

HOW TO INCREASE THE FUNCTIONS OF ARTIFICIAL INTELLIGENCE IN BUSINESSES

Bulent Eker¹ [0000-0003-3227-050X], Mustafa Cem Aldag^{2,3} [0000-0001-7224-2277]

Abstract

Artificial intelligence (AI) is a revolutionary technology with far-reaching implications for humanity across all disciplines. Businesses must enhance their AI capabilities to ensure customer satisfaction and gain a competitive advantage. Key measures to improve AI utilization include: AI Integration and Application Areas; Automation is increasingly used in customer service and production processes, with AI also enhancing prediction and data analytics for forecasting and strategic planning. Additionally, AI helps personalize customer experiences and supports quality assurance systems. AI Investment in Technological Infrastructure; Organizations are investing in cloud computing, big data solutions, and high-performance processors, alongside procuring or developing AI software and related technologies that suit their specific needs. AI Competencies and Training Programs; Businesses are focusing on employee development by implementing training programs that enhance AI-related skills, while also recruiting AI experts and upskilling their existing workforce. Data Management; Effective data management includes the collection and analysis of large datasets, as well as ensuring robust data privacy and security measures. AI Strategy and Vision; Developing a comprehensive AI strategy aligned with organizational goals is crucial, with a focus on fostering leadership buy-in and promoting cultural transformation across the company. Partnerships and Interconnected Network; Collaboration with universities, research centers, and tech companies is essential, alongside forming partnerships with innovative AI startups to leverage new opportunities. Evaluation and Enhancement of AI Performance; Continuous monitoring and evaluation of AI applications ensures they perform optimally, while implementing ongoing improvement processes helps maintain and elevate performance. Enhancing AI capabilities requires not only technological investments but also strategic planning, competence development, and cultural transformation. By focusing on these areas, organizations can fully leverage AI benefits and achieve long-term competitive advantages. This approach provides a comprehensive overview of AI's impact on organizations and offers recommendations for current and future actions.

¹ Tekirdag Namik Kemal University, Turkey, beker@nku.edu.tr

² Bandirma Onyedi Eylul University, Turkey, maldag@bandirma.edu.tr

³ AINTELIA Artificial Intelligence Technologies Company, caldag@aintelia.com

Keywords: *artificial intelligence, business innovation, digital transformation.*

1. Introduction

The advent of Industry 4.0 has marked a significant turning point in the landscape of industrial innovation and sustainability. This new industrial paradigm, characterized by the integration of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics, offers unprecedented opportunities for enhancing sustainable practices across various sectors. Ghobakhloo et al. (2021) emphasize that while the potential for sustainable process and product innovation is substantial, it is contingent upon the effective implementation of foundational Industry 4.0 functions, which are critical for achieving sustainable competitiveness in today's market. This assertion is supported by Awan (Awan, 2021), who highlights that the Sustainable Development Goals (SDGs) provide a conceptual framework that can guide manufacturing firms in leveraging Industry 4.0 technologies to foster innovation and sustainability.

Moreover, the role of multi-criteria decision analysis (MCDA) in identifying sustainable investments and projects is crucial for enhancing competitiveness and resilience in the face of evolving industrial challenges. Ali et al. (2023) note that stakeholder engagement is essential for aligning various SDGs, thereby facilitating a more integrated approach to sustainability. This integration is further reinforced by Bilderback (Bilderback, 2023), who discusses the importance of training and development programs that incorporate SDGs into organizational practices, thereby promoting long-term sustainability objectives.

The relationship between innovation and sustainability is multifaceted, as evidenced by Maier et al. (Maier et al., 2020), who conducted a bibliometric review that elucidates the intellectual structure and knowledge development directions in this field. This relationship is not only theoretical but also practical, as seen in the application of sustainable AI, which aims to align technological advancements with ecological integrity and social justice (Wynsberghe, 2021). The synthesis of these insights underscores the critical need for organizations to adopt innovative practices that are inherently sustainable, as they navigate the complexities of modern industrial ecosystems (Schilirò, 2019).

In conclusion, the intersection of Industry 4.0, innovation, and sustainability presents a dynamic landscape that necessitates a comprehensive understanding of the underlying principles and practices. As industries strive to meet the challenges posed by climate change and resource scarcity, the integration of sustainable practices into the core of industrial innovation will be paramount. This integration not only aligns with global sustainability goals but also enhances the overall resilience and competitiveness of industries in an increasingly complex world.

Innovation and sustainability are increasingly interconnected in contemporary applications, as organisations and industries strive to tackle present difficulties and avert future ones. Sustainability aims in creative applications encompass five principal domains: Environmental Preservation, Economic Viability, Social Sustainability, Business Sustainability, and Cultural Heritage Preservation. Seebode et al. (2012) Flores et al. (2018) Innovative techniques are crucial for attaining sustainability objectives, as they provide holistic development from the outset that meets the requirements of both current and future generations. The amalgamation of innovation and sustainability is apparent in these areas, since the adoption of new solutions is essential for achieving enduring sustainability objectives (Seebode et al., 2012).

2. Methodology

This study used a systematic review methodology to conduct a comprehensive search of relevant literature concerning the intersection of innovation, sustainability, and the Sustainable Development Goals (SDGs). The systematic review process involved several key stages, including the formulation of research questions, the establishment of inclusion and exclusion criteria, the execution of a literature search, the selection of pertinent studies, and the synthesis of findings.

Initially, the research questions were designed to explore how organizations can effectively integrate sustainability objectives with innovative practices, particularly in the context of the SDGs. The inclusion criteria encompassed peer-reviewed articles, books, and case studies published within the last decade that addressed themes of sustainability, innovation, and the SDGs. Exclusion criteria were applied to filter out studies that lacked empirical evidence or were not directly relevant to the research questions.

A comprehensive literature search was conducted across multiple academic databases, including Scopus, Web of Science, and Google Scholar. The search utilized a combination of keywords such as "sustainability," "innovation," "Sustainable Development Goals," and "systematic review." This approach ensured a broad capture of relevant literature, yielding a substantial number of articles for initial screening.

The selected studies were then analysed using qualitative synthesis methods, allowing for the identification of common themes and insights. For instance, Ghobakhloo et al. Ghobakhloo et al. (2021) provided a detailed examination of the functions of Industry 4.0 that support sustainable innovation, highlighting the importance of leveraging technological advancements to enhance sustainability outcomes. Similarly, Mhlanga Mhlanga (2021) explored the impact of artificial intelligence on poverty alleviation and infrastructure development within the framework of the SDGs, emphasizing the role of innovation in driving sustainable development in emerging economies.

Furthermore, the research incorporated findings from Bilderback (Bilderback, 2023), who reviewed the integration of training for organizational sustainability with the SDGs, identifying best practices and challenges faced by organizations in this endeavour. This literature review also included insights from Ali et al. (Ali et al., 2023), who discussed the implications of sustainability growth and its relevance to the SDGs, reinforcing the necessity for organizations to adopt innovative practices that align with sustainability goals.

The synthesis of these findings revealed a complex interplay between innovation, sustainability, and the SDGs, suggesting that organizations must adopt a holistic approach to effectively integrate these elements. This systematic review not only contributes to the existing body of knowledge but also provides practical implications for organizations seeking to enhance their sustainability practices through innovative strategies.

The synergy between innovation and sustainability has been extensively studied in the literature. Research has found that sustainable innovation, encompassing both environmental and social considerations, is positively related to firm performance. The integration of sustainability as an innovation objective has been shown to enhance innovation efficiency, with eco-innovation and green innovation emerging as key approaches. (Shin et al., 2018)

The relationship between innovation and sustainability has been further examined, with studies demonstrating a strong, positive correlation between the two. These studies highlight the importance of incorporating sustainability considerations into the innovation process, as it enables organizations to develop solutions that address both current and future challenges.

The literature also emphasizes the role of sustainable business models in driving innovation and long-term success. Firms that adopt sustainable practices and align their operations with sustainability goals are better positioned to innovate and stay competitive in the market.

The findings from this research paper underscore the critical role that the synergistic integration of innovation and sustainability plays in addressing the pressing challenges of our time and laying the foundation for a sustainable future.

Sustainability and innovation have become inextricably linked, as organizations strive to develop solutions that address current issues and prevent future challenges. By leveraging innovative methodologies and aligning them with sustainability objectives, remarkable outcomes can be achieved across various industries and domains.

3. Discussion

The findings of this study underscore the critical relationship between innovation and sustainability, particularly in the context of the Sustainable Development Goals (SDGs). As organizations increasingly recognize the importance of sustainable practices, the integration of innovative methodologies becomes essential for achieving these objectives. The systematic review revealed that

sustainability objectives can be effectively addressed through innovation across five key areas: environmental preservation, economic viability, social sustainability, business sustainability, and cultural heritage preservation.

Environmental preservation is a fundamental component of sustainable innovation, as emphasised by Ghobakhloo et al. (2021). Their research underscores the critical importance of Industry 4.0 technology in advancing environmental sustainability through increased energy efficiency, optimised waste management techniques, and the promotion of clean energy alternatives. The incorporation of these modern technology not only reduces environmental effect but also produces economic benefits, consistent with the tenets of the circular economy. The enormous potential for sustainable product and process innovation depends on the efficient application of fundamental Industry 4.0 technologies, which are often underutilised across many sectors (Ghobakhloo et al., 2021).

As organisations progressively adopt new technologies, the potential to diminish environmental footprints through innovative practices becomes more substantial. Ghobakhloo et al. (2021) contend that sustainable innovations in processes and products are essential for meeting environmental objectives. By utilising Industry 4.0 technologies like the Internet of Things (IoT) and big data analytics, businesses may optimise resource use, improve energy efficiency, and reduce waste. These technological breakthroughs contribute to environmental preservation and align with global sustainability objectives, emphasising the necessity for a strategic and integrated approach to technology-driven sustainability initiatives.

Economic viability is a crucial aspect in which innovation has a transformative impact. The advancement of green economy models and digital transformation is crucial for fostering sustainable economic growth. Mhlanga (2021) examines the role of artificial intelligence (AI) in promoting economic development in emerging economies through infrastructure enhancement and poverty reduction, thereby supporting various Sustainable Development Goals (SDGs). The convergence of artificial intelligence and sustainability highlights the imperative for organisations to leverage technological innovations that create economic benefits while simultaneously tackling social and environmental issues.

Economic viability is essential to the success of sustainability initiatives over the long term. Organisations ought to implement green economy models that foster sustainable growth and address environmental issues. Bibri and Krogstie (2020) emphasise the significance of smart cities in enhancing economic resilience via innovative technological solutions. With the acceleration of urbanisation, cities must adopt advanced technologies to enhance economic resilience and sustainability. The integration of digital transformation and social entrepreneurship can enhance sustainable economic growth, enabling organisations to maintain competitiveness while contributing to the achievement of the Sustainable Development Goals (SDGs).

Social sustainability is essential, involving progress in education, health technologies, and inclusive innovations. The incorporation of Sustainable Development Goals (SDGs) into organisational training programs, as detailed by

Bilderback (2023), establishes a solid framework for advancing equitable societal development. Aligning corporate training initiatives with sustainability objectives enhances employee engagement and fosters a culture focused on sustainability within organisations. This benefits the organisation and contributes to broader societal goals, illustrating the connection between social and environmental sustainability.

Social sustainability is crucial for promoting equitable development and enhancing the quality of life for individuals in various communities. The advancement of education, healthcare technologies, and the implementation of inclusive innovations are essential elements of this initiative. Bilderback (2023) highlights the necessity of integrating the SDGs into organisational training to enhance employee empowerment and promote social sustainability initiatives. Aligning corporate goals with social sustainability enables organisations to generate significant impacts in their communities, ensuring that innovations effectively tackle social challenges and foster inclusivity.

Business sustainability is fundamentally connected to the implementation of sustainable business models and ethical governance practices. The results indicate that organisations that prioritise sustainability in their core operations are more likely to attain long-term competitiveness. Ali et al. (2023) emphasise that multi-criteria decision analysis (MCDA) can aid organisations in identifying sustainable investments and projects. This analytical method enables organisations to assess the potential effects of their decisions on different stakeholders, ensuring the integration of sustainability considerations into the decision-making process.

Embedding sustainability into business models and governance frameworks enables organisations to cultivate a culture of sustainability. This strengthens commitment to long-term sustainability goals and enhances resilience in a rapidly evolving market. Ali et al. (2023) illustrates that utilising tools such as MCDA allows organisations to make informed and balanced decisions that align with stakeholder expectations and broader sustainability goals, thereby enhancing adaptability and competitiveness in the marketplace.

The preservation of cultural heritage is a critical component of sustainability that warrants increased focus. Preserving traditional practices and fostering cultural diversity are essential for sustaining cultural identity within sustainable development frameworks. This aspect of sustainability emphasises the necessity for a comprehensive approach that incorporates environmental, economic, social, and cultural factors.

Incorporating cultural heritage preservation into sustainability initiatives enables organisations to improve their contributions to sustainable development and promote a sense of community and belonging among diverse populations. Integrating traditional knowledge and practices with innovative solutions enables organisations to preserve cultural heritage and promote sustainable progress. This approach guarantees that sustainable innovation embodies the diverse cultural contexts that enhance societal resilience and vibrancy.

In conclusion, the synergy between innovation and sustainability is evident across these domains, demonstrating that innovative methodologies are crucial for achieving sustainability objectives. The integration of these concepts can lead to remarkable outcomes across industries, as organizations adopt comprehensive strategies that align with the SDGs. Future research should continue to explore the dynamic interplay between innovation and sustainability, particularly in the context of emerging technologies and their potential to drive sustainable development.

4. Conclusions

This study's findings emphasise the critical relationship between innovation and sustainability, especially in the context of the Sustainable Development Goals (SDGs). Organisations are increasingly acknowledging the significance of sustainable practices, making the integration of innovative methodologies essential for achieving these goals. This review identifies five key areas where sustainability objectives can be effectively addressed through innovation: environmental preservation, economic viability, social sustainability, business sustainability, and cultural heritage preservation.

Environmental preservation is a fundamental aspect of sustainable innovation. Advanced technologies, including the Internet of Things (IoT) and big data analytics, facilitate the optimisation of resource utilisation, enhancement of energy efficiency, and reduction of waste within organisations. Technological advancements support environmental preservation and align with global sustainability goals, highlighting the necessity for a strategic and integrated approach to technology-driven sustainability initiatives.

The economic viability of sustainability efforts is essential for their long-term success. The advancement of green economy models and digital transformation is crucial for fostering sustainable economic growth. Technologies like artificial intelligence (AI) are essential for promoting economic development through infrastructure enhancement and poverty alleviation, thus contributing to multiple Sustainable Development Goals (SDGs). The integration of AI and sustainability underscores the imperative for organisations to utilise technological advancements that yield economic advantages while simultaneously tackling social and environmental issues.

Social sustainability is crucial for fostering equitable development and improving the quality of life for individuals in diverse communities. Integrating the Sustainable Development Goals into organisational training programs provides a robust framework for promoting social sustainability. Aligning corporate training initiatives with sustainability goals enables organisations to foster a culture of sustainability that enhances both operational efficiency and broader societal outcomes.

Business sustainability is fundamentally linked to the implementation of sustainable business models and the adherence to ethical governance practices. Organisations that integrate sustainability into their core operations are more likely

to attain long-term competitiveness. The application of multi-criteria decision analysis (MCDA) enables organisations to identify sustainable investments and projects, thereby ensuring the integration of sustainability considerations into the decision-making process.

Cultural heritage preservation is an essential component of sustainability that warrants increased focus. Preserving traditional practices and enhancing cultural diversity enable organisations to more effectively contribute to sustainable development and cultivate a sense of community. Integrating cultural heritage preservation into sustainability initiatives allows organisations to ensure that innovations are reflective of diverse cultural contexts, thereby enhancing societal resilience.

In summary, integrating sustainability as a core objective in innovative applications is both a strategic necessity and a moral obligation for contemporary organisations. Organisations can establish a comprehensive framework for sustainable development by emphasising environmental preservation, economic viability, social sustainability, business sustainability, and the preservation of cultural heritage. Future research must further investigate the dynamic interactions among these domains, especially concerning emerging technologies and their capacity to promote sustainable innovation.

REFERENCES

- [1] Ali, S., Appolloni, A., Cavallaro, F., D'Adamo, I., Vaio, A., Ferella, F., ... & Zorpas, A. (2023). Development goals towards sustainability. *Sustainability*, 15(12), 9443. <https://doi.org/10.3390/su15129443>
- [2] Awan, U. (2021). Steering for sustainable development goals: A typology of sustainable innovation. In W. Leal Filho, A. M. Azul, L. Brandli, A. Lange Salvia, & T. Wall (Eds.), *Industry, Innovation and Infrastructure. Encyclopedia of the UN Sustainable Development Goals* (pp. 1026–1036). Springer. https://doi.org/10.1007/978-3-319-95873-6_64
- [3] Bibri, S., & Krogstie, J. (2020). The emerging data-driven smart city and its innovative applied solutions for sustainability: The cases of London and Barcelona. *Energy Informatics*, 3(1), Article 5. <https://doi.org/10.1186/s42162-020-00108-6>
- [4] Bilderback, S. (2023). Integrating training for organizational sustainability: The application of sustainable development goals globally. *European Journal of Training and Development*, 48(7–8), 730–748. <https://doi.org/10.1108/ejtd-01-2023-0005>
- [5] Fernando, Y., Xin, W. W., & Gani, A. B. D. (2016). *Five drivers of eco-innovation*, 1(1), 12–31. <https://doi.org/10.4018/ijdccs.2016010102>

- [6] Flores, M., Maklin, D., Ingram, B., Golob, M., Tucci, C. L., & Hoffmeier, A. (2018). Towards a sustainable innovation process: Integrating lean and sustainability principles. In I. Moon, G. Lee, J. Park, D. Kiritsis, & G. von Cieminski (Eds.), *Advances in Production Management Systems. Production Management for Data-Driven, Intelligent, Collaborative, and Sustainable Manufacturing* (pp. 34–42). APMS 2018. IFIP Advances in Information and Communication Technology, vol 535. Springer. https://doi.org/10.1007/978-3-319-99704-9_5
- [7] Genois-Lefrançois, P., Lefèvre, T., Elzein, H., & Cheriet, M. (2022). Sustainable innovation as a driver for socio-ecological transition. *Environmental Sciences Proceedings*, 15(1), 29. <https://doi.org/10.3390/envirosci2022015029>
- [8] Ghobakhloo, M., Iranmanesh, M., Grybauskas, A., Vilkas, M., & Petraitė, M. (2021). Industry 4.0, innovation, and sustainable development: A systematic review and a roadmap to sustainable innovation. *Business Strategy and the Environment*, 30(8), 4237–4257. <https://doi.org/10.1002/bse.2867>
- [9] Guo, R., Liu, S., Liao, T., Xi, F., Zhang, J., Zuo, X., ... & Zhang, Y. (2020). Classifying green technologies for sustainable innovation and investment. *Resources, Conservation and Recycling*, 153, 104580. <https://doi.org/10.1016/j.resconrec.2019.104580>
- [10] Jain, P., Chou, M. C., Fan, F., & Santoso, M. P. (2021). Embedding sustainability in the consumer goods innovation cycle and enabling tools to measure progress and capabilities. *Sustainability*, 13(12), 6662. <https://doi.org/10.3390/su13126662>
- [11] Maier, D., Maier, A., Aşchilean, I., Anastasiu, L., & Gavriş, O. (2020). The relationship between innovation and sustainability: A bibliometric review of the literature. *Sustainability*, 12(10), 4083. <https://doi.org/10.3390/su12104083>
- [12] Mhlanga, D. (2021). Artificial intelligence in Industry 4.0, and its impact on poverty, innovation, infrastructure development, and the sustainable development goals: Lessons from emerging economies? *Sustainability*, 13(11), 5788. <https://doi.org/10.3390/su13115788>
- [13] Schilirò, D. (2019). Sustainability, innovation, and efficiency: A key relationship. In M. Ziolo, B. S. Sergi (Eds.), *Financing Sustainable Development. Palgrave Studies in Impact Finance* (pp. 83–102). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-16522-2_4
- [14] Seebode, D., Jeanrenaud, S., & Bessant, J. (2012). Managing innovation for sustainability. *Creativity and Innovation Management*, 21(2), 195–206. <https://doi.org/10.1111/j.1467-8691.2012.00678.x>
- [15] Shah, K., Pan, S., Lee, I., Kim, H., You, Z., Jin, Z., ... & Chiang, P. (2021). Green transportation for sustainability: Review of current barriers, strategies, and innovative technologies. *Journal of Cleaner Production*, 326, 129392. <https://doi.org/10.1016/j.jclepro.2021.129392>

- [16] Shin, J., Kim, C., & Yang, H. (2018). The effect of sustainability as innovation objectives on innovation efficiency. *Sustainability*, 10(6), 1966.
<https://doi.org/10.3390/su10061966>
- [17] van Wylsberghe, A. (2021). Sustainable AI: AI for sustainability and the sustainability of AI. *AI and Ethics*, 1(3), 213–218.
<https://doi.org/10.1007/s43681-021-00043-6>



© 2024 Authors. Published by the University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>).