

Role of AI in Developing Countries

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Abstract- This paper explores the role and impact of Generative Artificial Intelligence (AI) in developing countries, emphasizing its potential to address significant socio-economic challenges. Unlike traditional AI, which primarily focuses on decision-making based on existing data, Generative AI can create new content, making it a powerful tool for innovation. This technology offers unique opportunities for sectors such as healthcare, education, agriculture, and infrastructure development, particularly in nations with limited resources and technological infrastructure. Generative AI can revolutionize healthcare by enhancing diagnostic tools, supporting drug discovery, and enabling remote medical services. In agriculture, it assists in optimizing crop yields and improving food security through advanced monitoring techniques. Additionally, the technology can personalize educational experiences and democratize access to learning materials. Despite these advantages, the adoption of Generative AI faces challenges, including ethical concerns, data privacy issues, and the risk of job displacement. The paper concludes that Generative AI holds immense potential to drive sustainable development in developing countries. However, careful implementation and strategic investments in infrastructure and education are required to overcome existing barriers and ensure equitable access to these technologies.

Index Terms- Generative Artificial Intelligence (AI), Developing countries, Socio-economic challenges, Healthcare, Agriculture, Education, Infrastructure development, Innovation, Data privacy, Job displacement, Sustainable development, Technological infrastructure, Remote medical services, Food security, Personalized education.

I. INTRODUCTION

1 Background

The role of Generative Artificial Intelligence (AI) in developing countries has emerged as a subject of increasing significance in recent years. Generative AI, a subset of artificial intelligence focused on creating new content or data, holds substantial promise for addressing various socio-economic challenges prevalent in developing nations. Unlike traditional AI, which primarily focuses on data analysis and decision-making, generative AI algorithms are designed to generate new content autonomously, including images, text, music, and even entire narratives.

Generative AI technology has the potential to revolutionize several key sectors critical to the development of countries with emerging economies. By leveraging generative AI, these nations can overcome limitations in resources, expertise, and infrastructure to drive innovation, economic growth, and societal progress. From healthcare and agriculture to education and infrastructure development, the application of generative AI offers novel solutions to longstanding challenges, paving the way for sustainable development and inclusive growth.

In healthcare, generative AI facilitates medical image generation, drug discovery, and personalized treatment recommendations, thereby enhancing access to quality healthcare services in remote and underserved areas. Moreover, it enables the development of predictive models for disease outbreaks and epidemiological trends, empowering governments and healthcare agencies to proactively address public health crises.

In agriculture, generative AI aids in crop monitoring, yield prediction, and pest detection, empowering farmers with valuable insights to optimize agricultural practices, increase productivity, and ensure food security. By harnessing generative AI-driven solutions, developing countries can mitigate the impact of climate change on agriculture and improve the livelihoods of millions dependent on farming.

In education, generative AI supports personalized learning experiences, adaptive tutoring systems, and content generation for educational materials, thereby democratizing access to quality education and fostering lifelong learning opportunities for learners of all ages. By leveraging generative AI-powered educational tools, developing countries can bridge the digital divide and enhance educational outcomes nationwide.

Furthermore, generative AI contributes to infrastructure development by enabling the design optimization of buildings, roads, and urban spaces, as well as the simulation of natural disasters for disaster preparedness and response planning. Through the application of generative AI in infrastructure projects, developing countries can build resilient and sustainable cities, thereby improving the quality of life for urban populations.

Despite its immense potential, the widespread adoption of generative AI in developing countries is not without challenges. Issues related to data privacy, ethical considerations, and the digital divide must be addressed to ensure equitable access to generative AI technologies and mitigate potential risks. Concerns about AI overtaking manual jobs, reducing employment opportunities for people in the creative field still pose a big threat.

In conclusion, the role of generative AI in developing countries is poised to catalyze transformative change across various sectors, driving inclusive growth, sustainable development, and socio-economic progress. By harnessing the power of generative AI, these nations can overcome barriers to innovation and leapfrog into a future characterized by prosperity and opportunity for all.

2 Problem Statement

Whether AI is a boon or a curse, is a staple question that has been, and still continues to be, addressed by every tech journal, asked in school essays and lingers in every person's mind that is associated with the IT industry.

The first industrial revolution (mid 18th century – mid 19th century) greatly benefitted the “western” countries whereas the once affluent nations like India and China experienced a much slower rate of growth, increasing disparities between the western and eastern nations. Though subsequent industrial revolutions did not any economies, but they had a drastic and significant impact on individuals and in cases, widened the gap between the privileged and marginalized communities.

We attempt to look what this fourth industrial revolution and AI have in store for the developing world. Emerging economies like India, Bangladesh, China can mobilize AI for economic development, lifting people out of poverty, digitalize processes that otherwise would have taken a lot of time to cater a large population.

AI in the context of developing countries is a subject that is yet to be thoroughly explored. We aim to address how this tech revolution will benefit the developing nations, identify potential threats it poses, examine how these nations have harnessed AI for increased productivity in sectors like agriculture, academia, healthcare and speculate what the future of AI looks like in these countries.

3 Motivation

Developing nations or the global south constitute about 85% and 45% of the total world's population and GDP respectively. Despite being a significant chunk of population, these nations and their issues more often than not get any coverage resulting in the underrepresentation of the majority of people living in the world.

As computer science students living in India, the impact and role of generative AI is a subject that we can closely associate with. It is the amalgamation of the two things that excite us the most, computer science and our country. As citizens of a developing country like India, we were driven by the idea of understanding how AI can be leveraged for economic prosperity, academia, poverty reduction and societal improvement. It has the potential to bring about significant changes in various aspects of society, including education, healthcare, agriculture, and governance. Investigating how AI can be harnessed to address societal challenges and improve quality of life in developing countries aligns with a desire to make a positive impact on society.

We understand that as global citizens, it is our responsibility to address the issues that not only persists in our country but the broader world.

4. Existing System: Some of the existing systems in the generative AI family are as follows

ChatGPT

ChatGPT, also known as GPT (Generative pre-trained transformer) is a conversational AI model developed by Open AI and launched in 2021. It works just like a chatbot where users put in queries and prompts and the AI model gives responses. GPT is trained on a large corpus of data to mimic human-like responses.

Dall-E

DALL-E is another advanced AI model created by OpenAI, designed for image generation from prompts. It is named after the artist Salvador Dali and the animated character Wall-E. DALL-E is used to generate highly realistic and novel images based on textual prompts, including surreal and imaginative compositions.

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II. LITERATURE SURVEY

Artificial Intelligence (AI) has emerged as a transformative technology with the potential to revolutionize various sectors across the globe. In recent years, there has been growing interest in understanding how AI, along with the emergence of Generation AI (Gen AI), impacts developing countries.

This literature survey aims to explore the role of AI and Gen AI in the context of developing countries, focusing on their opportunities, challenges, and potential implications for socio-economic development.

1. Opportunities for Developing Countries

Economic Growth and Innovation

Studies suggest that AI can catalyze economic growth and foster innovation in developing countries by optimizing processes, improving productivity, and unlocking new business opportunities (Nguyen et al., 2019).

Healthcare Advancements

AI-powered technologies have the potential to address healthcare challenges in developing countries by enabling more accurate diagnosis, personalized treatment plans, and telemedicine services (Jamison et al., 2020).

Education and Skill Development

Gen AI, characterized by digital nativism and familiarity with AI technologies, presents opportunities for enhancing education and skill development initiatives in developing countries through personalized learning platforms and AI-driven educational tools (UNESCO, 2021).

2. Challenges and Concerns

Digital Divide

The digital divide between developed and developing countries exacerbates disparities in access to AI technologies, infrastructure, and digital literacy skills, limiting the equitable distribution of AI benefits (Katz et al., 2020).

Ethical and Societal Implications

Concerns have been raised regarding the ethical implications of AI deployment in developing countries, including privacy risks, algorithmic bias, and socio-cultural challenges related to AI adoption (Mutembesa et al., 2021).

Job Displacement and Inequality

While AI holds the potential to create new job opportunities, there are concerns about job displacement, particularly in labor-intensive sectors of developing economies, exacerbating unemployment and income inequality (World Bank, 2019).

3. Policy Implications and Recommendations

Policy Frameworks

Developing countries need to formulate comprehensive policy frameworks that promote responsible AI adoption, address ethical concerns, and prioritize investments in digital infrastructure, education, and skills development (OECD, 2020).

Capacity Building

Capacity-building initiatives focused on AI literacy, skills development, and technology transfer are essential to empower individuals and organizations in developing countries to harness the potential of AI for socio-economic development (UNCTAD, 2020).

International Cooperation

Enhanced international cooperation and partnerships are crucial for facilitating technology transfer, knowledge exchange, and resource mobilization to support AI development initiatives in developing countries (World Economic Forum, 2021).

4. Conclusion

AI and Generation AI have the potential to significantly impact socio-economic development in developing countries, offering opportunities for economic growth, healthcare advancements, and education innovation.

However, realizing the full potential of AI in these contexts requires addressing various challenges, including the digital divide, ethical concerns, and job displacement.

Policymakers, researchers, and practitioners must collaborate to develop inclusive and sustainable strategies that harness the benefits of AI while mitigating its risks in the context of developing countries.

This literature survey provides an overview of the role of AI and Gen AI in developing countries, highlighting both the opportunities and challenges associated with their adoption and implementation.

III. ANALYSIS

Analyzing the role of Gen AI (Generation AI) in developing countries involves examining various aspects such as access to technology, education, economic implications, and societal impacts. Here's a breakdown of the analysis:

1. Access to Technology

Developing countries often face challenges in access to advanced technology due to factors like infrastructure limitations and financial constraints. Gen AI has the potential to bridge this gap by offering more affordable and accessible technology solutions. Mobile devices and low-cost computing devices can serve as gateways for Gen AI in these regions, enabling individuals to access educational resources, healthcare services, and economic opportunities.

2. Education

Gen AI can revolutionize education in developing countries by providing personalized learning experiences, adaptive curriculum, and access to vast knowledge repositories. AI-powered educational tools can help address the shortage of qualified teachers and enhance the quality of education in remote areas. However, challenges such as digital literacy and the need for infrastructure development must be addressed to fully harness the potential of Gen AI in education.

3. Economic Implications

Gen AI presents opportunities for economic growth in developing countries through automation, innovation, and entrepreneurship. Automation of repetitive tasks can increase productivity and efficiency in various sectors such as agriculture, manufacturing, and service industries. Gen AI technologies can also foster the growth of new industries such as AI development, data analytics, and robotics, creating job opportunities and driving economic diversification.

4. Societal Impacts

Gen AI has the potential to address societal challenges in developing countries, including healthcare access, resource management, and disaster response. AI-driven healthcare solutions, such as diagnostic tools and telemedicine platforms, can improve healthcare outcomes and reduce disparities in access to medical services. AI-powered data

These technologies analyze data on soil quality and crop health, enabling farmers to optimize practices and increase yields. AI identifies crop diseases and pests swiftly, allowing timely interventions to prevent crop loss and ensure food security. AI predicts market trends, helping farmers make informed decisions on crop cultivation and marketing strategies.

AI platforms adapt teaching methods to individual learning styles, improving learning outcomes and retention rates. It translation tools break language barriers, providing access to educational resources in multiple languages. Gen AI's digital proficiency enables the development of online learning platforms, expanding educational opportunities in underserved areas.

It assesses creditworthiness and provides microloans, promoting financial inclusion for individuals and small businesses. It detects financial fraud in real-time, safeguarding financial resources and instilling trust in financial systems and AI-driven chatbots offer financial advice and services, empowering underserved populations and promoting financial literacy.

Gen AI analyzes data to detect natural disaster signs, enabling timely evacuation and disaster response and AI-powered drones aid in locating survivors and delivering aid efficiently during and after disasters. analytics can enhance resource management practices in areas like agriculture, water conservation, and urban planning, contributing to sustainable development goals.

1. Ethical Considerations

As Gen AI becomes more prevalent in developing countries, it's crucial to address ethical concerns such as data privacy, algorithmic bias, and job displacement. Policies and regulations should be implemented to ensure responsible AI deployment and protect the rights of individuals, especially in vulnerable populations. Investments in AI education and skill development programs are essential to empower local communities and mitigate the risk of digital divide.

In conclusion, the role of Gen AI in developing countries is multifaceted, with the potential to drive socioeconomic development, improve quality of life, and address pressing challenges. However, realizing these benefits requires concerted efforts from governments, industry stakeholders, and civil society to ensure inclusive and ethical AI deployment.

Apart from this monitors wildlife and detects poaching activities, supporting conservation efforts and biodiversity preservation. Also, AI predicts climate change impacts and informs adaptation strategies, crucial for vulnerable regions. These are the some of the major highlights of the applications

IV. APPLICATIONS

AI assists in diagnosing diseases accurately and predicting outbreaks, crucial for regions with limited healthcare access. AI-driven telemedicine platforms enable remote consultations, bridging gaps in healthcare accessibility, especially in rural areas. AI-powered wearable devices and mobile apps monitor health indicators, aiding in early detection and prevention of health issues.

of Gen AI and AI that can contribute to the growth and development of the developing nations.

Table 1: -McKinsey & Company (2023).What’s the future of generative AI? <https://www.mckinsey.com/featured-insights/mckinsey-explainers/whats-the-future-of-generative-ai-an-early-view-in-15-charts>

Generative AI use cases, nonexhaustive

Modality	Application	Example use cases
Text	Content writing	Marketing: creating personalized emails and posts Talent: drafting interview questions, job descriptions
	Chatbots or assistants	Customer service: using chatbots to boost conversion on websites
	Search	Making more natural web search Corporate knowledge: enhancing internal search tools
	Analysis and synthesis	Sales: analyzing customer interactions to extract insights Risk and legal: summarizing regulatory documents
Code	Code generation	IT: accelerating application development and quality with automatic code recommendations
	Application prototype and design	IT: quickly generating user interface designs
	Data set generation	Generating synthetic data sets to improve AI models' quality
Image	Stock image generator	Marketing and sales: generating unique media
	Image editor	Marketing and sales: personalizing content quickly
Audio	Text to voice generation	Trainings: creating educational voiceover
	Sound creation	Entertainment: making custom sounds without copyright violations
	Audio editing	Entertainment: editing podcast in post without having to rerecord
3-D or other	3-D object generation	Video games: writing scenes, characters Digital representation: creating interior-design mockups and virtual staging for architecture design
	Product design and discovery	Manufacturing: optimizing material design Drug discovery: accelerating R&D process
Video	Video creation	Entertainment: generating short-form videos for TikTok Training or learning: creating video lessons or corporate presentations using AI avatars
	Video editing	Entertainment: shortening videos for social media E-commerce: adding personalization to generic videos Entertainment: removing background images and background noise in post
	Voice translation and adjustments	Video dubbing: translating into new languages using AI-generated or original-speaker voices Live translation: for corporate meetings, video conferencing Voice cloning: replicating actor voice or changing for studio effect such as aging
	Face swaps and adjustments	Virtual effects: enabling rapid high-end aging; de-aging; cosmetic, wig, and prosthetic fixes Lip syncing or "visual" dubbing in postproduction: editing footage to achieve release in multiple ratings or languages Face swapping and deep-fake visual effects Video conferencing: real-time gaze correction

V. ADVANTAGES AND DISADVANTAGES

1. Advantages

Gen AI have helped a lot of people to overcome language barrier and help in translating different languages. It also useful for us to learn various technical skills and thus improving the digital literacy of people in the work force. In offices Gen AI could be used to boost the efficiency of work by taking care of repetitive jobs. The technical skills we can learn are very much cheaper and will boost our skill set. Gen AI has produced new jobs like prompt engineer for example. Even in industries Gen AI can be used as it can be used to automate those tasks that are reducing the human efficiency and by automating such jobs, human resources can be used for much effective and reproductive work. This will surely improve the creativity as more monotonous work is being handled by the Gen AI. Apart from this Gen AI can also be used for getting a useful business insight and can assist us with the idea of customer behaviour, developing of product and marketing strategies. Creation of new products using Gen AI will definitely lead to innovations and increase in sales.

Analyzing data about the industries can improve the customer experience and will provide customers with better facilities.

Work Time Distribution by Industry & Generative AI Impact



Fig. 1: Todd McLees (2023). Generative AI’s Impact on Reshaping Work. <https://medium.com/human-skills-project/10-charts-explaining-the-impact-of-generative-ai-on-work-as-we-know-it-2b6293a6914f>

Gen AI is rapidly rising in the field of academics and literature by improving the writing style and providing better choices for words an individual is using. It is stimulating the academics and reasoning of those who don’t have english as their mother tongue. Research work is also has been revolutionized because of Gen AI as it open up the gate of never ending information on a particular topic, can even cross question a given statement and reducing the need of physical library for those who cant get access to such information which leads to the betterment in the quantity of work needed a research. AI can make a personalized learning experience for students and help them to avoid crowded classrooms. Gen AI and AI both can be useful for the students.

Another use of Gen AI and AI is that it can be used to predict climate and weather forecasting. AI can also help in spreading awareness about saving biodiversity. AI and Gen AI can also make a huge impact on the environment and can give us a deep analysis of what can be done to reduce different problems like controlling GHG (Green House Gases) emission and provide us with a deep insight of how to manage and save energy.

If you talk about the medical field AI and Generative AI also have different medical usage like in the making of different new medicine and with their trials. The tracking of physical statistics is also possible by wearing different health devices like a fitness band, which can track our heartbeat, blood pressure and can even track her sleep. Generative AI has make it possible for humans to interact with it like having a face-to-face conversation with the doctor, we are a patient and ask questions about disease or telling generative AI about the condition he or she is facing and the generative AI can give possible outcomes or diseases with which that person can be diagnosed with. A also improving the early detection of rare

diseases. the monitoring of health status and the progress of a patient can be done easily using AI and generative AI at a reduced cost.

2. Disadvantages

AI is surely replacinnng and killing certain jobs like Data entry which can automated and will perform better than the humans actually doing the job and providing the company with more efficient work environment and hring people who can do more creative work rather than just entering numbers and words in the system. Another example could be of basic programming which can be easily done with the help of various Gen AI code writers (Ghost writer is of the best example). Now people should be hold a deep knowledge of coding or programming otherwise their jobs are not secured. AI is also reducing the employment opportunities for creative writers and artists.

Even in industries the over dependencies on the Gen AI for decision making can reduce the chances of innovation and development of new technologies or ideas. The data on which the Gen AI model is trained should be unbias and if the data is bias then the Gen AI will result in the racial outputs and can cause chaos among the mases. Gen AI is also not sso protected and security breaches is often possible. Recently the Gen AI is a huge concern as it can create content that can be unethical and inappropriate like deep fakes or fake news which can be a lead cause to the disturbance in the industries. In the sector of education, student are over relying on the Gen AI and AI to do their work which can cause the degradation of their original ideas and content. It also leads to a major problem where most of the people have same writing style because of copying it directly from the Gen AI. It can be really helpful but using in such a way that student or their research is relying totally upon the Gen AI will also kill the traditional methodologies of doing a research. Also AI is somehow deepening the digital gap between two groups or individuals.

Gen AI is a powerful tool but it also causes a lot negative impacts on the environment like consuming a lot of energy, it needs a lot of water for cooling the heat generated. The generation of such huge amount of heat can lead to the increase in greenhouse effect.

Using AI in medical field is a good approach but ther will be always a concern for the data protection of the patient’s medical history or personal data record. People don’t trust easily on the Gen AI for treatment and taking recommendations. It will also increase the workload due to guidelines given by the AI.

VI. RESULTS AND DISCUSSIONS

We examined the implications of Generative AI in developing nations with all it’s advantages as well as disadvantages and our findings came to the conclusion that the usage and role of AI in developing nations is still a matter of speculation.

AI has not only revolutionized sectors like healthcare, agriculture, retail, finance and academia but it has also brought forward questions about how AI can be used in an ethical way so that it does not widen the gap between the privileged and the unprivileged.

AI is still in its infancy and this technology has still a long way to go. Therefore, diligent application of AI should be prioritized. There are instances of AI giving results that exacerbate stereotypes for a given community, religion or ethnicity, this means that AI, no matter how powerful it is, is still susceptible to the faulty data it trains upon. However, it does not imply that the disadvantages of AI outweigh its advantages.

The gap in AI implementation in developing nations can be lessened with strategic efforts. Investment in digital infrastructure is to be made. Government and private bodies need to come together to provide a robust infrastructure for AI implementation. Funding research and innovation in AI is fundamental to keep advancing in this field. Collaborations between academia and industry to foster an environment of careful AI use amongst students.

One of the most immediate effects of AI on the labor market is automation, where AI-driven technologies replace or augment human tasks and jobs. Routine and repetitive tasks in industries such as manufacturing, transportation, and customer service are increasingly being automated, leading to job displacement for workers performing these tasks. While automation can increase efficiency and productivity, it also raises concerns about unemployment and job polarization, particularly for workers with low skills or in routine. While AI may eliminate certain jobs, it also creates new job opportunities and industries. AI-driven technologies spur

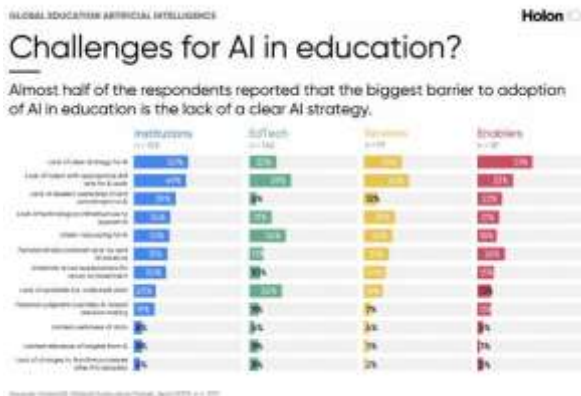


Fig. 2: Social (2024).AI In Education Statistics To Rethink. <https://www.soocial.com/ai-in-education- statistics/>

innovation and the development of new products, services, and business models, leading to job creation in emerging sectors such as artificial intelligence, data science, robotics, and cybersecurity. Moreover, AI can enhance human productivity and augment workers' capabilities, leading to the creation of hybrid roles that combine human skills with AI technologies.

Crafting regulatory frameworks is essential to ensure responsible AI use. Developing and enforcing ethical guidelines for AI development and deployment. These guidelines should encompass fairness, transparency, accountability, and the protection of privacy. Implementation of robust data protection regulations to safeguard individual privacy. Defining clear rules for data collection, storage, and sharing to prevent misuse. Establishing mechanisms for algorithmic accountability, requiring organizations to disclose and explain the decision-making processes of AI systems. Regular audits can ensure compliance.

The future of AI in developing countries holds immense promise, but its realization requires

- Strategic planning and responsible governance. By embracing emerging trends and implementing
- Thoughtful policies, governments and stakeholders can harness the transformative power of AI for inclusive and sustainable development.

VII. CONCLUSION

As we conclude our exploration of Artificial Intelligence (AI) in developing countries, it is evident that the transformative potential of AI is vast, holding the promise to reshape economies, societies, and the overall trajectory of development. This conclusion recaps key findings, summarizes main points discussed in the review paper, and issues a compelling call to action to encourage stakeholders to address challenges and seize opportunities, emphasizing the potential of AI in fostering inclusive development.

We have witnessed case studies showcasing real-world applications, illustrating that AI is not merely a technological luxury but a pragmatic solution to address pressing challenges in diverse domains. Whether enhancing precision agriculture for smallholder farmers, revolutionizing healthcare in remote communities, or monitoring environmental sustainability,

AI is proving to be a catalyst for positive change. Developing countries face challenges in infrastructure, skills, and ethical considerations, yet within these challenges lie opportunities for leapfrogging traditional constraints. Initiatives in education, awareness, and targeted policies can unlock the potential of AI.

AI is making significant impacts across sectors, from improving healthcare delivery and educational outcomes to optimizing agricultural practices and transforming financial services. The multifaceted applications of AI underscore its versatility in addressing diverse challenges.

The potential of AI in fostering inclusive development is evident. Precision applications tailored to local needs, coupled with strategic policies, can ensure that the benefits of AI are distributed equitably, contributing to sustainable and inclusive development.

Stakeholders, including governments, businesses, and educational institutions, must collaboratively address challenges. Investments in infrastructure, education, and initiatives to bridge skill gaps are essential. Public-private partnerships can play a pivotal role in creating an ecosystem conducive to AI implementation.

The potential of AI to drive inclusive development cannot be overstated. It is imperative for stakeholders to proactively seize opportunities presented by AI applications. This includes leveraging AI for sustainable agriculture, improving healthcare accessibility, and fostering innovative approaches to education. The challenges and opportunities of AI in developing countries extend beyond national borders. Global collaboration is essential to share knowledge, best practices, and resources. International organizations, tech companies, and research institutions can play a crucial role in supporting developing countries on their AI journey.

In conclusion, the integration of AI in developing countries is a dynamic journey requiring concerted efforts, strategic planning, and a commitment to inclusivity. The potential benefits are immense, and by addressing challenges collaboratively, stakeholders can pave the way for a future where AI serves as a catalyst for sustainable development, leaving no one behind.

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