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Limitations of AI Skilling Programs in India: A Critical Analysis

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Abstract:-

At a time when Artificial Intelligence (AI) is the maven of the contemporary technological boom, the need of AI skilling in India has become crucial for economic sustenance as well as to keep abreast of the global competition, if not to establish a competitive edge. In this article, it is explained in detail how AI is a golden avenue in skilling India for the future, which makes it a central question at present. The cruciality of AI skilling in India by engaging with its unique AI challenges and implications is highlighted through the prism of the present state of AI training. The AI training programs have become a necessity for a country to get prepared for the technological paradigm shift that the AI revolution has brought with itself. The article discusses initiatives taken up by government and private sector to contribute for the AI skilling. Among all the various initiatives taken up by different organisations, NIELIT has successfully embarked in not only developing but implementing AI certification programs at ground level in India. However in spite of all the collaborative efforts there is still a huge gap that can be seen in the AI skilling patterns in India. The article has also shed light on the challenges, implications and potential solutions to increase the reach and bandwidth of the AI skilling initiatives in India.

Keywords: AI skilling, NIELIT, Government Programs, IndiaAI

I. Introduction

Through initiatives like Digital India and platforms like INDIAai, India has started a mission to use AI technology's potential. However, within these actions certain limits and challenges have appeared needing deep checks to ensure the success and fairness of AI education programs. Realizing the importance of upskilling in India in AI, is crucial in preparing a workforce able to handle the complexity of future technology environments.

The present article reviews the different aspects of AI skilling programs in India. The article explores the different initiatives started by govt. of India and various private sectors to boost up the AI skill training in India. Notable among these programs are the programs run by NIELIT which covers up a range of technical and theoretical aspects of AI. It evaluates training programs from the government and the private sector. It also notes main patterns and issues in these programs. This evaluation contrasts India's preparedness and application of AI with that of both developed and developing nations. It shows unique AI challenges India faces. By studying the current state of AI education, the discussion opens up possible ways to better training efforts. This could improve India's skill to change and create new things in AI technology.

Government Skilling Programs for AI in India

The Government of India has launched many efforts to teach AI skills to its people. The aim is to make the nation a lead in the digital market. Two of the key effort in the given direction are mainly National AI Portal known as INDIAai, and NIELIT. The former portal is made with the help of the Ministry of Electronics and Information Technology (MeitY) the National e-Governance Division (NeGD) and NASSCOM while the latter develops and conducts certification courses in AI [1]. It serves as a main hub for all AI work in India and offers plenty of resources.

- Research papers
- Data collections

- Case analyses
- Learning resources

1. India AI Mission

The India AI mission is a state project to promote understanding of artificial intelligence (AI) and encourage a favorable setting for AI creativity and building in India. It includes several tasks and plans set to advance the employment and incorporation of AI in various fields. Here are extra details on the India AI mission:

· **Objectives**:

-Increasing AI Knowledge: The mission aims to increase knowledge and awareness of AI technologies among the average person, students, and workers.

- Innovation and Development: It aims to create a setting that promotes the growth of AI-based solutions and technologies to solve problems in society and industries.

- Research and Collaboration: The mission promotes research and working together in AI to lead to advancements and major discoveries.

· **Initiatives**:

- Skill Development Programs: The mission includes activities to train and increase the skills of people in AI giving them the needed knowledge and skills.

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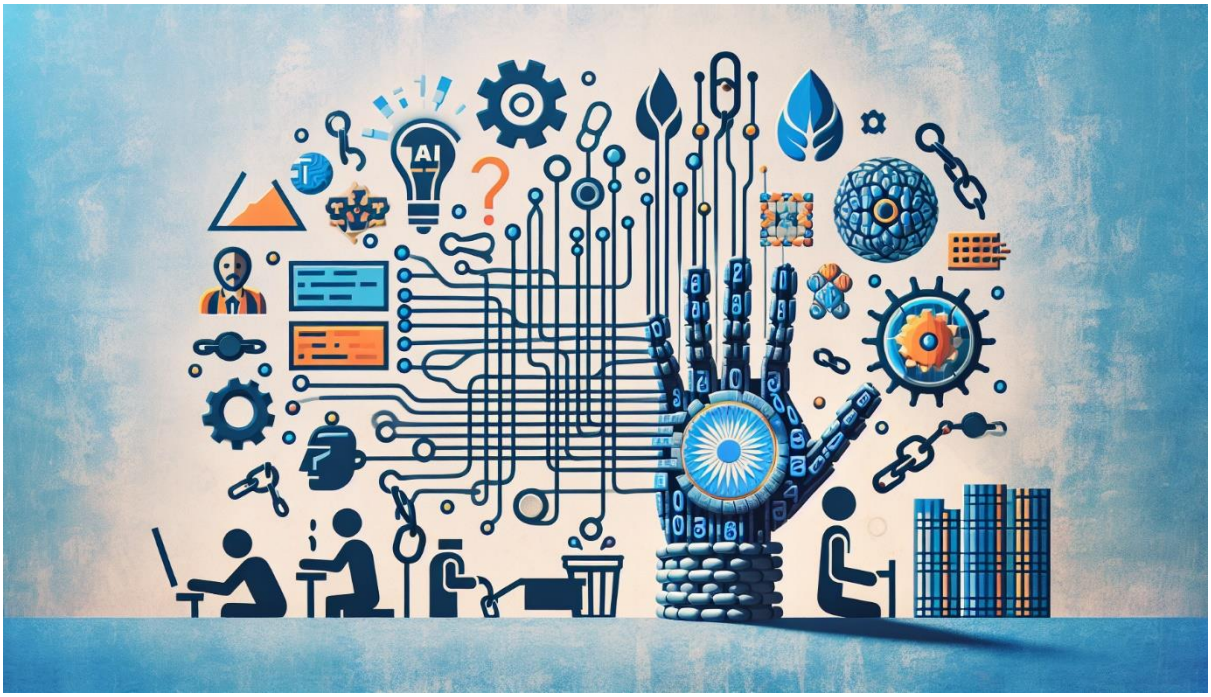


Incubation and Funding: It backs AI startups and business creators with incubation processes and money chances to help develop new AI projects.

- Policy Framework: The mission focuses on building a strong policy setup for managing AI and its moral usage.

· **INDIAai Portal**:

- The INDIAai portal acts as a main hub to access details, resources, and news about AI efforts, events, and rules in India.

Figure 1:Objectives, Initiatives and impact of India AI mission

-It offers a way for involved people to connect, work together, and help the development of the AI network in the nation.

· **Impact**:

- The goal is to make India a top world figure in AI invention and usage adding to economic growth and improvement in society.

- By creating a helpful setting for AI, the goal aims to bring digital change and tech progress in different areas.

The India AI mission is a focused attempt to use the power of AI to improve India's economy, society, and tech environment. Fig. 1 below gives a brief overview of the India AI mission as reviewed in earlier sections.

2. National Institute of Electronics & Information Technology (NIELIT)

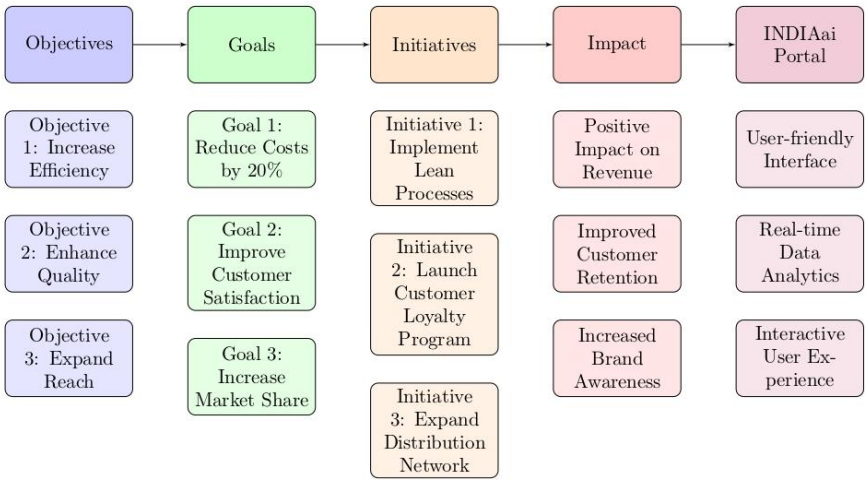
The National Institute of Electronics & Information Technology (NIELIT) has a major role in AI training throughout India with its multiple centers providing complete courses and top facilities.

Role of National Institute of Electronics & Information Technology (NIELIT) in AI Training in India

Complete Course Offerings:

NIELIT provides several AI courses at its locations, including Python to analyze data, machine learning deep learning, and a certified AI associate program. Centers in Calicut and Kolkata also offer courses in AI machine handling, and deep learning.

Collaborations and Certification Programs:



NIELIT has initiated collaboration and certification programs to be offered with IIT Ropar. These programs will not only help in building an AI based culture in academic institutes but will also serve as a platform for future AI courses to be build up as per industrial demands.

Advanced Facilities:

NIELIT centers like NIELIT Chandigarh is providing advanced labs and research centers to inculcate real and practical learnings of AI. The labs will help in demonstrating the implementation aspect of AI. These labs deals with areas like IoT, Cyber Forensics and more.

Focus on Digital Literacy and Skill Development:

NIELIT focuses on digital literacy and skill development making sure people are ready for the changing digital world. They provide courses through the PMKVY scheme and other government plans to improve digital skills.

Inclusivity and Accessibility:

NIELIT makes sure their courses reach many people, including those from poorer parts of society. For example, they have free training courses for SC/ST candidates and other disadvantaged groups.

Online and Virtual Training:

NIELIT has adapted to modern learning places. It offers training in virtual classrooms on platforms like Moodle. This training has sessions where you can interact online discussions, and thorough methods to evaluate to make sure learning is successful.

NIELIT is vital in training to implement AI in India by offering a combination of textbook education and real skills. This stems from their range of courses, collaboration with leading schools, and excellent training facilities. Their focus on involving everyone and educating digital skills demonstrates their commitment to producing a skilled and knowledgeable workforce in India.

3. Digital India Initiative

The Digital India Initiative started in July 2015. It is a major government project to make India a society and economy with a lot of digital skills and knowledge. This project uses digital tech in different parts of public services to make governance better and offer services when they are needed. It stresses how key digital skills are and tries to give everyone digital services. The project also backs the creation of AI tools to better governance and how services in healthcare, education, and smart mobility are given.

National AI Portal

The National AI Portal has a key role in focusing AI work in India. It shares information and helps AI workers and fans work together. Through the portal, the government started the IndiaAI Mission to make AI open and boost AI growth in the nation. The mission focuses on better computing access better data quality making local AI skills, and keeping AI uses fair to help everyone grow.

These government plans work to close the skill gap and make Indian youth more employable by teaching useful skills over book knowledge. By using AI, these efforts also plan to solve big social issues and make life better for India's rural people.

4. Private Sector Initiatives

Corporate Training Programs

In the area of AI training private companies in India are making big steps. A key project is Microsoft's ADVANTA(I)GE INDIA initiative, which has the goal to train 2 million people in AI by 2025. This program is part of Microsoft's larger Skills for Jobs program and involves working with India's Ministry of Skill Development and Entrepreneurship and ten state governments. The aim is to give basic and advanced AI training to 500,000 students and job seekers at 100 rural vocational education places and training centers. Also, Microsoft aims to provide thorough AI technical skill training to 100,000 young women using 5,000 trainers at colleges in Tier 2 and Tier 3 cities[3].

The American firm Goldman Sachs is helping with AI education in India. They created a center to look at how generative AI can be used. They intend to train over one thousand people who do not work in engineering in 2024 across their offices in Bengaluru and Hyderabad. These attendees are from various areas like operations, treasury, sales, and investment banking. This shows how useful AI skills are in many sectors.

Microsoft's ADVANTA(I)GE INDIA Initiative

Goal: Give AI skills to 2 million individuals by 2025

Emphasis: Provide training in Tier 2 and Tier 3 cities and rural places

Partners: Government bodies, nonprofits, companies, and communities

II. Collaboration with Educational Institutions

Working Together with Schools

The partnership between schools and the AI mission in India is growing because there is a need to improve research, innovation, and learning in artificial intelligence (AI) and machine learning (ML). This review looks at the current situation of these partnerships and centers on the roles of AI and data science centers, relationships between industries and universities, and global partnerships.

1. NIELIT Collaborations with UNESCO

To develop AI , NIELIT has partnered with UNESCO. This partnership focuses on:

- Initiatives to build capacity and train: Making sure that policy, regulation, and ethics are considered in AI.
- Creating and sharing knowledge: Working together on research about AI ethics and its effect on society, adding to the UNESCO Global Observatory on the Ethics of Artificial Intelligence.

2. NIELIT Cybersecurity Programs

NIELIT, in collaboration with Microsoft, runs the CyberShikshaa and Ready4Cybersecurity programs aimed at skilling underserved youth and women in cybersecurity. These programs are focused on cybersecurity for women engineering students. Various other programs are also conducted in this scheme for rural colleges as well.

3. AI and Data Science Centers in Indian Institutions

AI and data science centers in India are typically housed within single institutions, unlike their multi-institutional counterparts in more mature ecosystems. These centers focus on research, teaching, and consulting, and are funded by a mix of alumni, philanthropic contributions, industry, and government[4].

Industry-University Partnership: Industry-university partnership in India is less developed than in advanced countries and often focuses on top institutions. Effective models, like the partnership between Intel Technology India Ltd and PES University, show the possibility for technology, innovation, and entrepreneurship to help both sides.

Government Efforts and Policies: The Indian government has been active in encouraging partnerships with universities abroad to improve education quality and bring in foreign direct investment. This has caused more public attention and efforts from institutions to create these partnerships.

III. Challenges and Opportunities in Partnership

Even with excitement for partnerships, problems like old curricula little focus on research, and the demand to train for specific jobs remain. The recent education rule in India seeks to fix these problems by creating important partnerships with schools worldwide4**.**

Digital Learning and Content Generation:

Indian schools work together to make digital learning spaces. This is shown by the National Mission in Education through Information Communication Technology (NME-ICT) project. The project shows that working together is important to make content and teach .

Partnership Projects in AI Training Programs

The partnership between schools and companies is creating a strong AI environment in India. IIT Madras and Taylor & Francis Group have partnered to enhance research in AI and data science through the Robert Bosch Centre for Data Science and Artificial Intelligence (RBCDSAI). In the same way, the Indian Institute of Science (IISc) with Kotak Mahindra Bank has set up the Kotak-IISc AI-ML Centre aiming to provide complete courses in AI and related areas.

Further enhancing this partnership, IIT Roorkee has teamed up with the USA's Mehta Family Foundation to create the Mehta Family School of Data Science and Artificial Intelligence, which provides degrees at different levels to develop skilled workers in AI and data science. Also, Teerthanker Mahaveer University has entered into a Memorandum of Understanding with NVIDIA to create a Centre of Excellence for AI Research aiming to make AI and machine learning more accessible to young learners and developers in India.

These actions highlight the crucial part the private sector plays in progressing AI technology and training in India. They show a strong promise to improve the country's AI preparedness and use in different areas. Figure 2 shows the connection to analyze the various skill programs in India along with the efforts by the private sector and educational institutes in India, some of which is listed as follows[5,6]:

· **AI for All (CBSE and Intel Partnership)**

- **Description:** A no-cost online, self-paced course to introduce the main ideas of Artificial Intelligence to the Indian public.

- **Partnership:** Central Board for Secondary Education (CBSE) and Intel

Goals: Reach over 3 million students available in 11 languages, can be accessed using standard Braille file formats, focuses on "preparing everyone for an AI-driven economy".

· **GUVI's AI for India 2.0 Programme**

Description: This is a free online course created by Skill India and GUVI approved by the National Council for Vocational Education and Training (NVET) and IIT Madras.

Features: Offers personalized study options, provides classes in various regional languages.

Infosys AI Certification Courses

Description: Free AI certification training available on the Infosys Springboard virtual learning platform.

Features: Provides beginner classes on AI generative AI deep learning, and natural language processing. It also offers master classes on AI and the influence of generative AI.

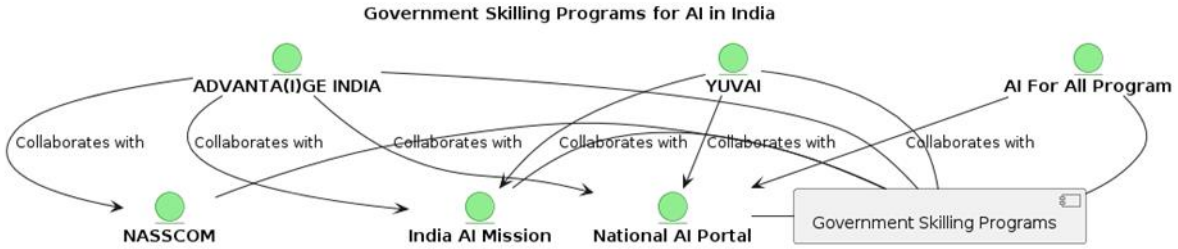


Figure 2:Pattern of AI skilling programs in India

IV. Key Patterns in Skilling Programs

In India's AI skilling programs, two main patterns stand out in the areas of focus and training methods used in various initiatives.

Focus Areas

AI skilling programs aim to close the talent gap and improve skills related to the changing job market. As AI reshapes the workforce, the focus is on new job roles and AI skills as well as using AI in work environments. This involves a major effort to include skill development in education systems to fulfil the large need for trained professionals in India.

Training programs are now designed to develop critical thinking and creativity, skills needed to succeed in today's fast-changing work environment. By helping students see different views and find new answers, these programs prepare a workforce ready to meet the demands of today's world[7].

Training Methodologies

A main method in AI skilling programs is personalized learning. This approach lets students learn at their speed focusing on areas they find difficult while also going deeper into their interests and abilities. Intelligent Tutoring Systems (ITS) are very important here using AI to look at student data, spot weaknesses, and give tailored advice and suggestions to get better. These systems change their teaching methods by watching performance improving how much students learn.

, AI's role in educational assessments is causing a revolution in the way we gauge student understandings. Adaptive assessments that AI algorithms drive provide a learning experience tailored to each student by identifying areas to improve allowing educators to collect exact data on how students are doing. This method helps not in measuring students' abilities but also allows them to keep track of their academic path, which builds their achievement feeling and a forward-thinking attitude toward their studies. Some key points in implementing self-paced AI-equipped programs include:

· **Enhanced Learning through Personalization:**

- Personalized e-learning systems deliver learning materials and evaluations that match the student's understanding level and learning preferences.

AI-driven personalized learning environments change teaching methods and education materials to meet the specific needs and abilities of each student.

AI Techniques and Tools:

AI and machine learning methods gather student traits through analysis of past events and extensive data, suggest fitting content, and recommend long-term study plans.

New AI techniques like knowledge representation tools and optimization methods help learners change their study sequences and get private help from digital learning friends.

Benefits of AI in Personalized Learning:

AI improves the importance of learning by focusing on students' needs, promoting creativity, and supporting innovative collaboration among students with shared interests[8].

AI tutors and developmental learning networks track learner status and preferences recommending suitable learning contents to aid in achieving high academic success.

These trends in skill-building programs emphasize personalized educational experiences and new assessment methods showing a progressive plan for education in India that uses AI to ready a workforce for the future.

V. Limitations and Challenges

The difficulties in AI training programs in India come from money problems. The big money needed to buy better technology and infrastructure is a big barrier. Some of the main points to think about here are:

1. Funding Limitations

- **Money Needed**: To change a manufacturing site to use robots involves spending a lot of money to add Industrial Internet of Things (IIoT) and other Industry 4.0 parts.

- **Technology Improvements**: Putting in AI and cloud technologies, important for making AI work better because they use a lot of data, runs into problems due to the lack of special computing and storing places in India.

Hindrance to Progress: Despite the potential, these financial barriers block the progress of adopting AI in different sectors.

These funding issues are a large challenge for the progress of AI skilling programs in India. Solving these challenges is key to implement and adopt AI technologies in the country.

Some possible solutions to improve the financial condition in these areas are as follows[9,10]:

Innovative Financing Mechanisms: Various innovative financing mechanisms like outcome-based bonds, Social Impact Bonds (SIB), Development Impact Bonds (DIB), and fund of funds are seen as good options to fund skilling programs in India.

These methods can bridge the funding gap and ensure sustainable finance to develop skills.

Public-Private Partnerships: The National Skill Development Corporation (NSDC) has a key role in training initiatives through public-private partnerships aiming to train 150 million people by 2022.

Private sector participation is vital for the success of these programs providing both financial support and expertise.

- Overcoming Challenges in Current Policies:

Current skill development policies focus on supply with not enough focus on demand factors resulting in a mismatch between skills provided and market needs.

- There's a need to balance both supply and demand to improve skilling programs.

- Levy-Based Financing:

- Creation of national training funds supported by levies from organized and big companies, is advised to aid skill development in the informal sector.

- Levy-based financing can tackle problems like free-riding and moral hazard ensuring that these funds are used to develop skills.

- Support for Rural Entrepreneurship:

- The Skill India Program has played a crucial role in encouraging entrepreneurship among rural youth by offering financial support, mentorship, and training in various sectors.

This initiative has made rural youth independent and skilled in technology leading to business expansion in rural areas.

2. Industry-Academia Gap in AI Education

The difference between what the industry needs and what schools teach is a big problem in AI education. This problem shows itself in several ways:

- **Curricular Misalignment**: School courses do not match what the industry requires creating a gap in AI education.

- **Limited Resources**: In rural schools, there is a shortage of important things like labs and digital tools, which lowers the quality of AI education.

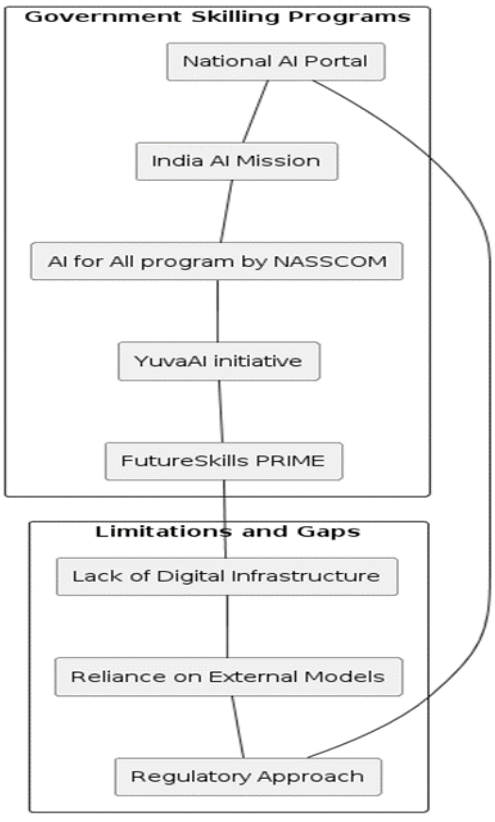


Figure 3:Limitations and gaps for AI skill programs in India

- **Financial Challenges**: High prices on educational products and services make it hard for schools to pay for the needed AI training and resources. Fig. 3 displays the gap that has an impact on the quality of AI education and the real-world skills students gain thus influencing their job prospects in the AI-driven employment market.

3. India's Position Compared to Developed Countries

Infrastructure Gaps

Areas need better basic facilities, systems, and services. Many places lack good roads, schools, and hospitals. Upgrading these is important for a better life and economic boost. Communities need improved water and energy supply also. These upgrades can help in reducing poverty and increasing business opportunities.

India faces big challenges in creating advanced AI and ML systems because it does not have the needed infrastructure. Specialized computer chips crucial to AI advancement, are not within India's production ability even though it is good at designing chips. The reason India can't make these chips is the huge amount of money needed to build a fabrication facility, which few private investors want to pay for. Also, India does not have a big presence in the world of supercomputing having three out of the top 500 supercomputers , while China has 215 and the US has 113. This lack of infrastructure makes many Indian AI companies depend on cloud infrastructure, which is still starting out. India spends just 1.6% of its GDP on IT almost half the world average, with 6% of its IT budget going to cloud services falling behind the world average of 7.9%.

Supporting Policy

Despite these issues, India has potential because of its strong talent pool and big role in the IT sector worldwide. The draft National Strategy for Artificial Intelligence released in 2020 seeks to create a base to grow and accept AI in the future. This includes launching a task force to manage ethical, legal, and social concerns regarding AI and suggesting the setup of a regulatory body for AI. The strategy also underlines the need for data privacy and protection recommending the introduction of laws like the EU's General Data Protect Regulation (GDPR) to protect the rights of citizens. , the government's recent actions like the National Single Window System, which makes it easier to get business approvals for AI development, and creating Centres of Excellence for AI, show a devoted effort to push past the infrastructural and policy issues blocking India's progress in AI[10,11].

4. India's Position Compared to Developing Countries

India compares its work with AI to other developing countries through a number of forward-thinking steps meant to weave high-end tech into various areas. These actions show up in projects that make data governance better and spread the use of AI in many fields.

Emerging Competitors

India stands out from other developing nations by forming strategic partnerships and pushing for bold projects. A key example is the FutureSkills Prime program, an effort led by the Ministry of Electronics and Information Technology (MeitY) and NASSCOM to teach new skills and improve existing skills in AI professionals. This program acts as a business-to-consumer platform focusing on how to use AI in both IT and non-IT fields[12].

The Natural Languages Translation Mission made by MeitY with the Ministry of Electronics and the Department of Science and Technology, shows India's commitment to building a society rich in knowledge. This service uses AI to help with translations between English and various Indian languages making it easier for more people to access digital content.

The opening of the Virtual and Augmented Centre of Entrepreneurship in Bhubaneswar done together with the Government of Odisha and IIIT Bhubaneswar, is meant to create a strong research environment for Virtual Reality and Augmented Reality technologies.

5. Challenges in AI Implementation

In India's implementation of AI, there are several key challenges that must be tackled. These challenges include protecting data privacy, addressing bias and fairness, ensuring accountability, maintaining transparency, handling employment concerns, and exploring ethical implications.

Protecting data privacy is a critical issue when using AI, as these systems often need a large amount of personal data to work well. It is vital to manage this data and follow privacy rules to keep public trust in AI technologies.

Addressing bias and fairness is also crucial in the implementation of AI. AI systems might continue the biases present in the training data leading to unfair or discriminatory results. It is necessary to fix these biases and guarantee fairness in AI algorithms to avoid harm and support equal opportunities.

Accountability and transparency are crucial to gain trust in AI systems. We must set clear rules and guidelines to hold AI creators and users responsible for AI's actions and decisions. Also, openness in how AI algorithms make decisions can increase trust and knowledge among users and those involved.

Job worries also pose a challenge with using AI. AI can automate some jobs and make work more effective, but it might also lead to job losses and affect the workforce. It is necessary to think about the social and economic effects of using AI, and ensure there are plans in place to help workers move to new jobs or fields.

Lastly, the ethical implications are a major part of putting AI to use. AI systems can make choices that have big ethical effects, like in healthcare or criminal justice. Making sure that AI systems are built and operated , with the right care for human values and rights, is necessary to avoid harm and improve the health of people and society.

Joint Work

India's way to enhance its AI skills also involves major work together with leaders in world technology. The Memorandum of Understanding between IndiaAI, under the Digital India Corporation, and Meta, Inc. shows such partnership. This deal is about making AI research better and bringing top technologies to more people, strengthening India's place in the digital space.

In addition, the Software Technology Parks of India, a plan made by MeitY, aims to boost software exports and to create a special Centre for Entrepreneurship in AI technologies. This action is to help grow local AI ideas and support the country's software industry.

India's method to improve its AI abilities is shown by joint work with world technology leaders. The agreement between IndiaAI, under the Digital India Corporation, and Meta, Inc., shows this partnership. The agreement aims to advance AI study and give more people access to latest technologies, strengthening India's spot in the digital field. The main points and range of the joint AI plans are as follows[14,15,16]:

- Joint AI Research and Development:

- Joint work between India and global tech leaders like Meta aims to improve AI research and increase technology access.

- Partnerships like the one among Google, Facebook, Microsoft, Amazon, and IBM aim to establish best practices and enhance public knowledge of AI.

- AI for Social Good and Sustainable Development:

AI applications are being steered to tackle world problems and meet the United Nations' Sustainable Development Goals (SDGs) through teams from different disciplines.

AI for Social Good (AI4SG) efforts focus on creating devices and answers for a positive social effect.

- Human-AI Collaboration:

The future of data science and other areas is viewed as teamwork between humans and AI systems where both automation and human skills are crucial.

- Collaborative AI frameworks in marketing and other areas show the teamwork between AI and human thinking.

- AI in specific areas:

- AI is growingly used in sectors like manufacturing, forestry, and biodiversity protection in India, though its use grows slower than in other nations.

- AI systems combined, like CRM in companies, show a significant impact on user actions and organization performance.

- Issues and chances in AI use:

- Using AI techs in India meets challenges like having access to large data, cloud tech, and digital setups.

- Explainable AI (XAI) is key to make AI clearer and push its use in important fields.

India's work together with the world's top technology experts is key to growing AI research and bringing top technology to more people. These partnerships are not just making AI better but also tackling world issues through AI for Social Good projects. The future of AI in India will see a lot of human-AI work across many areas, though problems with using it and setting up the right systems need to be handled. Overall, these actions are strengthening India's role in the online world and helping with worldwide AI progress.

These actions all together show India's smart approach in using AI unlike other developing countries aiming at both improving local skills and adding worldwide progress to get an advantage in today's digital time.

VI. Conclusion

In this in-depth study, we traveled across the complex setting of AI skilling programs in India revealing their vital roles and meeting the challenges that stand strong toward achieving technological dominance. From the basic projects initiated by the government to the bold efforts of the private sector, the combined steps to enhance India's workforce with AI skills mark a crucial move towards accepting the digital future.

Institutes like NIELIT have given the IndiaAI mission strength by launching various AI certifications programs in diverse fields of AI, IoT, Cybersecurity for students and academicians. The holistic approach of these programs have really elevated the reach and inclusivity of the institute initiatives.

However, the path is blocked by the combined issues of lack of infrastructure and the disconnect between industry and academia, which together obstruct the smooth introduction of AI technology into India's growth plan. The insights gathered here not highlight the progress made but also disclose the significant steps still needed to close the existing gaps.

Looking ahead, the need to synchronize policy frameworks educational bodies, and industry participants becomes more urgent aiming to strengthen India's role in the global AI field. It is crucial that in the future we focus on easing the identified challenges through strategic money allocation new partnerships, and a solid promise to improve AI knowledge and reach throughout social levels.

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