Environmental and social impacts of artificial intelligence and digital transformation on industrial management in Bangladesh

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ABSTRACT

Artificial Intelligence (AI) largely impacts on industrial management and builds the relationship between digital transformation and the environment and society. As a result, organizations across different sectors in Bangladesh are increasingly focusing on artificial intelligence, automation, and digitization in an effort to do more with less to improve productivity, operational efficiency, and enhance global competitiveness. AI technologies that help optimize supply chains also have the potential to make manufacturing processes smoother, reducing energy consumption and improving environmental benefits through reduced carbon emissions and less waste generation. However, industrial digitization comes with its own environmental challenges: electronic waste from outdated technologies continues to grow, while the increasing energy burden on industry from data centers and artificial intelligence infrastructure threatens to hinder the achievement of sustainable development goals. In addition, machines not only drive economic growth by improving industrial efficiency, but also bring challenges to employment. The paper encourages a smart approach to AI technologies and urges policymakers in Bangladesh to develop regulations that enable sustainability, equitable use of technology, and social and economic inclusion. It highlights the need for targeted deskilling initiatives and ethical AI policies to minimize negative impacts while ensuring equitable benefits from digital transformation.

Keywords: environmental impacts, social impacts, artificial intelligence (AI) and digital transformation, Bangladesh.

1.0 INTRODUCTION

The global transformation of industry by digitalization and artificial intelligence is fundamentally changing how our industry works, innovates and interacts with the world. Artificial intelligence and digital technologies are becoming use cases in Bangladesh, a developing economy with an emerging industrial base, to increase productivity, drive operational efficiency and enhance global competitiveness. However, these technological developments come with significant advantages but also substantial challenges, which relate in particular to environmental sustainability and social inclusion (Dillard et al., 2013). Artificial intelligence technology is increasingly being adopted across various industries in Bangladesh and helping optimize operations, enhancing supply chain and improving the manufacturing process. Digital

transformation is about the integration of advanced digital tools and technologies in the C-suite component of industrial management, which can evidently lead to the creation of value in terms of efficiency and/or costs or increased productivity (Butt, 2020). From an ecological view, such technologies can provide world with less waste and energy consumption via automation and smart systems. But the accelerated adoption of technology over the past few years has led to some difficult predicament, including a rapid increase in e-waste and the environmental costs of high energy consumption in data centers and AI infrastructures (Shi et al., 2021).

From a new perspective of society, even though driving industrial transformation through artificial intelligence will bring opportunities of economic growth and new job creation, there is still an industrial development risk that challenges the workforce, especially in labor-intensive industries. Job loss, digital divide and data privacy and security issues are becoming areas of concern (Boinapalli, 2020). This shifts of the AI and automation in Bangladesh, where significant part of the workforce is engaged in traditional industries, would cause inequality and create socioeconomic issues (Farahani, & Ghasemi, 2024). The paper attempts to present the corresponding environmental and social implications of the digital transformation (DT) and AI in the industrial management in Bangladesh, elucidate the potential benefits associated with its growth and their adverse effects, and the strategies to sustainably develop and include with the growth opportunities.

Both AI and digital technologies require large amounts of energy to run sophisticated algorithms, data centers, and cloud resources, making them inherently energy-intensive from an environmental standpoint. The use of energy-demanding systems can contribute to the increase of carbon emissions, particularly for countries, like Bangladesh, that mostly use non-renewable energy (Baul, et al, 2018). The proliferation of devices only adds to the environmental strain created by every other obsolete digital device that is consumed as electronic waste (Townsend, 2011).

AI-based digital technologies go from workplace to supreme to social bestowal, and vice poise are enormous and go age-old; the impacts of former have the more impacting. Although these tools may help boost productivity and limit human errors, they also risk job losses, especially at the lower levels. This trend has the potential to exacerbate income inequality if not matched with targeted workforce retraining and inclusion policies (Ahmed, et al., 2024). Additionally, the digital divide in Bangladesh—access to technology and digital literacy is still uneven—makes economic inequality even more serious (Badiuzzaman et al., 2021).

The study scope includes the exploration of the environmental and social consequences of digital transformation and artificial intelligence incorporation in the industrial management practices in Bangladesh. The rise of AI technologies and digital transformation have been adopted at a dazzling pace in industries with significant potential to improve operational efficiency, and result in cost and strategic decision savings (Ali et al., 2024). Nevertheless, the advancement also poses challenges, which require there is in-depth evaluation of the socio-economic and environmental aspects, especially in developing country like Bangladesh.

The study also examines the implications of AI-driven solutions and digital transformation on energy consumption, waste management, and carbon footprint in industrial processes. Through case specific studies and industry sectors the study will look for sustainable practice(s) as well as other technological interventions that will help mitigate adverse environment consequences while getting more eco-efficient (Munyoka, 2022). On the societal side, the paper investigates the effects of AI adoption on jobs, worker skill requirements and income inequality. Specific attention must be paid to labor-intensive industries where automation and digitalization can displace traditional jobs or necessitate retraining. The study also discusses how society perceives and accepts AI technologies in the industrial sector, focusing on ethical issues, fairness, and inclusion (Ameh, 2024).

However, the novelty of this study lies in its focused examination of the environmental and social impacts of artificial intelligence and digital transformation within the framework of industrial regulation in Bangladesh, a history that is severely missing in the literature. Compared to studies conducted in developed economies, this research explores the unique limitations of an emerging economy with weak digital infrastructure and heavy reliance on non-renewable power. It combines ecological concerns of carbon emissions and e-waste with social concerns of job loss and inequality, providing a comprehensive, two-way impact examination. Through the inclusion of case-specific proof from prime sectors of manufacture and textiles, the work offers policy relevance and applicability aimed at Bangladesh. The situational embedding of the analysis provides fresh insight into the global debate on sustainable digitalization and inclusive industrial transformation.

So, the environmental impacts of digital transformation and AI have been extensively discussed in literature globally, and numerous studies had highlighted the potential of the two technologies to simplify the consumption of energy, minimize waste, and enhance industrial sustainability. The majority of the available literature provides insights on research conducted on developed economies, which have developed advanced digital infrastructure and sustainability frameworks. But what stands out from this literature is the

paucity of work on how these technologies affect newly industrializing countries like Bangladesh, which are strongly digitalizing but are exceptionally exposed environmentally. This study fills that gap by critically examining the way digital transformation and AI are transforming environmental footprints in industry in Bangladesh. It aims to provide actionable insights into sustainable approaches, identify the most relevant environmental concerns, and propose solutions tailored to the country's developmental landscape thus posing a new and context-related contribution to international green industrialization debates.

2.0 RESEARCH METHODOLOGY

The research methodology adopted in the current study is qualitative and analytical in scope with the purpose of analyzing environmental and social impacts emerging as a result of the integration of AI and digital transformation (DT) within industrial management in Bangladesh. The study is based on an exploratory-descriptive design with the purpose of understanding the pros and cons of technological changes within the industrial sector of the country. In order to gather relevant data, secondary sources of information were mostly utilized. These include peer-reviewed articles, policy documents, government reports, industry whitepapers, and case studies relating to Bangladesh's industrial environment. Utmost caution was exercised while choosing literature published between 2018 and 2024 to ensure the research was as up-to-date and relevant as possible.

The data collected were thematically content-analyzed to identify significant trends and repeating patterns in the social and environmental consequences of AI and DT adoption. It encompassed the examination of themes like energy consumption, carbon footprint, and electronic waste on the environmental side, and employment loss, displacement of skills, and data privacy on the social side. Industry-specific research, particularly from the textile and manufacturing industries—sectors Bangladesh is well-populated in—were examined to contextualize broader theoretical structures using day-to-day illustrations.

A conceptual structure was developed to utilize the findings, integrating three essential dimensions: technological progress through AI and DT, environmental concerns (such as sustainability and waste minimization), and social dimensions (such as equity, labor dynamics, and ethical considerations). In a bid to authenticate the reliability of results, triangulation was employed through cross-verification of data from diverse reputable sources, including international publications on Industry 4.0. Through this research approach, a comprehensive and in-depth assessment of the opportunities and challenges fostered by AI and digital transformation in Bangladesh's industry was achieved.

3.0 ENVIRONMENTAL IMPACT

Environmental impacts of digital transformation and artificial intelligence in industrial management are multifaceted with significant scope for sustainability on the one hand, while facing pressing issues of energy consumption, e-waste, and carbon dioxide emission on the other.

3.1 Positive Contribution to Environmental Sustainability

AI solutions through boosting resource utilization, minimizing energy consumption, and decreasing waste generation in Bangladesh. Machine learning algorithms for predictive maintenance, for instance, can ensure that machines run optimally, in turn reducing energy use while also prolonging the life of equipment (Biswas et al., 2024). Moreover, IoT sensors can track live emissions and waste, facilitating adherence to environmental regulations and fostering sustainable practices (Ameh, 2024). Also, digital transformation is enabling the take-up of renewable energy solutions. Smart grid systems powered by artificial intelligence; optimization of energy distribution, integration of renewable energy sources (such as solar and wind) into the industrial processes (Boza, & Evgeniou, 2021). Moreover, digital tools enable supply chain transparency which helps companies to detect and avoid harmful environmental practices like over-packaging or inefficient transport routes (Astill et al. 2019). These technological advancements are aligned with the global sustainable development goals and help industries in Bangladesh move towards green operations without compromising economic growth.

3.2 Energy Efficiency

Energy efficiency is one of the basic components for sustainable industrial management, and for that, developing countries (Ahmad et al., 2021) like Bangladesh should take special consideration because the rapid industrialization is one of the major contributors to energy demand globally. Data driven by the revival of AI in terms of their degree of accuracy and suitability for business problems has started to play a critical role in digital transformation. AI-enabled predictive analytics, for example, can use historical data and operational trends to forecast energy demand, enabling industries to adapt their processes and minimize energy waste (Zong, & Guan, 2024).

Energy efficiency is crucial in Bangladesh, where industries like textiles and manufacturing dominate and the country still depends on non-renewable energy sources. AI technologies can help to reduce the amount of greenhouse gases produced and resource consumption across the globe. Energy-saving practices, in turn, assist well-operating cost-effectiveness in addition to economic sustainability of commercial operations. Digital transformation also facilitates real-time monitoring of organizational practices, enabling the pinpointing of inefficiencies and swift enactment of remedial action (Habib et al., 2016).

3.3 Waste Reduction

This has positive implications for preventing material waste during the production process through predictive analytics, and is consistent with circular economy (Mamudu et al., 2024). Waste reduction through industrial management is a prominent issue in industrialization, especially for a resource-constrained country like Bangladesh that is advancing rapidly in the field of industrial development using artificial intelligence, and digital transformation. AI can also highlight inefficiencies within manufacturing using predictive analytics, allowing businesses to maximize resource usage while reducing waste. Machine learning algorithms have the potential to monitor production trends, forecast demand, and detect anomalies to avoid overproduction and waste of materials. Digital tools like IoT devices and real-time monitoring systems enhance resource allocation and energy consumption, making sustainable industrialization possible (Sithole et al., 2024). Bangladesh has strong industries like textiles and apparel, with digital transformation having the potential to greatly reduce industrial waste impact on the environment. AI systems, for example, can identify efficiencies in dyeing processes and limit the consumption of water and chemicals. Moreover, blockchain technology supports traceability in supply chains and minimizes recycling, as well as responsible waste disposal (Centobelli et al., 2022).

3.4 Sustainability of Resource Management

With AI systems at the forefront, they allow for effective distribution of resources, preventing over-consumption and exhaustion (Onyeaka et al., 2023). Since industrial sector of Bangladesh is witnessing digital transformation and AI integration, sustainability in resource management is one of the key factors which will ensure the long-term environmental and economic stability of the nation. For manufacturing processes, AI-driven systems allow for real-time monitoring and predictive maintenance, thus optimizing resource allocation and reducing waste while enhancing energy efficiency. Machine learning algorithms, for example, can analyze large data sets and identify inefficiencies in energy consumption and aid the adoption of more sustainable practices (Ohalete et al., 2023). In addition, the implementation of digital transformation supports the introduction of circular economy principles which support the recycling of materials and lowers the environmental impact of the activities of industry significantly. Through Internet of Things (IoT) devices and AI analytics, businesses can improve their supply chains for minimal resource consumption and lesser impact on the natural ecosystem (Sallam et al., 2023).

3.5 High Carbon Footprint

The methods for training AI models and operating data centers require a large amount of energy most of which comes from fossil fuels. This study highlights and elaborates on the upcoming contribution – intensified by the introduction of AI and the digital transformation of industrial management – to energy

consumption and, therefore, to the carbon footprint of this phenomenon. Machine learning and deep learning (the basis of most artificial intelligence models) consume a lot of computing resources and often reside in high-energy data centers. Studies such as (Dayarathna et al, 2015) found that the carbon dioxide emissions generated by training an artificial intelligence model are equivalent to the emissions generated by five cars in their lifetime. As Bangladesh's industrial sector relies heavily on fossil fuels for electricity generation, carbon emissions from energy production add to environmental pressures. Emerging digital transformation technologies like Internet of Things (IoT) and block chain also need high quantities of energy to maintain constant data processing and storage. (Viriyasitavat et al. 2019), Bangladesh's dependency on non-renewable energy can be a hurdle for achieving sustainable digitalization.

3.6 Amount of Electronic Waste Generated

The fast pace of technological development has rendered many digital devices obsolete making electronic waste. In context, increasing the generation of electronic waste (e-waste) in Bangladesh is the rapid adoption of AI and digital transformation of industrial management. This also includes discarded electronic devices like computers, servers, and industrial sensors, which are essential in AI-powered processes. According to United Nations estimates, global e-waste amounts to 53.6 million metric tons and has an annual growth of 3-4% (Forti et al., 2020), resulting in taking a serious environmental challenge. Furthermore, the absence of well-established e-waste management systems in Bangladesh also contributes to the growing issue of e-waste in the country, as inappropriate disposal was then the most common method due to less awareness (landfill and informal recycling). Such practices emit heavy metals such as lead, mercury, and cadmium into the environment, contaminating the soil, water, and air (Dehkordi et al., 2024).

3.7 Environmental Deterioration

However, some rare earth elements used to produce AI hardware can impact ecosystems and local communities (Golroudbary et al, 2022). In Bangladesh, industrial management through the rapid implementation of AI and digital transformation has caused immense environmental degradation. AI and digital technology-optimized industrial sectors are notoriously energy-expensive, relying on high-performance compute infrastructure and data centers and tend to consume significantly more energy. Cloud computing, AI algorithms, and machine learning models have been widely used for industrialization, but this will also generate tremendous energy and be more carbon footprint efficient. The use of these technologies becomes widespread, which increases the need for electricity (commonly from fossil fuels), contributing to the worsening of air pollution and climate change (Kalair et al., 2021).

Furthermore, as the technology adoption rises, the phenomenon of electronic waste also accompanies it and is becoming an important environmental issue. The fast-paced replacement of devices in the AI and industrial sectors has resulted in e-waste, and improper recycling could result in the release of pollutants, such as lead and mercury, into the environment (Gahlot & Nautiyal, 2024). These pollutants negatively affect ecosystems and human health and present a significant challenge for sustainable industrial management.

4.0 SOCIAL IMPACTS

The association of AI and digital transformation with industrial management has significant social implications for Bangladesh. AI assisted technologies have beholden in improving industrial processes, productivity, and economic growth and have also raised concerns about the loss of occupations. While automation has removed low-skilled jobs, the technological revolution and the nature of jobs will increasingly depend on manual labor in industry for repair jobs, meaning a serious effort must be made to retrain workers who will become obsolete. Education and training are key to sustainable growth (Motorga, 2023) as a digitally transformed workforce needs new skills. Moreover, the inclusion of AI in decision-making processes has the propensity to reinforce bias that can be detrimental to social equity if not executed appropriately (Lainjo, 2020). AI boom has raised issues of data privacy and security. Most industries are creating huge volumes of data as they are becoming more and more digitalized and with that many personal and confidential information is vulnerable to cyber-attacks. To prevent that potential harms to individuals and communities are minimized; it is very important to have strong data protection laws (Soni et al., 2020).

4.1. Labor Dynamics

AI or digital transformation in industry management in Bangladesh has changed the relationship between people and technology. Across industries, AI technologies are maximizing production processes, accelerating operational efficiency, and enhancing decision-making. But these advancements do have massive environmental and social effects on the workforce. An environmental benefit of AI and industrial digital transformation is in reducing waste and energy and, at the same time, optimizing processes. One such example is AI-powered predictive maintenance that reduces machine malfunctions, causing fewer repairs and less resource usage. In the end, this enhances the carbon footprint of industrial work (Luo & Wang, 2022). Also, the environmental impact of AI hardware infrastructure, such as energy consumption and electronic waste, is an important concern for developing nations, such as Bangladesh (Fatema et al., 2021). On the social side, the rise of AI could cause job layoffs because of automation. Although the tech

industry might create some jobs for some people, many low-skilled workers might be jobless or have to deskill (Li, 2024).

4.2 Job Losses on Industrial Management

The impact of AI and digital transformation of industrial management has transformed the workplace and labor market dramatically, especially in developing countries including Bangladesh. One of such adverse impact is job displacement due technology advancements including automation and artificial intelligence. With industries adopting techno styles and digitized tools to automate, minimize expenses, and expand productivity, some job roles could vanish. In particular, workers conducting repetitive manual tasks are one of the most vulnerable jobs to replace, because AI can perform these much faster and more precise than people do.

In Bangladesh, where much of the workforce is employed in labor-intensive sectors such as textiles and manufacturing, digitalization risks being inordinately damaging. So, while AI and automation could become powerful forces for productivity growth, they also could create job losses and income inequality. Low skilled workers might find it challenging to move into new positions that encompass technological skill, despite the demand for a skilled workforce, resulting in a disparity between available positions and the talent that can fulfill them.

4.3 Unethical Use

AI and digital transformation in Bangladesh's industrial management create ethical extremes. A major concern is that automation will take away jobs, which could increase unemployment and inequality in this country with a big labor force. It is crucial to ensure a fair transition for affected workers via retraining accompanying new work opportunities and social safety nets (Conning & Kevane, 2002). Also, there are risks to data privacy and security. Our interest in these applications often leaves us with questions of just how is it that the information being used is being collected, stored and consumed with all the big data involved. To ensure that this does not get abused and that transparency is maintained, ethical guidelines need to be developed (Baron & Young, 2022).

In the field of industrial management, AI-driven decisions can also lead to bias or discrimination if algorithms are not properly designed or audited. This may have a particularly detrimental impact on marginalized groups and thus worsen current social inequities. Beyond usage, AI technologies can be polluting as well, such as in their energy use in data centers. To lessen these impacts, adopting sustainable practices and green technologies is necessary (Al-Emran & Griffy-Brown, 2023). The solution to these

ethical dilemmas lies in adopting a framework that encourages development whilst also ensuring social and environmental responsibility.

4.4 Bias in AI Systems

AI algorithms share and reinforce biases already present in the database, which may lead to discrimination in sectors such as recruitment and resource distribution (Modi, 2023). There are a considerable number of implications regarding the use of AI in industrial management; one of them is the risk of prejudiced outputs from AI systems. AI bias is often a result of 'unequal representations of various groups in data, mathematical imperfections in algorithms, or human prejudices, resulting in discriminatory decisions that have increasingly adverse effects on certain groups' (Schwartz et al., 2022). In Bangladesh, where AI is increasingly being integrated into industrial management decision-making processes, such biases can have the effect of exacerbating existing social disparities in the society. AI systems could inadvertently exclude certain demographics from the process, if the data used to train those models are biased toward particular groups.

Moreover, biased AIs might cause environmental wastages. When AI algorithms are trained using biased datasets focused on short-term economic benefits, they risk disregarding sustainable practices so crucial to minimizing the environmental impact of industry (Tripathi & Trigunait, 2024). A solid framework focused on fairness, accountability, and transparency of AI deployment is essential to address bias. In Bangladesh this means collecting inclusive data, implementing culturally sensitive algorithm design considerations, and policy interventions to achieve equitable AI outputs.

4.5 Privacy Issues

The pervasive use of digital tools and designing platforms raises the importance on data security and privacy (Kumar et al., 2019). In Bangladesh, the unprecedented significance of privacy and privacy risk in relation to the digital transformation and AI convergence with industrial management has raised serious concerns. With industries ramping up their use of AI, machine learning systems, and the Internet of Things, vast quantities of sensitive data are being collected, stored, and processed. These constitute employee records, operational, and consumer data. The lack of a robust data protection framework in Bangladesh not only fuels the potential chances of data breaches and misuse but may also provide the mean and could lead to illegal access, identity theft or surveillance (Babu, 2021).

Moreover, industrial data, if compromised, could cause massive reputational and financial losses. These risks are compounded by weak cyber security protocols and ambiguous regulatory frameworks. Data privacy from ethical perspective is also high, and in this context, AI models trained on ill-process or

unchecked databases can unintentionally discriminate and disadvantage stakeholders (Emma, 2024). Overcoming these challenges involves establishing robust data governance frameworks, ensuring transparency, and fostering collaboration across industry, government, and regulators.

4.6 Improving Workplace Safety

AI based monitoring systems help in monitoring hazardous environments (Dattamajumdar, 2021). In Bangladeshi industry, advanced AI & digital transformation in industrial management helps substantially to improve the safety of workplace. KI-powered security tech available in the market helps monitor and retain a watch on staff in real-time, helping to predetermine problems, decrease office accidents, and improve workplace safety. For instance, machine learning algorithms can be used to analyze historical accident data to predict high-risk scenarios, enabling managers to take preventive measures effectively (Ebrahimi, 2023). Moreover, wearable devices with AI sensors could be used to track workers' health and warn them about hazardous environmental conditions, such as elevated temperatures or toxic gas exposure. The digital transformation has enabled immersive safety training using virtual as well as augmented reality platforms to create hazardous scenarios for the workers without real-life risk (Yazdi, 2024). Moreover, automating machines and robotics minimizes human involvement in risky tasks, resulting in considerably reduced injury rates.

4.7 Improving Accessibility

Digital transformation has allowed remote work and teleportation which has been advantageous for marginalized communities (Musthafa et al., 2024). A significant improvement in accessibility in Bangladesh has been the adoption of AI and digital transformation of industrial management. They helped industries become more efficient using digital tools and AI based solutions which have given well-advanced technologies to the hands of small and medium-sized enterprises (SMEs). Such innovations allow businesses to access real-time data, optimize supply chains, and automate processes, filling the gaps of traditional management practices. For instance, AI-oriented predictive analytics can assist industries in predicting demand fluctuations and minimizing waste and resource inefficiencies (Zong & Guan, 2024).

Digital platforms also allow for remote work and training, so employees can access skills and information when there are no geographical barriers. This is especially relevant for developing countries like Bangladesh, where many rural regions do not have traditional industrial alleys. AI and digital transformation have the power to foster socioeconomic inclusion and decrease rural-urban disparity by democratizing access to tools and knowledge. (Chari, 2024).

5.0 POLICY RECOMMENDATIONS

The opportunity landscape of AI for the industrial management ecosystem in Bangladesh in industry and its impact in Bangladesh is playing a part in the adoption of industry 4.0 technologies, both in the manufacturing, service (such as health care), and finance sectors. The following policy recommendations are. Establish a mandatory framework for AI and digital technologies in manufacturing to assess the long-term environmental impact of digital transformation. This will provide insights into the resource consumption and emissions of AI systems. Push industries to implement energy-efficient AI technologies and digital infrastructure. Governments may offer incentives for companies to adopt green technologies in artificial intelligence systems.

Develop a mechanism to track the social impacts of AI deployment including job losses and income disparities. These policies should aim to both retrain the workforce and facilitate employment transformation in industries impacted by automation. Journal of Ethics work with the technocracy and the technologists alongside the government to actively work with the ethical and societal challenges that competition in AI presents to society, as well as to guarantee that all digital transformation provides economic and social value without sacrificing the health of the environment.

It is the responsibility of the government to create the right policies to ensure that any AI system uses energy efficiently. Most importantly, energy standards help to reduce the environmental and social damages caused by industrial management practices, especially from a developing country perspective like Bangladesh where the industry is expanding rapidly. AI and digital transformation in industry can improve energy efficiency when processes are optimized, waste is reduced and predictive maintenance is enabled. However, the absence of suitable energy standards can provoke resources consumption and contribute to an increase in energy demand.

AI driven solutions are on the rise in industries in Bangladesh including textiles, manufacturing, and power generation, among others. Yet the absence of firm energy regulations can stimulate wastage and environmental degradation. First, energy performance of industries can be improved by limiting its adverse effects on the environment through the help of strong energy regulations. Energy standards can also touch the social dimension as they can accelerate pollution free technologies which can improve public health and reduce energy poverty.

It is important that AI and digital transformation of Bangladesh's industries meet energy standards as it can help reduce the carbon footprint and promote sustainable development. The development of these

standards will not only require the collaboration of government and industry stakeholders, but also of technology developers. These rapid advancements in digital technologies and AI have revolutionaries' industrial management in Bangladesh. However, this transition has resulted in a greater amount of electronic waste (e-waste), which can have dire environmental and social consequences. In Bangladesh, the e-waste management system is not yet well developed; there is little infrastructure and awareness for proper disposal. Consequently, electronic waste is frequently not recycled appropriately or tossed into landfills, leaking damaging metals like lead, mercury, and cadmium into the atmosphere and polluting groundwater.

From a social point of view, there is a considerable number of workers in the informal e-waste industry of Bangladesh, particularly in urban areas like Dhaka. Many of these workers, including children, undertake dangerous work without proper protective equipment, such as burning wires and taking apart electronics, thereby risking exposure to toxic substances. Not enough regulation and enforcement compounds these issues and puts public health at risk. Additionally, due to a lack of regulations, e-waste recycling is illegal in many places, leading to low recovery rates of precious metals and components and hindering economic growth. To overcome these challenges, it would require collaborative responsibility among government policies and laws, industry reform, and public education. Building e-waste recycling infrastructure and encouraging sustainable practices helps curtail the negative effects of digital transformation on the environment and society in Bangladesh.

6.0 CONCLUSION

Technological advancement came as a mixed blessing in terms of sustainability; artificial intelligence and digital transformation in industrial management have been emerging as exciting opportunities on one hand but a challenge towards sustainability on the other hand. To harness these technologies successfully, we need a multifaceted strategy that includes an enabling policy environment, corporate responsibility, and inclusive strategies for the workforce. In Bangladesh, the use of AI and digital transformation in industrial management has a mixed impact on environment and society. The study examines opportunities and challenges in this rapidly changing landscape. On the other hand, he argues, AI and digital technologies can also double industrial productivity, streamline operations and significantly lower its environmental impact through better management of resources and efficiency. Artificial intelligence powered systems for energy optimization, waste reduction, and supply chain logistics are vital components of sustainable industrial practices, paving the way for green growth of industrial sector for Bangladesh.

But the arrival of these techs also matters some risks, especially in social effect. The rush towards a more intense use of AI could very well deepen inequalities, as some sectors might not move to the latest technology and lose jobs in the process. Moreover, the digital divide may marginalize some communities by limiting the availability of these innovations particularly in rural settings. Thus, both technologies and digital transformation in general, although they offer immense opportunities for industrial growth in Bangladesh, must be balanced with social inclusion and environmental sustainability. Future studies should pay attention to the importance of policy frameworks to balance and enhance the positive outcomes of AI from an environmental and social impact perspective.

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