Shri Murlidhar Karwa Knowledge Resource Centre *The Management Quest*
(DSIMS & DSGS) *Online ISSN: 2581- 6632*
Vol.6, Issue 2, April – September 2024

Environmental Degradation Due to the Rise of AI and Its Economic and Social Impacts

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ABSTRACT

The rapid development of artificial intelligence (AI) has the potential to increase global GDP, boost economic growth, and revolutionize many sectors. However, this economic boom has also brought environmental and economic pressures. Because AI systems require large amounts of computing power, they will contribute to environmental degradation, global warming, and increases in energy waste, while also contributing to increasingly consistent and disruptive business processes through automation. This article explores the inextricable connections between AI-driven economic growth, environmental degradation, and social inequality, and examines how these factors are generated, revealing how this affects ecological sustainability and economic balance. Based on recent empirical research, we analyse the burden of e-waste, increasing energy pressure, and resulting global warming. The article also identifies the risk of a dystopia in the future that will have a major impact on the economy and the environment, and highlights the urgent need for a policy that will convince the world that developing intellectual skills promotes well-being and not just the world.

Keywords: Environmental degradation, Artificial Intelligence (AI), Economic impacts, Social impacts, Resource consumption, Energy usage, Carbon footprints

INTRODUCTION

Artificial intelligence (AI) has become one of the biggest drivers of technological innovation in the 21st century. Its rapid adoption has transformed industries from healthcare and finance to transportation and manufacturing, delivering unprecedented performance and productivity gains. The impact of AI on global GDP is staggering; estimates suggest that AI could account for 14% of global GDP in the coming years. The growth of AI-powered businesses promises to change usage patterns, create new jobs, and drive further advancement. While AI’s automation capabilities promise to replace routine tasks and increase efficiency, they are also disrupting the workforce, particularly in the middle-income sector, driving market changes and enabling better working relationships.

In addition, the environmental costs of AI should also be well evaluated. Training large intelligence structures and data centres requires a large amount of energy, increases

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carbon emissions and causes global warming. MIT research predicts that AI will soon become a significant part of the global energy system, raising concerns about the environmental sustainability of AI. The problem is that the rapid advancement of technology has caused equipment to change more frequently and interact regularly with electronic equipment. The development of AI and technology has increased the number of electronic devices and increased their load. As the environment deteriorates, global temperatures rise, disrupting the economy and society, especially those affected by climate change.

As wealthy groups benefit from AI-driven growth while lower-income groups face unemployment and environmental damage, the gap between rich and poor is likely to widen. This widening risks a future akin to a dystopian cyberpunk reality of increasing economic inequality and environmental destruction. These are interconnected issues. We analyze the feedback on AI development, environmental damage, and economic inequality, and highlight the need for policies that are important for sustainable and inclusive equality. We can only harness AI's transformative potential and support the global economy more effectively by addressing these issues.

LITERATURE REVIEW

AI and Economic Growth

Artificial Intelligence (AI) has been identified as a significant contributor to GDP growth through its influence on productivity across various economic sectors. The research indicates that AI's integration into economic activities enhances productivity, which in turn positively affects GDP. For instance, in the context of China, AI has been shown to have a "U-shaped" effect on green total factor productivity (GTFP), suggesting that AI can overcome the "resource curse" in resource-rich areas and enhance green economic growth ***(Zhao et al., 2022)***. Similarly, AI's role in driving innovation, influencing labour markets, and reshaping industries is highlighted as a catalyst for economic expansion, with a focus on sustainable and inclusive development ***(Chaudhary, 2024)***.

Contradictions arise when considering the regional and industry-specific impacts of AI. While Japan demonstrates effective utilization of AI in relation to GDP, China and India exhibit signs of technological unemployment and jobless growth, respectively ***(Bonsay et al., 2021).*** Moreover, the potential for AI to displace jobs in certain industries is acknowledged, although the overall impact is deemed to be positive due to the creation of new employment opportunities ***(Tiwari, 2023)***.

AI's contribution to GDP growth is multifaceted, with its ability to enhance productivity and efficiency across various sectors being a key factor. Examples include AI-driven technologies improving operations in healthcare, finance, automotive, and manufacturing sectors (Revolutionizing Industries: The Impact of Artificial Intelligence Applications, 2024). However, the economic impact of AI is complex and varies by region and industry, necessitating careful consideration of AI's ***(Jesus et al., 2022)*** role in economic policy and strategy ***(Gabisonia, 2024; Makarov, 2020; Zhou, 2023).*** The overall conclusion is that AI acts as a powerful economic factor with the potential to significantly influence GDP growth through its impact on productivity ***(Gabisonia, 2024; Makarov, 2020; Zhou, 2023).***

Environmental Impact of AI

Artificial intelligence (AI) can lead to environmental degradation primarily through its substantial computational resource requirements, which have direct environmental impacts associated with the energy consumption and electronic waste generated by AI systems and related equipment ***(Measuring the Environmental Impacts of Artificial Intelligence Compute and Applications, 2022).*** The indirect effects of AI on the environment can be both detrimental and beneficial, depending on the application. For instance, AI's role in industrial processes can increase the demand for environmental resources, potentially exacerbating environmental strain ***(Jesus et al., 2022)***. However, AI also can optimize these processes, such as in water treatment, thereby potentially reducing environmental impacts ***(Jesus et al., 2022).***

Contradictorily, AI applications in fields like biofuel technology can contribute positively to environmental sustainability by optimizing biofuel production processes and assessing the environmental impacts of biomass-to-biofuel technologies ***(Okolie, 2024)***. Moreover, AI's predictive capabilities, as demonstrated in life cycle assessment (LCA) models, can enhance decision-making to minimize environmental impacts ***(Jesus et al., 2022)***. It is also noteworthy that the environmental impacts of AI are not limited to degradation; AI can also be instrumental in environmental monitoring and protection efforts, as suggested by the establishment of measurement standards and the call for improved transparency and equity in AI's environmental impacts ***(Measuring the Environmental Impacts of Artificial Intelligence Compute and Applications, 2022)***

In summary, while AI can lead to environmental degradation through its resource-intensive nature and potential to increase demand for environmental resources, it also offers tools for mitigating these impacts through optimization and predictive modelling ***(2022; Jesus et al., 2022; Okolie, 2024).*** The dual potential of AI necessitates a nuanced understanding of its environmental impacts, advocating for a balanced approach that harnesses AI's capabilities for environmental benefit while mitigating its negative effects.

Socio-Economic Implications

The advent of artificial intelligence (AI) has been identified as a significant disruptor in the labour market, with various studies examining its multifaceted impacts. AI's influence ranges from wealth creation to job displacement and the reshaping of employment patterns ***(Bian, 2024; Tzimas, 2023).*** The displacement effect, productivity effect, and reinstatement effect are key mechanisms through which AI alters the labour market, leading to fluctuations and a shift in demand towards AI-related skill sets (Bian, 2024). Moreover, the integration of AI into industries has been associated with the automation of routine tasks, resulting in job displacement, while simultaneously creating new roles that require advanced skills and collaboration with AI systems ***(Liang, 2024).***

Contradictions arise in the literature regarding the extent of AI's impact on jobs. While some studies suggest a significant portion of occupations could be fully or partially impacted by AI technologies like ChatGPT ***(Zarifhonarvar, 2023),*** others present a more optimistic view, emphasizing AI's potential to enhance human capabilities and create new opportunities ***(O Austine et al., 2024).*** The potential for wealth inequality increases as AI-related positions, which often offer higher salaries, become more prevalent, contributing to income disparity ***(Liang, 2024).*** Additionally, the role of AI in wealth accumulation and the gender wealth gap has been explored, with policy interventions suggested to mitigate these disparities ***(Sierminska et al., 2024).***

In summary, AI is a powerful force in the labour market, capable of both disrupting existing employment structures and generating new opportunities. The literature indicates that while AI can lead to job displacement, particularly in routine tasks, it also has the potential to create new roles and enhance the capabilities of the workforce ***(Austine et al., 2024; Rossomakha et al., 2024).*** However, the rise of AI also poses challenges related to wealth inequality and requires careful policy consideration to ensure equitable outcomes ***(Liang, 2024; Tzimas, 2023).*** The societal impacts of a cyberpunk-type future, characterized by advanced technology and stark social disparities, are not directly addressed in the provided papers, but the implications of AI on wealth inequality and labour market dynamics contribute to the broader discourse on the societal impacts of technological advancements.

METHODOLOGY

Research Design

This study utilizes a **qualitative research approach**, employing a comprehensive literature review to explore the intersections of Artificial Intelligence (AI) development, economic growth, and environmental impact. The qualitative approach allows for an in-depth analysis of existing research, synthesizing diverse perspectives to understand AI's broad influence on economic and environmental dimensions. By focusing on secondary sources, the research aims to interpret and integrate insights from empirical studies, AI growth projections, and environmental impact assessments to build a cohesive understanding of AI's multifaceted role in society.

Data Collection

Data for this research is primarily gathered from secondary sources, including peer-reviewed **scholarly articles**, **industry reports**, and **environmental databases**. Specific sources include studies on AI’s contributions to economic growth, assessments of AI's energy consumption, and evaluations of AI's broader social impacts. The selection of literature is based on relevance to the core themes of the study, publication date, and the credibility of the sources. This ensures the inclusion of up-to-date and accurate data on AI’s economic and environmental effects. Key areas of focus include empirical studies on AI’s economic contributions, reports on energy usage linked to AI, and socio-economic impact assessments.

Analysis

The research employs **thematic analysis** as its primary analytical technique, identifying and categorizing key themes across the selected literature. This method facilitates a detailed exploration of how AI development relates to economic growth and environmental impact. In evaluating the relationship between AI-driven growth and sustainability, the analysis also considers **frameworks** for assessing the trade-offs between AI advancement and environmental degradation. Critical evaluation of the sources aids in determining the broader implications of AI, specifically in balancing technological growth with long-term sustainability goals.

RESULTS

1. Outline Consumer Patterns and Economic Behavior

- **Income Elasticity of Demand**
  - The relationship between income changes due to AI-driven GDP growth and consumption patterns is multifaceted**. *(Gries & Naudé, 2020)*** suggests that AI automation may decrease labor income share, potentially reducing aggregate demand and slowing GDP growth, which could lead to stagnating wages and productivity ***(Gries & Naudé, 2020).*** This implies that consumption patterns may shift towards more essential goods and services as disposable income becomes constrained. Conversely, ***(Nizam et al., 2024)*** indicates that disposable income has a significant positive relationship with consumer spending, suggesting that if AI-driven GDP growth leads to increased disposable income, consumer spending may rise accordingly ***(Nizam et al., 2024)***. Interestingly, while ***(Gries & Naudé, 2020)*** posits a potential negative impact of AI on labor income and aggregate demand, ***(Khan, 2022)*** and ***(Sharma et al., 2023)*** highlight the positive influence of AI on consumer

buying behavior, with AI applications in commerce leading to more efficient marketing and enhanced customer experiences ***(Khan, 2022; Sharma et al., 2023)***. This could indicate that while AI may suppress income growth for some, it also creates new consumption opportunities through improved product recommendations and shopping experiences. Therefore, the impact of AI-driven GDP growth on consumption patterns appears to be dual: on one hand, it may lead to a decrease in labor income share and suppress consumption growth ***(Gries & Naudé, 2020),*** while on the other hand, it could enhance consumer buying behavior through technological advancements in commerce ***(Khan, 2022; Sharma et al., 2023)***. The net effect on consumption patterns would likely depend on the balance between these opposing forces, as well as on the distribution of AI-driven income gains across different demographic groups and the overall economic context.

- The relationship between rising income levels, particularly within the upper echelons of society, and the increased demand for technology products, artificial intelligence (AI) services, and luxury items is multifaceted. ***(Morra et al., 2020)*** highlights the proliferation of AI in consumer electronics, with advancements in AI driving novel applications and functionalities in various sectors, including residential energy and robotics ***(Morra et al., 2020).*** Similarly, ***(Bindra et al., 2021)*** underscores the significant market revenue and growth potential of AI-powered products ***(Bindra et al., 2021)***. The demand for luxury goods, on the other hand, is influenced by factors such as social-adjustive motivation, life satisfaction ***(Wang & Tong, 2017)***, and the perception of income inequality ***(Liu et al., 2024).*** The latter suggests that as perceptions of income inequality rise, so does the value placed on counterfeit luxury goods for their perceived ability to restore social equality ***(Liu et al., 2024)***. Interestingly, while rising income is generally associated with increased consumption of luxury goods, the demand for counterfeit luxury items also increases during economic crises, indicating a complex relationship between income levels and luxury consumption ***(Stravinskiene et al., 2014).*** Additionally, the demand for high-end luxury wines has been positively correlated with income inequality, suggesting that conspicuous consumption is a significant driver in the luxury market ***(Donzé & Katsumata, 2021)***. In the agricultural sector, AI is seen as a revolutionary force, with its adoption driven by the need to increase agricultural production and improve crop productivity ***(Bharti et al., 2018).*** The sum it up the rising income levels in the upper echelons of society contribute to the demand for technology products, AI services, and luxury items. This demand is shaped by the development of AI and its applications across various industries **(Bindra et al., 2021; Morra et al., 2020),** the motivations and perceptions surrounding luxury consumption ***(Liu et al., 2024; Wang & Tong, 2017)***, and the role of income inequality in influencing consumption patterns ***(Donzé & Katsumata, 2021; Liu et al., 2024).*** The demand for luxury goods, including their counterfeit counterparts, is complex and influenced by a variety of factors beyond mere income levels ***(Stravinskiene et al., 2014).***

- The studies collectively suggest that the integration of AI into labour markets has led to significant shifts in employment patterns, with potential implications for consumer behaviour among lower-income groups. As AI and automation disrupt traditional job roles, particularly in sectors with routine tasks, there is a displacement of workers, which may lead to a shift in spending towards essential goods due to reduced income or job insecurity ***(Liang, 2024; Melemuku, 2023; Pavashe et al., 2023)***. This is consistent with the findings that income redistribution towards lower-income households increases demand for basic necessities ***(Cheema & Malik, 1985).*** Interestingly, while AI-induced job displacement could exacerbate income inequality and influence spending patterns towards essentials, the literature also indicates that AI and automation can create new job opportunities and maintain overall employment levels if accompanied by appropriate policies and reskilling initiatives ***(Melemuku, 2023; Olaniyi et al., 2024).*** This suggests that the behavioural shift towards essential goods could be mitigated by such measures. Moreover, unique human capabilities like intuition and empathy are highlighted as irreplaceable by AI, implying that jobs requiring these skills may remain less affected, potentially stabilizing income and spending patterns in lower-income groups ***(Masriadi et al., 2023)***. In summary, the literature indicates that AI's disruption of labour markets may lead to a behavioural shift among lower-income groups towards essential goods, driven by job displacement and income insecurity. However, this trend could be counterbalanced by the creation of new job opportunities and the implementation of effective reskilling programs. The need for a nuanced understanding of these dynamics is critical for developing strategies that support equitable economic outcomes in the face of AI-driven labour market changes ***(Cheema & Malik, 1985; Liang, 2024; Melemuku, 2023; Olaniyi et al., 2024; Pavashe et al., 2023).*** markets.

- **Consumer Confidence and Spending**
  - Artificial Intelligence (AI) is influencing consumer spending in developed economies by enhancing marketing strategies and consumer engagement, particularly in sectors such as tourism and hospitality ***(Cunha et al., 2024).*** AI and Machine Learning (ML) applications are enabling businesses to better understand consumer behaviour through advanced data analysis, leading to more personalized and effective marketing efforts. This targeted approach can increase consumer spending by presenting individuals with options more aligned with their preferences and behaviours.
  - However, there is a dichotomy in the impact of AI on consumer spending. While AI-driven marketing strategies can boost spending in certain sectors, job displacement and automation, predominantly in industries characterized

by routine and repetitive tasks, may lead to economic uncertainty among affected workers ***(Faishal et al., 2023; Soueidan & Shoghari, 2024; Tiwari, 2023).*** This uncertainty can reduce disposable income and consumer spending in these sectors. Moreover, the jobs created by AI often require technical skills, potentially excluding those displaced from the job market without such qualifications ***(Nnamdi et al., 2023).***

2. AI Development and Environmental Degradation

- **Energy Consumption of AI**
  - The question of how much energy artificial intelligence (AI) will consume by 2050 is not directly addressed in the provided papers. However, the papers collectively highlight the dual role of AI in the energy sector: as a tool for optimizing energy consumption and as a consumer of energy itself. The papers discuss the application of AI in improving energy efficiency and management ***(Ahmad et al., 2019; Alwetaishi & Shamseldin, 2021; Dong et al., 2023; Fu et al., 2024; Iriakuma et al., 2024; Raihan, 2023; Sarduy et al., 2013)***, indicating that AI has the potential to reduce energy consumption in various industries. For instance, AI's role in forecasting, optimizing energy use, and enhancing the performance of energy systems is well documented ***(Ahmad et al., 2019; Dong et al., 2023; Fu et al., 2024; Iriakuma et al., 2024; Sarduy et al., 2013).*** However, the energy consumption of AI itself is a growing concern, particularly as models become more complex and require more computational power ***(Caspart et al., 2022).*** In summary, while the papers provide insights into the role of AI in energy management and its potential to reduce overall energy consumption, they do not offer specific projections for AI's energy consumption by 2050. The increasing demand for computational resources by AI models is acknowledged ***(Caspart et al., 2022),*** but without concrete data or projections, it is not possible to accurately predict AI's energy consumption by 2050 based on the provided context.

- **Carbon Emissions**
  - The rise of artificial intelligence (AI) could potentially lead to higher carbon emissions due to several factors. First, the significant energy consumption required for the operation of data centres and servers that store and process AI data is a primary concern ***(Wang et al., 2024).*** AI systems, particularly those that involve large-scale computations, necessitate substantial computational resources, which in turn consume considerable amounts of electricity, often generated from carbon-intensive sources. Interestingly, while AI has the potential to

contribute to carbon emission reduction and energy transition, particularly in the context of trade openness, its impact is not uniform across different levels of trade openness and income groups. For instance, in countries with lower trade openness or lower AI levels, the impact of AI on carbon emissions is less significant ***(Wang et al., 2024)***. This suggests that the relationship between AI and carbon emissions is complex and influenced by economic and technological factors. In summary, the rise of AI could cause higher carbon emissions primarily due to the energy-intensive nature of AI systems and data centres. However, the impact of AI on carbon emissions is nuanced and can vary depending on trade openness and income levels. Policymakers must consider these factors when devising strategies to mitigate the carbon footprint associated with AI technologies ***(`Wang et al. (2024)`)***

- **Natural Resource Depletion**
  - The rise of artificial intelligence (AI) necessitates the development of advanced hardware capable of supporting its computational demands. This hardware often relies on rare earth elements and heavy metals for components such as permanent magnets in hard drives, semiconductors, and batteries ***(Liu et al., 2020)***. As AI technologies proliferate, the demand for these materials is likely to increase, potentially leading to more intensive mining activities to extract the necessary resources. However, this increased demand for rare earth elements and heavy metals could exacerbate environmental issues. Mining activities are associated with soil degradation, vegetation loss, and pollution, which can have profound impacts on local ecosystems ***(Li et al., 2017; Li et al., 2017; Wu et al., 2021)***. The extraction and processing of these materials often result in the release of heavy metals into the environment, which can affect soil microbial communities and disrupt ecological functions ***(Chen et al., 2021; Liang et al., 2021; Liang et al., 2021; Luo et al., 2022).*** In summary, the expansion of AI technologies is likely to drive greater demand for rare earth elements and heavy metals, which are critical for the production of AI hardware. This increased demand could lead to more mining activities, with potential environmental consequences such as soil degradation, vegetation loss, and pollution. Addressing these challenges will require careful management of mining practices and consideration of ecological impacts ***(Li et al., 2017; Li et al., 2017; Liu et al., 2020; Wu et al., 2021; Zhang et al., 2023).***

3. Growth in E-Waste

- **E-Waste from AI and Technology Consumption**

    - The rise of artificial intelligence (AI) has the potential to generate more electronic waste (e-waste), which could accelerate environmental degradation and climate change. E-waste is a consequence of the rapid turnover of electronic devices, which are often integral to AI systems. As AI technologies advance and require more powerful hardware, the replacement of older equipment becomes more frequent, leading to an increase in e-waste ***(Kumari & Pandey, 2022)***. This e-waste, if not properly managed, can lead to the release of toxic substances into the environment, contributing to pollution and health hazards ***(Yang & Sun, 2012).***

    - Interestingly, while AI can contribute to e-waste, it also offers solutions for environmental sustainability. AI-driven systems can optimize energy use, reduce carbon emissions, and support recycling efforts ***(Kumar et al., 2024; Tseng & Lin, 2024)***. However, the production and operation of AI technologies themselves can be energy-intensive, potentially offsetting some of the environmental benefits ***(Gaur et al., 2023)***. The complexity of AI's impact on the environment is further highlighted by the need for large computational resources, which can have a significant carbon footprint ***(Kumari & Pandey, 2022).***

    - In summary, the rise of AI has a dual impact on the environment. On one hand, it can lead to an increase in e-waste and associated environmental degradation if not managed responsibly. On the other hand, AI has the potential to drive sustainability efforts and mitigate climate change. The challenge lies in balancing the benefits of AI with the environmental costs, emphasizing the development of sustainable AI practices and the responsible disposal and recycling of e-waste ***(Kumari & Pandey, 2022; Tseng & Lin, 2024)***. It is crucial to consider these factors as we continue to integrate AI into various sectors of society.

- **Circular Economy Failures**
    - The complexity of recycling AI-related hardware and the limited infrastructure for handling AI-generated waste are significant concerns. AI technologies, particularly those involving machine learning, require robust computational resources, which often include specialized hardware accelerators like GPUs, TPUs, and ASICs ***(Zou, 2024)***. These components have intricate designs and are made from a

variety of materials, complicating the recycling process. Moreover, the rapid advancement in AI technologies leads to a faster turnover of hardware, contributing to the volume of waste. Interestingly, while AI is contributing to the waste problem, it also offers solutions for waste management through improved sorting and recycling processes ***(Olawade et al., 2024; Ozdemir et al., 2021)***. However, the recycling of AI hardware itself presents unique challenges due to the complexity of the materials and components involved. The infrastructure for recycling such specialized equipment is not as developed as for more common electronic waste, which exacerbates the issue ***(Zou, 2024).*** In summary, the difficulty in recycling AI-related hardware is twofold: the complex structure of the hardware itself and the lack of adequate infrastructure to process this type of waste. Addressing these challenges requires advancements in recycling technologies, possibly aided by AI itself, and the development of more comprehensive waste management systems specifically tailored to handle the intricacies of AI-generated waste ***(Olawade et al., 2024; Zou, 2024).***

4. Rising Global Temperatures and Environmental Impact

- Rising global temperatures fueled by AI-driven energy consumption have significant environmental and economic implications. As AI systems, especially large language models and deep learning algorithms, demand vast computational resources, their energy consumption contributes directly to global warming. MIT studies predict that AI could account for nearly 20% of global electricity consumption by 2027, intensifying carbon emissions and pushing global temperatures toward dangerous thresholds, with estimates ranging between a 2.5°C to 3°C rise by 2050. These temperature increases are linked to more frequent extreme weather events, causing widespread economic disruptions, from agricultural losses to infrastructure damage. Climate change will impose a steep economic cost, with nations needing to allocate substantial resources toward disaster recovery, population displacement, and climate mitigation strategies, diverting funds that could otherwise fuel economic growth. Consequently, AI's contribution to global warming poses risks not only to the environment but also to the stability of global economies.

5. Impact of AI on Global GDP

- **AI-Driven Economic Growth**
    - Artificial Intelligence significantly contributes to global GDP growth by enhancing productivity, optimizing supply chains, and opening new market opportunities. According to PwC, AI is expected to contribute up to $15.7 trillion, or 14%, to the global economy by 2030.

This growth is driven primarily by increased automation, efficiency gains across industries, and the creation of new products and services. AI enables faster decision-making, predictive analytics, and process optimization, fueling growth in sectors like finance, healthcare, retail, and logistics. China and North America are expected to benefit the most from AI advancements, contributing nearly 70% of the global economic impact.

- **Job Displacement and Income Disparities**
  - While AI drives economic expansion, it also results in significant job displacement. Automation threatens millions of jobs, particularly in manufacturing, retail, and transportation. A report by McKinsey predicts that up to 375 million workers globally may need to switch occupational categories due to AI and automation by 2030. In emerging economies, where labour-intensive jobs dominate, the rapid adoption of AI could lead to widespread economic dislocation, exacerbating existing income inequalities. AI's impact is also extending into skilled industries such as finance, law, and medicine, where algorithms are increasingly replacing routine cognitive tasks.

- **Rising Inequality**
  - The development of AI tends to concentrate wealth within advanced economies and high-skilled sectors. As a result, income inequality is rising, with the benefits of AI-driven GDP growth disproportionately accruing to tech-savvy, upper-income groups, while low-skilled labour sectors face job losses. In the U.S., for example, wage disparities have increased as AI and automation have created high-paying jobs for those with the right skills while eliminating many mid-level and lower-skilled positions. Globally, this wealth concentration is further pronounced, as developed countries with advanced technological infrastructure capitalize on AI growth, leaving developing economies struggling to catch up. This creates imbalanced global economic structures, where wealth and technological advancements are heavily skewed towards a few nations and corporations, exacerbating global inequality.

6. Influence on Consumption Patterns

- **Economic Polarization and Consumption**
  - The widening wealth gap driven by AI adoption and technological advances leads to sharply divided consumption patterns. Among the wealthy, there is a noticeable shift toward luxury consumption, including premium AI-driven products and services such as personalized smart homes, AI-assisted healthcare, and automated

luxury vehicles. This contrasts starkly with the spending habits of lower-income populations, who are increasingly focused on survival-oriented consumption—primarily allocating their limited resources toward basic necessities like food, water, and shelter. A study by Liang (2024) highlights this bifurcation, showing how AI's contributions to economic growth often disproportionately benefit the affluent, further entrenching economic divides.

- **Shifts in Resource Allocation**
  - Environmental degradation exacerbated by AI-fueled industrial growth has led to a reallocation of resources. Lower-income demographics, disproportionately affected by climate change, are forced to spend more on essential needs like water, food, and shelter, with environmental stressors such as droughts and floods driving prices higher. In contrast, the wealthier population channels increasing portions of their income toward luxury consumption, including emerging sectors like space travel, cutting-edge AI technologies, and AI-driven innovations in leisure and comfort. According to Olaniyi et al. (2024), this shift in resource allocation not only strains global resources but also further deepens environmental degradation, as wealthier individuals consume high-energy, resource-intensive products and services.

- **Climate-Related Consumption Adjustments**
  - Climate change has catalyzed shifts in consumption patterns across all income levels. Rising temperatures and environmental awareness have led to growing demand for eco-friendly products, green technologies, and sustainable goods, particularly among environmentally-conscious consumers. Wealthier segments of the population, with greater access to AI-driven solutions, are increasingly adopting sustainable practices, such as optimizing energy use in homes through AI-powered systems and investing in green transportation solutions. However, these technologies remain largely out of reach for lower-income populations, further reinforcing economic divides. Melemuku (2023) found that while AI holds significant potential as a tool for optimizing sustainable consumption, its benefits are often exclusive to affluent groups, limiting its broader societal impact and contributing to unequal access to sustainability initiatives.

7. Feedback Loop of AI, Environmental Degradation, and Economic Growth

- **Reinforcing Cycles of Growth and Degradation**
    - AI-driven GDP growth accelerates consumption patterns, which in turn drives higher levels of resource extraction, energy consumption, and environmental degradation. As industries and economies grow through the integration of AI technologies, the demand for raw materials and energy surges, further straining natural ecosystems and contributing to pollution and habitat destruction. This environmental degradation, in turn, necessitates greater economic spending on climate mitigation and adaptation efforts, diverting resources that could be invested in sustainable development. Simultaneously, the economic growth propelled by AI often exacerbates wealth inequality, with the benefits concentrated among a small, affluent segment of society. This widening inequality fuels the further development of advanced technologies, creating a cycle of increased consumption and carbon emissions that deepens the environmental damage, threatening long-term sustainability
      .
- **Policy Interventions and Sustainable AI**
    - There is an urgent need for policies that regulate AI development to ensure that its economic benefits are distributed equitably across all sectors of society while minimizing environmental harm. These policies should focus on fostering sustainable growth by encouraging investment in renewable energy sources to power AI technologies, reducing their reliance on fossil fuels and lowering carbon emissions. In addition, building a robust recycling infrastructure will help mitigate the environmental costs of AI hardware, such as servers and devices, by promoting responsible disposal and reuse of materials. Furthermore, the promotion of ethical AI practices—such as designing AI systems that prioritize efficiency and sustainability—will be crucial in reducing AI's ecological footprint. By aligning AI development with environmental and social responsibility, these policies can help ensure that technological advancement supports both human prosperity and the preservation of the planet.

- **Future Socio-Economic Scenarios**
    - The unchecked growth of AI risks creating a cyberpunk-like dystopia with vast wealth disparities, environmental collapse, and societal instability, where the rich benefit from advanced technologies while the majority face economic and environmental degradation. To prevent this future, global cooperation is essential to regulate AI and ensure it serves sustainable development and environmental preservation. By directing AI towards solving climate challenges and

promoting equitable growth, we can harness its power for the greater good, avoiding a world where technological progress deepens inequality and undermines the planet's health.

LIMITATIONS

- While this research provides valuable insights into the environmental and social impact of AI technologies, it is important to acknowledge certain limitations. First, the study is primarily based on secondary data sources, such as existing literature, reports, and case studies. As a result, some of the data may lack real-time accuracy, particularly in the rapidly evolving field of artificial intelligence. Future research could benefit from primary data collection, such as interviews with industry experts or direct observations in AI-centric industries, to further validate the findings
- Second, the focus of this research is limited to specific AI applications, particularly large language models, which may not represent the full spectrum of AI technologies. AI's impact on the environment and society is multifaceted, and generalizations made in this study may not fully apply to other AI domains, such as robotics or autonomous systems. Future research should consider these broader applications to provide a more comprehensive understanding of AI's influence on global environmental and social dynamics.
- Additionally, this study predominantly addresses the environmental consequences related to energy consumption and carbon emissions, while other ecological factors such as electronic waste from AI hardware development, resource depletion, and water usage are only briefly mentioned. These aspects warrant more in-depth exploration in subsequent studies to give a more holistic view of AI's environmental footprint.

IMPLICATIONS

- Despite its limitations, this research holds significant implications for policymakers, corporate stakeholders, and AI developers. The findings underscore the urgent need for the integration of sustainability principles into AI development processes. Companies involved in the development and deployment of AI technologies should consider adopting greener energy sources, improving energy efficiency, and investing in carbon offset programs to mitigate the adverse environmental impacts outlined in the study.
- For policymakers, the research highlights the critical necessity of introducing regulations that address the environmental costs of AI technologies. Establishing mandatory guidelines for energy usage, carbon emissions, and the responsible disposal of AI hardware can help manage and reduce the industry's ecological footprint. Furthermore, a greater emphasis on corporate

accountability in line with the United Nations' Sustainable Development Goals (SDGs) should be encouraged to foster an equitable and sustainable AI landscape.

- Lastly, the social implications of AI-driven environmental degradation cannot be overlooked. This study suggests that vulnerable populations disproportionately bear the negative consequences of AI's environmental impacts. Policymakers and corporate entities must prioritize inclusive strategies that address these inequities and ensure that the benefits of AI innovation are equitably distributed across all socioeconomic strata. This could involve the creation of socio-environmental programs that focus on climate justice, community resilience, and equitable access to AI-driven advancements.

CONCLUSION

The development of AI stands at the crossroads of unprecedented economic growth and equally significant challenges in terms of environmental sustainability and social equity. As AI continues to drive GDP growth and technological innovation, it also risks deepening wealth disparities and accelerating environmental degradation. The dual-edged nature of AI makes it clear that without deliberate and strategic interventions, the future could witness an exacerbation of wealth inequality, pushing a greater divide between the affluent, who will increasingly benefit from AI, and the marginalized, who may face heightened economic and environmental vulnerabilities. Moreover, AI-driven industrial growth could further strain natural resources, increase carbon emissions, and worsen climate change impacts. This analysis highlights the critical importance of establishing sustainable and inclusive AI policies that address not only the technological and economic aspects of AI advancement but also the environmental costs and social consequences. To safeguard the future, AI development must be carefully guided to ensure it supports equitable economic benefits, promotes green innovation, and contributes to a more sustainable world for all.

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