AI-driven machines, including automated tractors and harvesters, has made farming much more efficient and cut down on the cost of labour. These machines can find their way around fields and do jobs with great accuracy on their own thanks to computer vision and machine learning. AI-powered machines make farming more efficient, which cuts down on waste and boosts productivity. They do everything from sowing seeds to harvesting crops.

AI in Agriculture: A Case Study

The National Agriculture Market (e-NAM): The e-NAM platform shows how AI may be used in farming to help farmers find better prices and get into markets. The platform uses AI-driven data to assist farmers make smart choices about when to sell their crops, which increases their income and market reach. e-NAM connects farmers with buyers all throughout the country by creating a single online marketplace. This cuts down on the need for middlemen and makes things more open. This direct link helps farmers get better prices and makes sure that agricultural products are distributed more fairly.

Pradhan Mantri Fasal Bima Yojana (PMFBY): AI-powered tools like the PMFBY use satellite images and weather data to quickly and accurately assess crop damage and handle insurance claims. The plan can swiftly find locations that are hit by bad weather and figure out how much harm has been done to crops by using AI to look at satellite imagery and weather patterns. This quick assessment lets insurance companies pay farmers quickly and accurately, which helps them get back on their feet and stay financially stable.

Using AI in farming is more than simply a new technology; it's a whole new way of doing things. Indian agriculture is heading towards a future where farming is smarter, more efficient, and more sustainable by using AI. The ongoing growth and use of AI technology will continue to change farming, making sure that millions of farmers in India have enough food and money.

Artificial Intelligence in School

Artificial Intelligence (AI) is changing the way education works and how people learn in a big way. The use of AI technology is changing the education system in India in a big way. Students in remote and underprivileged areas can now get better access to excellent education, and administrative duties can be done automatically. AI-powered systems are making the learning environment more interesting and effective by offering personalised learning routes, adaptive assessments, and feedback in real time.

1. Learning that is tailored to you

AI algorithms look at data on how well students are doing in school to make personalised learning programs that fit each student's requirements and ability. This method makes sure that every student gets lessons that fit their learning style and speed, which makes them more interested and improves their results.

Adaptive Learning Platforms: Byju's and Vedantu are two of the most important platforms in this new field. Byju's uses AI to keep track of how well students are doing and change classes based on that. The platform makes content more personal by showing issues in a way that works for each student's learning style. For instance, a student who has trouble with visual information would get more text-based explanations, while a student who is good at interactive assignments might get more interactive modules.

Real-Time Feedback: AI-powered systems give real-time feedback on how well students are doing, which lets teachers step in and help right away. This feedback helps students figure out what they're good at and what they need to work on, which encourages them to keep learning and grow.

Customised Tests: AI may make tests that are unique to each student and meet their specific demands. These tests change their level of difficulty dependent on how well the student is doing. This keeps them from being too easy or too hard, which keeps the learner motivated and confident.

2. Administration that runs on its own

AI technologies are changing the way schools do administrative work by automating procedures that are boring and take a lot of time. This automation lets teachers spend more time on teaching and interacting with students instead of doing administrative tasks.

Grading and Assessment: AI-powered programs can grade tests and assignments with a lot of precision and consistency. For instance, AI systems can look at grammar, coherence, and content quality to grade written essays and give students detailed feedback. This not only makes grading go faster, but it also makes sure that the grades are fair.

Tracking Attendance: AI systems can use facial recognition technology to keep track of who is present automatically. This cuts down on the amount of work that needs to be done by hand and makes sure that records are kept correctly. AI can also keep an eye on how many students are participating in online classes, which might give you an idea of how engaged they are.

Scheduling and Resource Management: AI can make class schedules better, distribute resources better, and keep track of schedules better. AI systems can make schedules that make the best use of resources and minimise conflicts by looking at past data and current needs.

3. Education that is easy to get to

AI-powered educational apps and platforms are helping students in rural and underprivileged places get a good education, closing the gap between those who have and those who don't.

Digital Learning Resources: The Indian government's DIKSHA platform employs AI to provide digital learning resources in a variety of languages to meet the needs of students across the country who speak different languages. This platform has interactive content, practice tests, and quizzes that make studying more fun and useful.

Remote Learning: AI-powered systems make remote learning easier by giving people access to high-quality educational content no matter where they are. Students in rural locations can use the same resources as those in cities, making sure that everyone has the same chances to learn.

Special Education: AI technologies are also being utilised to help kids with special needs. AI-powered apps, for instance, can help students with learning difficulties by giving them personalised learning tools and resources. Speech recognition and text-to-speech technology make it easier for pupils who have trouble hearing or seeing to get to educational content.

AI in EdTech: A Case Study

Byju's: Changing the Way People Learn Individually

Byju's is one of India's top edtech companies, and it uses AI to provide personalised learning experiences. The app's AI algorithms change based on how each student learns and how fast they learn, giving them personalised information and tests to keep them interested and improve their results. Byju's has changed the way students study, making high-quality education available to millions of people in India and around the world. The platform's success shows how AI could change education and help people who are having trouble learning.

AI-Driven Content Personalisation: Byju's AI engine keeps track of how students use the app to learn and figures out how they learn best. The platform changes how it delivers content to fit the needs of each learner based on this data. For example, if a learner is having trouble with a certain idea, the AI system gives them more resources and practice problems to help them understand it better.

Byju's uses AI-powered animations and interactive simulations to make lessons more fun and interesting. These things help pupils picture complicated ideas and remember what they've learnt. The website also uses gamification methods like quizzes and challenges to keep students interested and motivated.

Comprehensive Learning Analytics: Byju's gives students and parents detailed learning analytics that show how well they are doing, what their strengths are, and what they need to work on. These analytics let students keep track of how well they are doing and set realistic learning goals. Parents can also keep an eye on their child's learning and help out when they need it.

Vedantu: Making Live Online Learning Better

Vedantu, another well-known Indian edtech business, uses AI to make live online learning better. The platform has live, interactive sessions taught by qualified experts. AI-driven features make learning more personal and keep students interested.

Interactive Sessions with AI: Vedantu's AI algorithms look at how students interact during live lessons and give professors real-time feedback and ideas. This allows teachers adapt their teaching to meet the needs of each student, which guarantees that everyone learns well.

Personalised Learning routes: Vedantu uses AI to build personalised learning routes for each student depending on how well they do on tests and how much they participate in class activities. The website suggests certain subjects and practice problems to help students better understand the material and raise their marks.

Adaptive Assessments: Vedantu's AI-powered testing system changes the complexity of questions based on how well the learner does. This makes sure that tests are hard enough to enable pupils gain confidence and become experts in different subjects.

What the Future Holds for AI-Driven Education

AI has a lot of room to grow and develop in the future of education. As AI technologies get better, they will make learning increasingly more personalised, effective, and easy to get to.

Advanced Personalisation: In the future, AI systems will be able to offer even more advanced personalisation by taking into consideration a wider range of elements, such as mood, cognitive ability, and learning styles. This will give each learner a learning experience that is truly unique to them.

lifetime Learning: AI will help people learn new things and improve their skills all the time, which is a big part of lifetime learning. AI-powered platforms will give professionals who want to learn new skills or improve their current ones personalised learning paths. This will help them stay competitive in the job market.

Global Collaboration: AI can help teachers, students, and researchers work together throughout the world, making it possible for them to share information and resources across boundaries. This will help make the global education community more connected and open to everyone.

By putting these pictures together, the chapter can show how AI is changing education in a way that makes it easier for readers to understand how technology is changing how people learn in India.

Money

The financial sector in India is using AI to make decisions, improve the consumer experience, and find fraud. AI systems look at huge volumes of financial data to give information, guess what will happen in the market, and make trading easier.

Customer Experience: AI-powered chatbots and virtual assistants can help customers 24 hours a day, seven days a week by answering questions and processing transactions quickly. HDFC and ICICI banks have put AI chatbots to work helping clients with banking services.

Fraud Detection: AI algorithms look at transaction data to find trends that aren't normal and spot fraudulent behaviour. This helps banks and other financial institutions keep fraud from happening and keep their customers' money safe.

Decision Making: AI systems look at market data to give investing advice and insights. AI is used by platforms like Zerodha and Upstox to give users personalised financial advice and trading tactics.

AI in Banking: The State Bank of India (SBI) is the largest public sector bank in the country. It has used AI to make its operations

and customer service better. SBI's AI-powered chatbot, YONO (You Only Need One), helps users with banking tasks, managing their accounts, and getting personalised financial advice. SBI has used AI to make the customer experience better, speed up processes, and make operations more efficient.

Getting around

AI is making transportation better in many ways, such as by making traffic flow more smoothly and by making cars that drive themselves. AI-powered solutions are making transportation more efficient and sustainable by optimising routes, cutting down on traffic, and making it safer.

Smart Traffic Management: AI algorithms look at traffic data to make signal timings better, cut down on traffic jams, and make traffic go more smoothly. To help with traffic challenges in cities like Bengaluru and Delhi, they are putting in place AI-based traffic management technologies.

Self-Driving Cars: AI is being utilised to make self-driving cars that can drive and find their way without any help from anyone. Companies like Tata Elxsi and Mahindra are putting money into research and development for self-driving cars.

AI-powered technologies keep an eye on how drivers act and how well their cars work to make them safer. For instance, AI algorithms can find signals that a driver is tired and send notifications to stop accidents from happening.

Case Study: AI in Transportation Bengaluru Traffic Police has put in place an AI-based traffic management system to deal with the city's well-known traffic jams. The technology employs AI to look at real-time traffic data from cameras and sensors and adjust signal timings and traffic flow to make things better. The city has used AI to make the roads safer, cut down on traffic jams, and make the whole transit experience better for its citizens.

What it means for ethics and society

Privacy and safety of data

Concerned about data privacy and security when AI is used widely. To acquire the public's trust and avoid possible exploitation, it is important that AI systems handle data in a responsible and open way.

Data Privacy: AI systems often need to see a lot of personal information in order to work well. It is important to keep this information safe from people who shouldn't have it and who might use it wrong. The Indian government is working on the Personal Data Protection Bill to set rules for how to keep data safe and private.

Data Security: It's very important to keep the data utilised by AI systems safe so that hackers can't get in and steal it. Strong encryption, access controls, and monitoring systems can help keep private information safe.

Job Loss and Changes in the Workforce

AI opens up new possibilities, but it also brings up problems with employment loss. Reskilling and upskilling programs are important for getting the workforce ready for AI-driven developments so that they don't have as big of an effect on jobs.

Job Loss: AI and automation can take over some jobs and functions, especially in fields like manufacturing, customer service, and transportation. It's quite important to come up with plans to help workers who are affected by these developments.

Transforming the Workforce: Putting money into programs that teach workers new skills will help them move into new jobs that AI creates. Skill India and Pradhan Mantri Kaushal Vikas Yojana (PMKVY) are two programs that help Indian workers get vocational training and improve their skills.

Fairness and Bias

It is important to make sure that AI systems are fair and free of bias. Fixing algorithmic prejudice and encouraging diversity in AI development teams are important steps towards making AI solutions that work for everyone.

Algorithmic Bias: AI systems might unintentionally keep biases that are already in the training data, which can lead to unjust results. One way to help with this problem is to make sure that data sets are broad and representative and to regularly check AI systems.

Diversity in AI Development: Encouraging diversity in the teams that build AI can result in AI solutions that are more fair and open to everyone. It is important to get people from under-represented groups to participate and make the workplace more welcoming.

Studies of Cases

The Aarogya Setu App: AI in Healthcare

The Indian government produced the Aarogya Setu app, which employs AI to keep an eye on and control the spread of COVID-19. The app's AI algorithms look at user data to provide you live updates on places where infections are likely to happen and where you could be at danger of getting sick. The app has been very important in India's reaction to COVID-19 since it uses AI to help with contact tracking, risk assessment, and public health communication.

The e-NAM Platform for AI in Agriculture

The National Agriculture Market (e-NAM) platform uses AI to help farmers find better prices and get into the market more easily. AI-powered analytics assist farmers decide when to sell their crops, which increases their income and market reach. e-NAM connects farmers with customers all throughout the country through a single online marketplace. This cuts down on middlemen and makes things more clear. Also, AI-powered tools like the Pradhan Mantri Fasal Bima Yojana (PMFBY) use satellite images and weather data to quickly assess crop damage and handle insurance claims.

Byju's Learning App: AI in Education

Byju's is a top edtech startup that uses AI to give students personalised learning experiences. The app's AI algorithms change based on how and at what speed each student learns, giving them personalised information and tests to keep them interested and improve their results. Byju's has changed the way students study, making high-quality education available to millions of people in India and around the world. The platform's success shows how AI could change education and help people learn better.

What Lies Ahead

AI Research and New Ideas

India's concentration on AI research and new ideas will help the field grow in the future. Working together, academia, business, and government will help create new AI technology and solutions.

Collaborations in research: Partnerships between Indian universities and research organisations throughout the world can speed up the development of AI. Advanced AI technologies will grow thanks to joint research projects, conferences, and sharing of information.

Innovation Ecosystem: Building innovation hubs and incubators will help AI entrepreneurs and startups. Startups can grow their solutions and bring new AI products to market by getting money, advice, and infrastructure.

AI for a Better World

AI could help solve some of India's most important societal problems, such poverty, access to healthcare, and protecting the environment. Using AI for good can help make society more fair and open to everyone.

Reducing poverty: AI-powered solutions can make it easier for people in underserved communities to go to schools, hospitals, and banks. AI can help lift up marginalised groups and lower poverty by offering personalised remedies.

AI-powered telemedicine solutions can help people in remote places get the treatment they need. AI can help people who don't have access to healthcare get better care by allowing remote consultations and diagnoses.

Environmental Sustainability: AI can help protect the environment by making better use of resources, keeping an eye on ecosystems, and anticipating how the weather will change. AI-powered solutions can help lessen the effects of climate change and encourage environmentally friendly behaviours.

Leading the World in AI

India is becoming more important in the global AI scene, which might make it a leader in AI innovation. To keep this momentum going and become a worldwide leader, it will be important to keep investing in AI talent, infrastructure, and research.

Talent Development: By offering education and training programs, we can build a robust pipeline of AI talent that will make sure we have a skilled workforce. Key approaches include encouraging institutions to do more research and development in AI and boosting STEM education at all levels.

Investing in infrastructure: Building strong digital infrastructure, such as high-speed internet, data centres, and cloud computing capabilities, can help AI make new things. The National Digital Communications Policy and BharatNet are two government programs that aim to improve India's digital infrastructure.

Working with other countries: India will be stronger in the global AI community if it works with other countries and forms partnerships. India's power and leadership will grow if it takes part in global AI forums, helps set international standards, and works on AI initiatives that cross borders.

Conclusion

Artificial Intelligence is leading the way in changing India by creating new chances for growth and innovation. India is ready to solve important problems, boost productivity, and give its people a better future by using AI in many different areas. The path to an AI-driven India has barely begun, but there are good things to come.

As India continues to adopt AI, it is important to find a balance between new ideas and moral concerns to make sure that AI technologies are created and used in a responsible way. India can use AI to reach its goal of a fair and successful society by encouraging people to work together, investing in talent, and supporting prosperity that includes everyone.

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