

ARTIFICIAL INTELLIGENCE IMPLEMENTATION CHALLENGES IN INDUSTRIES: DEVELOPING COUNTRIES PROSPECTIVE

Moti Melkamu¹

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ABSTRACT

Artificial intelligence technologies are developing rapidly and cause radical changes in organizations, Industries, society, and individual levels and playing an increasingly important role in current world through replace and performing tasks that require human intelligence. The use of artificial intelligence (AI) as an innovation driver is increasingly gaining importance in small and medium-sized manufacturing and service industries. The main goals of the Artificial intelligence in industries are improve efficiency, productivity and overall performance by automating repetitive tasks, enhancing decision making and enabling new capabilities. However, in developing countries like Ethiopian industries has major challenges in implementation of Artificial intelligence. This study assessed and identified major challenges in Artificial intelligence implementation from manufacturing industries: Sugar, Chemical, Garment, Footwear and service industries: health and bank. As the overall identified study showed that work culture, skill and educational gap, technological infrastructures, lack of awareness and understanding, Adopt AI as a local context, High Financial investment requirement and Unclear and ineffective data are the major challenges in Artificial intelligence implementation. For effective and successful Artificial intelligence implementation it needs more attention and effective plan from all industries stakeholders including government.

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1. INTRODUCTION

Artificial Intelligence (AI) refers to the ability of computers to simulate human behavior in order to help humans perform better in the fields of science and technology. Other specific objectives of AI include the replication of human intelligence, the solution of knowledge-intensive tasks, the construction of machines that are capable of performing tasks requiring human intelligence, and the creation of self-learning systems (Ertel, 2018, Xu et al., 2021). Artificial intelligence (AI) is playing an increasingly important role in our daily lives

and complex tasks are thus delegated to increasingly autonomous technological processes, capable of driving economic and social development (Jaldi, 2023), (Aderibigbe et al., 2023). The rise of AI in the world is not limited to new technology developments; it also affects society institutions, changing the nature of communication, education, and work. AI is a worldwide catalyst for unprecedented change, as seen by the substantial productivity increases, innovative business model innovation, and process optimization that developed nations have experienced (Aderibigbe et al., 2023). Artificial intelligence has been evolved as one of

¹ Corresponding author: Moti Melkamu
Email: motimelka.aui@gmail.com

the most important technology in this world, with its impact on almost every field of human endeavour (Ertel, 2018; Nazeer & Gil, 2023; Zhang & Tao 2020) and as AI technologies advance globally, their impact on socio-economic development becomes increasingly critical, particularly in regions with diverse challenges and opportunities scale (Jaldi, 2023). Artificial Intelligence has been an area of great interest and investment in the industrial sector, offering numerous possibilities to enhance efficiency and accuracy in production processes (Moreira et al., 2023). The AI has been used and implemented in many fields especially in technological domain and is expected to provide 2.3 million jobs by 2020 (Ertel, 2018; Nazeer & Gil, 2023). Artificial intelligence (AI) has the potential to increase economic growth and social well-being in both wealthy and developing countries. Developing countries are already at a disadvantage in the global economy due to limited access to advanced technologies like AI, which can make them more competitive in the global market. Developing countries stand to gain from artificial intelligence's widespread use. Developed nations have been able to capitalize on the advantages of AI technology, yet acceptance and application of this technology still present obstacles (Mhlanga, 2021; Nazeer & Gil, 2023). Price water house Coopers AI sizing the price report estimated that by 2030, AI technologies could increase the global economy by \$15.7 trillion (14%), with increased productivity contributing about \$6.6 trillion and consumption side effects providing \$9.1 trillion and to put this into perspective, the financial gains for the markets in Africa are estimated to be around \$1.2 trillion (Jaldi, 2023). Artificial intelligence (AI) has the potential to significantly boost economic development and societal well-being in developing nations and according to a report by the World Bank, the adoption of AI technology in developing countries could increase their GDP growth by up to 1.2% (Mhlanga, 2021). In current African society, AI is becoming more popular and seeking to cover all facets of human activity. The adoption and use of these modern technologies in the African context are currently low because of some emerging challenges. These difficulties may have a direct influence on African economic development (Jaldi, 2023). Developing countries, characterized by diverse socio-economic contexts, are at the crossroads of harnessing the potential benefits of AI to address existing challenges and propel economic development and the adoption of AI technologies offers the promise of leapfrogging traditional constraints, yet the unique landscape of developing nations requires strategic navigation to bridge the gap between potential and effective implementation (Aderibigbe et al., 2023). To enhance the adoption of Artificial Intelligence in the industrial context of an emerging economy, taking into account the needs of Industry 4.0, it is important to prioritize overcoming challenges such as Lack of clarity in return on investment, Organizational culture, Acceptance of AI by workers, Quantity and quality of data, and Data protection (Zhang & Tao, 2020). AI has been applied in

various industrial areas such as manufacturing, logistics, and energy, among others, with significant results in terms of cost reduction, increased productivity, and improved quality of the products and services offered (Moreira et al., 2023). However, developing countries face significant challenges in the adoption and implementation of AI technology. These challenges include inadequate infrastructure, a shortage of skilled workers, limited financial resources, and insufficient government support. Addressing these challenges is crucial for developing countries to bridge the AI development gap and leverage the benefits of AI technology (Mhlanga, 2021). Countries such as Ethiopia have launched high-profile AI initiatives, but not adopted according to its requirements (Kshetri, 2021).

2. LITERATURE REVIEW

2.1 Basic terms in Artificial Intelligence

Artificial intelligence (AI) has transformed global business, aiding operational efficiency and innovation. It utilizes machine learning and big data analytics, driving predictive market trends and strategic decision-making. Using AI in business is critical for improving productivity, competitiveness, and decision-making, especially in the context of multinational enterprises. AI integration significantly empowers businesses in navigating intricate global environments by facilitating advanced predictive analytics, task automation, and leveraging data-driven insights. Adoption of AI in company operations can result in significant economic gains. It is predicted that there will be an additional \$13 trillion in global economic activity by 2030 as a result of AI use, according to a McKinsey report (Hasan & Ojala 2024; Zhou et al., 2022).

Major contents of AI: Artificial intelligence has emerged as a boon for the society for the furtherance of advanced techniques to deal with the real-life problems and major two subsets of AI are Machine Learning (ML) and Deep Learning (DL) (Ertel, 2018; Zhang & Tao, 2020; Nazeer & Gil, 2023).

Machine Learning: AI machines can also learn from the past experiences with the help of the concept known as Machine Learning (ML). The machine learning deals with the development of algorithms that enables the computer to learn from its data and past experiences on their own.

Deep Learning: is considered as the subdomain of ML and thereby the subset of AI. In ML, the system is provided with given input data sets and subjected to self-learning from the past experiences and give predictions as output. Deep learning can be denoted as the next level of machine learning where the system is similar to human nervous system and mimic the working of the neurons.

Goals of AI: To Create Expert Systems: The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users. To Implement Human Intelligence in Machines: Creating systems that

understand, think, learn, and behave like humans (Thirunavukarasu et al., 2023).

Challenges in AI Implementation: Implementation of Artificial Intelligence (AI) in developing countries is not without its intricacies, and several challenges must be addressed to unlock the full potential of these transformative technologies and those challenges are associated with infrastructure limitations, skill gaps and education challenges, ethical and societal considerations, Lack of Clarity in Return on Investment, Organizational Culture, Acceptance of AI by Workers (Demaidi, 2023, Jaldi, 2023, Moreira et al., 2023, Nazeer & Gil, 2023; Zhou et al., 2022).

Table 1. Selected industries and sample size

S/no	Name of industry	Types of industry	Denoted	N	$n = N/(1+Ne^2)$
1	Health	Service	I ₁	50	44
2	Sugar	Manufacturing	I ₂	75	63
3	Chemical	Manufacturing	I ₃	100	80
4	Garment	Manufacturing	I ₄	150	109
5	Footwear	Manufacturing	I ₅	110	86
6	Bank	Service	I ₆	45	40

4. DATA ANALYSIS AND DISCUSSION

As the analysed data showed that the major identified major challenged for implementation of artificial intelligence in both manufacturing and service industries are Work Culture, Skill and Educational Gap, Technological Infrastructure, Lack of Awareness/understanding and Adopt AI as a local context.

Work Culture: its which related with adapted working system on the industry for a long period of time and workers work their work as the previous and known without amendments of the basic working procedures and systems. Workers itself haven't interest to change the working system of the exist industry. It can maximizing employee engagement through artificial intelligent in organizational culture in the context of leadership and training of employees (Rožman et al., 2023).

Skill and Educational Gap: The different levels of artificial intelligence autonomy can have an impact on the employees' work ability and on the speed and intensity of the acceptance and trust building journey. Implementation of artificial intelligence at the workplace it needs considering of the work ability of employees and also successful AI implementation, both the business requirements and the needs of human resources must be considered (Werens & von Garrel, 2023). Successfully adapting to this transformation requires organizations to implement new working models and develop strategies for upskilling and reskilling their workforce (Morandini et al., 2023). Most of the developing country education systems focused theoretical knowledge rather than practical, but in the case of Artificial intelligence implementation and uses it needs updated skills and knowledge through support of the both theoretical and practical knowledge. It needs to plan and develop advanced knowledge and skills for future industrial

3. METHODOLOGY

3.1 Data collection

Data collected from selected six industries (both manufacturing and service) for each major challenges and analysis according to its requirements.

3.2 Sample size and types of industry

Depend on the selected industries from both manufacturing and service industries it determined the sample size of each industries according to their total population (Table 1).

employees in the field of artificial Intelligence (Paško et al., 2022).

Technological Infrastructure: Different technological infrastructure is required to implement Artificial intelligence throughout the industries, but in developing countries this technological infrastructure are most challenges and require more attentions from all stakeholders of the industries and government.

Lack of Awareness/understanding: There is very less awareness and understanding about Artificial intelligent in different industries, but Artificial intelligent implementation require awareness and detail understanding on its uses, contents, challenges and others including deep learning and machine learning on their industry context. The adoption and integration of AI technologies it needs well-documented and understanding the challenges (Omoga, 2023).

Adopt AI as a local context: most of the sophisticated and modern technology are developed in developed countries according to their context and transfer to developing countries. This developed technology difficult to adopt in developing countries as it is without amendment as the local context.

High Financial investment requirement: AI is an expensive technology and it's difficult to implement in low financial investment (Bécue et al., 2021). Artificial intelligence requires high financial investment to implement in industries because all its basic contents are very expensive and t require more attentions in their financial investment.

Unclear and ineffective data: Data is the key element of what the organization needs to have before it engages in adopting AI technology (Umurerwa & Lesjak, 2021). Machine learning and decision-making capability of AI and AI application are based on huge volumes of classified data, often sensitive and personal in nature (Bécue et al., 2021). The availability of data is essential

for training artificial intelligence systems, with products and services rapidly moving from pattern recognition and insight generation to more sophisticated forecasting techniques and, thus, better decisions. Data is a backbone of the artificial intelligence implementation and it needs clear and effective data.

Because all process are through a given data (input/program/code) and information which related with goal of the Ai for the industry and Unclear and ineffective data affect the implementation of Ai and goal of the industry. The detail assessed result are showed in the table below (Table 2).

Table 2. Major challenges in each industries

Major challenges	I ₁ (%)	I ₂ (%)	I ₃ (%)	I ₄ (%)	I ₅ (%)	I ₆ (%)
Work Culture	70.5	84.1	75.0	82.6	69.8	77.5
Skill and Educational Gap	88.6	93.7	75.0	70.6	96.5	95.0
Technological Infrastructure	81.8	87.3	68.8	78.0	68.6	87.5
Lack of Awareness/understanding	47.7	66.7	86.3	96.3	87.2	85.0
Adopt AI as a local context	65.9	63.5	73.8	73.4	87.2	92.5
High Financial investment requirement	95.5	79.4	97.5	94.5	97.7	90.0
Unclear and ineffective data	70.5	87.3	86.25	96.3	91.9	72.5

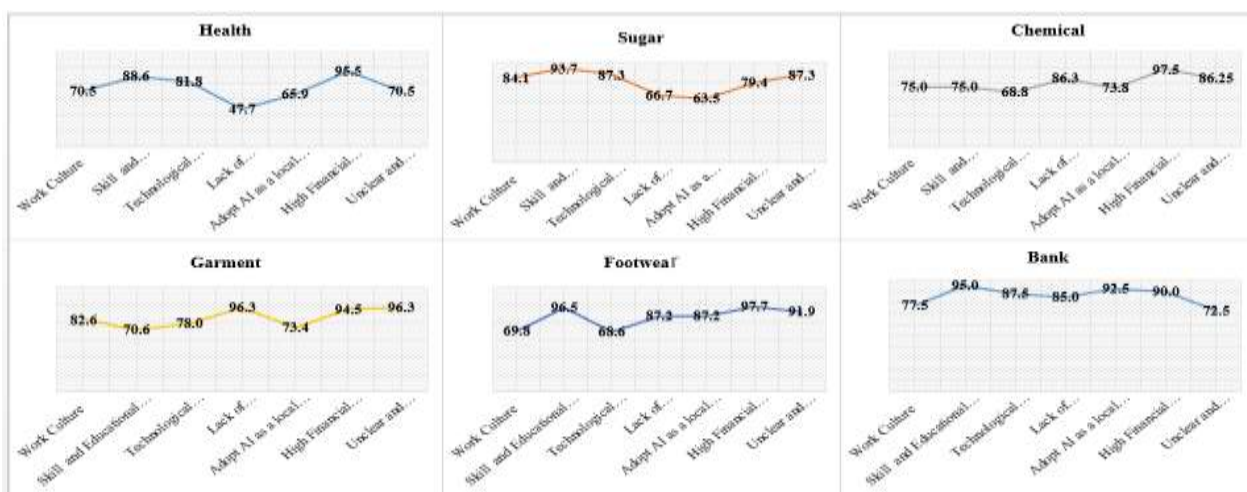


Figure 1. Challenges in each industries

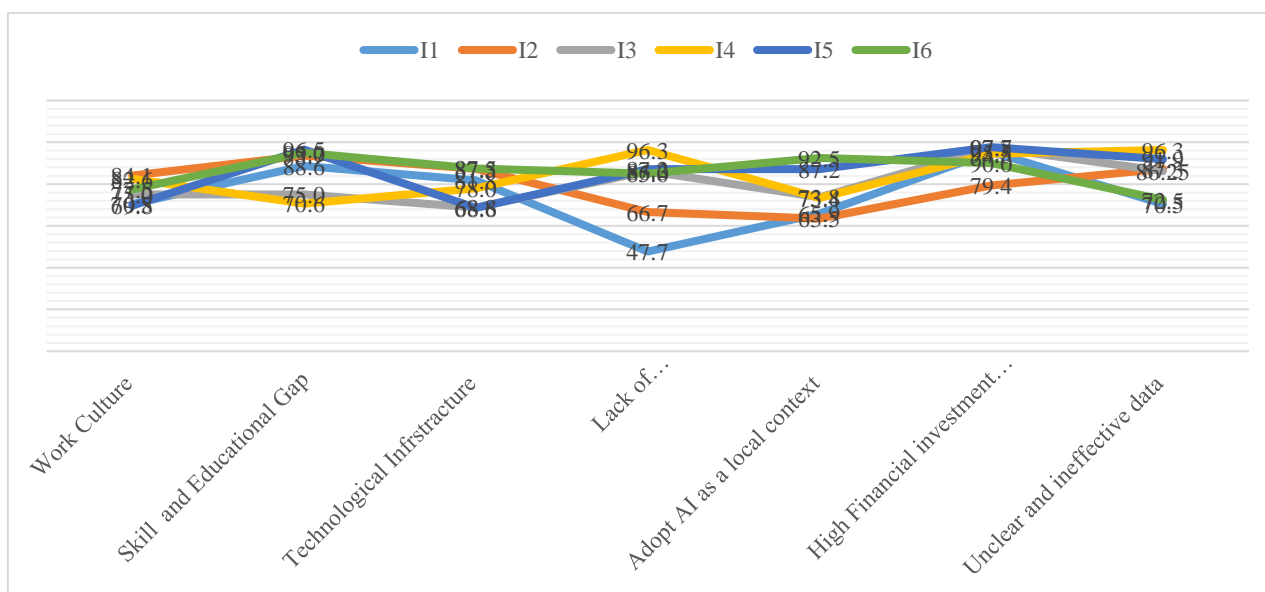


Figure 2. Overall challenges

5. CONCLUSION

The overall identified major challenges in Artificial intelligence implementation are work culture, skill and educational gap, technological infrastructures, lack of awareness and understanding, Adopt AI as a local

context, High Financial investment requirement and Unclear and ineffective data (Table 2, Figure 1 and Figure 2). For effective and successful Artificial intelligence implementation it needs more attention and effective plan from all industries stakeholders including government.

References:

- Aderibigbe, A. O., Ohenhen, P. E., Nwaobia, N. K., Gidiagba, J. O., & Ani, E. C. (2023). Artificial intelligence in developing countries: bridging the gap between potential and implementation. *Computer Science & IT Research Journal*, 4(3), 185-199.
- Bécue, A., Praça, I., & Gama, J. (2021). Artificial intelligence, cyber-threats and Industry 4.0: Challenges and opportunities. *Artificial Intelligence Review*, 54(5), 3849-3886.
- Demaidi, M. N. (2023). Artificial intelligence national strategy in a developing country. *AI & Society*, 1-13.
- Ertel, W. (2018). *Introduction to artificial intelligence*. Springer.
- Hasan, R., & Ojala, A. (2024). Managing artificial intelligence in international business: Toward a research agenda on sustainable production and consumption. *Thunderbird International Business Review*, 66(2), 151-170.
- Jaldi, A. (2023). Artificial Intelligence Revolution in Africa: Economic Opportunities and Legal Challenges. *Policy Cent. New South*. 1-23.
- Kshetri, N. (2021). Evolving uses of artificial intelligence in human resource management in emerging economies in the global South: some preliminary evidence. *Management Research Review*, 44(7), 970-990.
- Mhlanga, D. (2021). Artificial intelligence in the industry 4.0, and its impact on poverty, innovation, infrastructure development, and the sustainable development goals: Lessons from emerging economies?. *Sustainability*, 13(11), 5788.
- Morandini, S., Fraboni, F., De Angelis, M., Puzzo, G., Giusino, D., & Pietrantoni, L. (2023). The impact of artificial intelligence on workers' skills: Upskilling and reskilling in organisations. *Informing Science*, 26, 39-68.
- Moreira, P. A., Fernandes, R. M., Avila, L. V., Bastos, L. D. S. L., & Martins, V. W. B. (2023). Artificial intelligence and industry 4.0? validation of challenges considering the context of an emerging economy country using cronbach's alpha and the lawshe method. *Eng*, 4(3), 2336-2351.
- Nazeer, S., & Gil, Y. (2023). Embracing artificial intelligence challenges for public sector organizations in Pakistan. *Journal of Contemporary Studies*, 12(1), 35-52.
- Omoga, C. O. Challenges in Implementing Artificial Intelligence within Management Information Systems: Case of County Governments in Kenya. *International Journal of Advanced Research in Computer and Communication Engineering*, 12(9), 135-143.
- Paško, Ł., Mądział, M., Stadnicka, D., Dec, G., Carreras-Coch, A., Solé-Beteta, X., ... & Atzeni, D. (2022). Plan and develop advanced knowledge and skills for future industrial employees in the field of artificial intelligence, internet of things and edge computing. *Sustainability*, 14(6), 3312.
- Rožman, M., Tominc, P., & Milfelner, B. (2023). Maximizing employee engagement through artificial intelligent organizational culture in the context of leadership and training of employees: Testing linear and non-linear relationships. *Cogent Business & Management*, 10(2), 2248732.
- Thirunavukarasu, A. J., Elangovan, K., Gutierrez, L., Li, Y., Tan, I., Keane, P. A., ... & Ting, D. S. W. (2023). Democratizing artificial intelligence imaging analysis with automated machine learning: tutorial. *Journal of Medical Internet Research*, 25, e49949.
- Umurerwa, J., & Lesjak, M. (2021). AI implementation and usage: A qualitative study of managerial challenges in implementation and use of AI solutions from the researchers' perspective. <https://www.diva-portal.org/smash/get/diva2:1596232/FULLTEXT01.pdf>
- Werens, S., & von Garrel, J. (2023). Implementation of artificial intelligence at the workplace, considering the work ability of employees. *TATuP-Journal for Technology Assessment in Theory and Practice*, 32(2), 43-49.
- Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., ... & Zhang, J. (2021). Artificial intelligence: A powerful paradigm for scientific research. *The Innovation*, 2(4), 1-20
- Zhang, J., & Tao, D. (2020). Empowering things with intelligence: a survey of the progress, challenges, and opportunities in artificial intelligence of things. *IEEE Internet of Things Journal*, 8(10), 7789-7817.
- Zhou, X., Yang, Z., Hyman, M. R., Li, G., & Munim, Z. H. (2022). Guest editorial: Impact of artificial intelligence on business strategy in emerging markets: a conceptual framework and future research directions. *International Journal of Emerging Markets*, 17(4), 917-929.

Moti Melkamu

Ambo University,
Institute of Technology,
Ambo, Ethiopia.

motimelka.ait@gmail.com

ORCID: 0000-0002-9968-1293
