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Digital Technology to Support Sustainable Development Goals (SDGs): Literature Review

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Abstract

Digital technology is a critical enabler in achieving Sustainable Development Goals (SDGs) by enhancing efficiency, transparency, and inclusivity across sectors such as education, health, economy, and the environment. This study employs a Narrative Literature Review (NLR) approach to explore the role of technologies like artificial intelligence (AI), the Internet of Things (IoT), and blockchain in advancing SDG targets. The research identifies opportunities for these technologies to improve service delivery, foster innovation, and mitigate challenges like unequal access, cybersecurity risks, and ethical concerns. The literature search covered journal articles, books, and reports from academic databases, focusing on keywords related to digital technologies and the SDGs. An analysis framework was applied to synthesize findings across diverse sectors. Results indicate that AI and IoT drive efficiency in education and healthcare, while blockchain enhances financial inclusivity and sustainable urban planning. However, disparities in digital access and ethical issues, such as data privacy, remain substantial obstacles. This review provides actionable insights for policymakers and stakeholders to leverage digital tools effectively for inclusive and sustainable development. Emphasizing multisectoral collaboration, the study underscores the importance of ethical frameworks and inclusive digital infrastructure to maximize technological benefits. These findings contribute to the broader understanding of digital technology's integrative impact on sustainable development, offering strategic recommendations for future research and implementation.

Keywords: Digital technology; Sustainable development goals; Artificial intelligence; Internet of things; Digital literacy; inclusivity.

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INTRODUCTION

Background

In the ever-evolving digital era, digital technology has become an important component in efforts to achieve the Sustainable Development Goals (SDGs) set by the United Nations. The SDGs consist of 17 key goals designed to address global challenges such as poverty, inequality, and climate change through innovative and collaborative approaches (Senja Shafira et al., 2024; Şimşek, 2024). With its ability to improve access, efficiency, and transparency, digital technology has great potential in accelerating the achievement of various SDGs targets, including quality education (SDG 4), poverty alleviation (SDG 1), and inequality reduction (SDG 10) (Hikmah et al., 2024; Senja Shafira et al., 2024). Therefore, understanding the role and impact of digital technology in the context of the SDGs is crucial to creating

inclusive and equitable sustainable development (Maltsev et al., 2020; Voronkova et al., 2023).

The importance of the role of digital technology in achieving the SDGs cannot be overlooked, given that they are able to accelerate the achievement of certain targets in the SDGs. For example, digitalization can encourage inclusivity and wider access to education, which is part of SDG 4 (quality education), as well as improve access to health services covered by SDG 3 (health and well-being) (A. Rosário & Dias, 2022; Vărzaru, 2024). In addition, digital technology also plays a role in poverty reduction through the use of fintech and digitalization in the economic sector, which is relevant to SDG 1 (poverty alleviation) (Raihan, 2024; Syifa et al., 2024). Thus, the adoption of the right digital technologies can drive more inclusive, equitable, and sustainable economic development around the world (Gupta & Rhyner, 2022; Maehara et al., 2021).

Digital technology offers various opportunities to accelerate the achievement of the SDGs through increased efficiency and transparency in various sectors. For example, artificial intelligence (AI), big data, and Internet of Things (IoT) technologies have been proven to be able to drive innovation and improve efficiency in public services, education, and the economic sector (Anshari et al., 2024; Varriale et al., 2024). This digital transformation not only improves the quality of services, but also encourages the development of more sustainable solutions, including in the field of urbanization and environmentally friendly production (Font Vivanco & Makov, 2020; A. T. Rosário & Dias, 2023). Therefore, the adoption of well-integrated digital technology can be the main driver of achieving the SDGs at the global and local levels (Maltsev et al., 2020; Obasi et al., 2024).

However, behind the opportunities provided by digital technology in supporting the achievement of the SDGs, there are significant challenges that need to be overcome. One of the main challenges is unequal access to digital technology, especially in developing countries that face limited infrastructure and technological literacy (Gupta & Rhyner, 2022). This inequality can exacerbate social and economic disparities, as well as hinder the achievement of the SDGs, especially in terms of social inclusion and economic empowerment (Senja Shafira et al., 2024; Strilchuk et al., 2024). In addition, challenges related to cybersecurity are also an important concern, considering the increasing threats to privacy and information security in this digital era (Ige et al., 2024). Therefore, it is important to develop a comprehensive and inclusive strategy to address these challenges so that digital technology can be optimally utilized in achieving the SDGs (Maltsev et al., 2020).

In addition to infrastructure and access challenges, ethical and social issues are also a major concern in the implementation of digital technologies to achieve the SDGs. The use of digital technology must consider an ethical framework that not only focuses on innovation, but also on possible social and environmental impacts (Chalmeta Rosaleñ & Guede Tejedor, 2022; Pastor-Escuredo et al., 2022). For example, data privacy, cybersecurity, and the potential for discrimination arising from digital algorithms are important issues that must be managed so that technology can be used fairly and responsibly (Ige et al., 2024; Obasi et al., 2024). Integrating ethics in the development and use of digital technologies is essential to ensure that digital transformation can have an equitable positive impact on all societies (Lemsieh et al., 2024; Muschert & Ragnedda, 2021).

Although there has been a lot of research on the role of digital technology in supporting the achievement of the SDGs, there are several research gaps that need to be addressed for a deeper understanding. Most of the existing research has only focused on the application of technology in specific sectors, such as education or healthcare, without considering the broader cross-sectoral impact (Anshari et al., 2024; Varriale et al., 2024). In addition, many studies emphasize the direct benefits of digital technologies, such as efficiency and innovation, but few examine their long-term impacts on social and economic sustainability(Font Vivanco & Makov, 2020; Ige et al., 2024). Therefore, more research is needed to understand how the integration of digital technologies can be carried out comprehensively across different sectors and ensure maximum contribution to the achievement of the SDGs holistically (Lal & Umer, 2024; A. T. Rosário & Dias, 2023).

Digital technologies not only serve as tools to improve efficiency, but also as key drivers of innovation that can help address complex sustainability challenges. In this context, technologies such as artificial intelligence (AI), big data, and blockchain have the potential to create more environmentally friendly and sustainable solutions in various sectors, including energy, transportation, and industry (A. Rosário & Dias, 2022; Şimşek, 2024). However, the adoption of digital technologies must also be supported by a framework that allows cross-sectoral and cross-disciplinary collaboration to maximize its positive impact (Maltsev et al., 2020; Philbin et al., 2022). Thus, to achieve optimal results in supporting the SDGs, digital technology needs to be integrated with a more holistic and collaborative development strategy, involving various stakeholders including the government, the private sector, and civil society (Kluczek et al., 2022; Varriale et al., 2024).

Cross-sector collaboration is a crucial aspect in ensuring optimal use of digital technology to achieve the SDGs. Cooperation between the government, the private sector, and civil society can help overcome the challenges of digital technology adoption, strengthen infrastructure, and expand digital literacy at various levels of society (Kluczek et al., 2022; Syifa et al., 2024). This collaborative approach is important to build a more inclusive policy framework and ensure that the benefits of digital transformation can be felt equally by all levels of society, especially in developing countries (Raihan, 2024; Varriale et al., 2024). In addition, this collaboration also allows the development of digital solutions that are more responsive and in accordance with local needs, so that they can support the achievement of SDGs targets more effectively (Anshari et al., 2024; Hikmah et al., 2024).

Literature reviews play an important role in providing a comprehensive understanding of the relationship between digital technologies and the achievement of the SDGs. Through literature reviews, researchers can identify existing trends, patterns, and research gaps, thereby providing a stronger basis for the development of sustainability policies and strategies (Olfe-Kräutlein, 2020). With this approach, research not only helps in understanding the contribution of digital technology to the achievement of the SDGs, but also allows the development of a more holistic and integrated framework (Alhassan & Adam, 2024; Corsini & Moultrie, 2022). Therefore, an in-depth and systematic review literature is urgently needed to strengthen empirical evidence and support policy formulations that are

more responsive to the global challenges faced (Gupta & Rhyner, 2022; Muschert & Ragnedda, 2021).

This article seeks to contribute to the existing literature by reviewing how digital technology can be optimized to effectively support the achievement of the SDGs. By identifying research gaps and reviewing the potential impacts of digital technologies in various sectors, this article is expected to provide deeper insights into how technology can be used to create more inclusive and equitable sustainability strategies (Senja Shafira et al., 2024; Vărzaru, 2024). This literature review is also expected to provide practical recommendations for policymakers, researchers, and industry players to work together in strengthening the adoption of digital technology to achieve the SDGs targets globally (Anshari et al., 2024; Obasi et al., 2024). With a systematic and evidence-based approach, this article seeks to offer relevant and applicable solutions to maximize the role of digital technology in sustainable development.

Research Objectives

This research aims to provide a comprehensive overview of the contribution of digital technology in achieving the Sustainable Development Goals (SDGs) set by the United Nations. With a broader focus, this study examines the role of digital technologies in various sectors, including education, health, economy, and the environment, with the hope of clarifying how technology can improve efficiency, inclusivity, and reduce social and economic inequalities at the global and local levels. Furthermore, this study also seeks to identify the main opportunities and challenges related to the application of digital technology in various development sectors.

In addition, this research seeks to fill the existing literature gap, especially related to the lack of understanding of the integrative impact of cross-sectoral digital technology. By analyzing various aspects of digital technology, this study is expected to strengthen the theoretical and practical basis in an effort to achieve the SDGs holistically. Through this approach, it is hoped that the research findings can provide broader insights into the potential long-term contribution of digital technology to social, economic, and environmental sustainability more equitably.

This research is also expected to provide practical and evidence-based recommendations for policymakers, researchers, and industry players. Thus, the results of this study can support the implementation of more responsive, evidence-based, and targeted strategies and policies in increasing the adoption of digital technologies that are more inclusive, effective, and sustainable in supporting the achievement of the SDGs in various regions and contexts.

Significance of the Review

This review has important significance in developing a deeper understanding of the strategic role of digital technology in supporting the achievement of the SDGs. Through the identification of trends, key findings, and existing gaps, this review aims to provide a relevant knowledge base for the development of better sustainability policies and strategies. The review also emphasizes the importance of a cross-sectoral approach in the implementation of digital technology, which can strengthen its positive impact on various development sectors in a more integrated and effective manner.

Furthermore, this study offers practical value for policymakers and industry players in understanding the opportunities and challenges of implementing digital technology as a whole. By presenting relevant empirical evidence, the review can guide the development of more inclusive and collaborative strategies between governments, the private sector, and civil society. This aims to ensure that digital technology not only functions as an efficiency tool, but also as a key driver of innovation that supports equitable and equitable sustainable development.

Overall, this review not only provides theoretical insights, but also facilitates the practical application of digital technologies in various development contexts. Thus, this study contributes to a broader and directed understanding of how digital technology can be optimally utilized to accelerate the achievement of the SDGs globally and locally.

METHOD

Review Approach

The approach used in this study is the Narrative Literature Review (NLR), which allows for a broad exploration and understanding of the role of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). In contrast to the more rigorous and structured approach of Systematic Literature Review (SLR), NLR is more flexible and descriptive, making it more suitable for identifying trends, themes, and patterns in the literature related to this topic. This approach allows literature reviews to be conducted with a focus on discussing concepts, key findings, and contributions of digital technology without being bound by overly strict inclusion or exclusion criteria.

Through NLR, this article not only seeks to collect relevant literature findings, but also presents a narrative that includes various perspectives, applications, and impacts of digital technology on efforts to achieve the SDGs. This approach aims to provide a comprehensive overview that covers various sectors, such as education, health, economy, and the environment, in the context of sustainable development. With this approach, it is hoped that various key opportunities and challenges arising from the implementation of digital technologies in these various sectors can be identified, thus providing a solid basis for more inclusive and effective research and policy.

The NLR approach also allows for the incorporation of literature from various types of sources, including journal articles, books, reports, and other publications that are relevant and influential to the SDGs. The review aims to create a rich and comprehensive narrative, which not only reveals empirical findings, but also provides new insights into the integration of digital technologies to achieve sustainable development goals globally and locally.

Literature Search Process

The literature search process in this study is designed to cover various types of sources relevant to the application of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). The literature sources used include journal articles, books, research reports, government publications, and other digital sources that are considered to have a significant contribution to the understanding of this topic. The selection of sources was carried out by considering the relevance to the topic, its influence in the field of digital technology

and sustainability, and its contribution to the achievement of the overall SDGs targets.

The first step in a literature search is to explore through academic databases such as Google Scholar and Semantic Scholar. The keywords used include terms that reflect the application of digital technology and its relation to the SDGs, such as "digital technology for the SDGs", "digitalization and sustainable development", and "digital innovation for the SDGs". The search includes publications from a variety of disciplines, including information technology, environmental science, development economics, and public policy, in order to create a broad and holistic literature review.

Once the relevant literature has been identified, further selection is carried out based on its direct connection to the main theme of the study, namely the role of digital technology in supporting the SDGs. This selection process is not as rigorous as used in the Systematic Literature Review (SLR), but it still maintains a focus on literature that has a significant contribution to the main discussions, trends, and relevant findings. The selected literature is then analyzed to identify the main trends, innovations, and challenges in the application of digital technology in various SDGs sectors.

In this review, the literature search process not only focuses on empirical studies but also includes conceptual and theoretical research that provides insights into the potential and long-term impact of digital technologies in sustainable development. With this approach, this study is expected to provide a comprehensive and evidence-based picture of how digital technology can be optimally utilized to support the achievement of the SDGs in various development sectors.

Literature Description

The literature description in this study is carried out with a narrative approach, which allows the incorporation of various perspectives and research results related to the role of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). The selected literature includes empirical and theoretical studies describing how digital technologies are applied in various SDGs sectors, as well as their impact on sustainable development. This review includes not only specific findings but also emerging trends and key themes found from the analysis of the existing literature.

Each literature reviewed is summarized by focusing on its contribution and relevance to the main theme of this research, namely the integration of digital technology for the achievement of the SDGs. In each of these sectors, the author also identifies the main technologies used, such as artificial intelligence (AI), Internet of Things (IoT), and blockchain, as well as the impact of their implementation on certain SDGs.

The literature description process also involves a critical analysis of existing research gaps. This gap reflects the need for a more integrative approach to digital technology research and implementation, in order to ensure a broader impact on various aspects of sustainable development. This description is expected to provide a solid foundation for the development of more targeted strategies and policies, which maximize the benefits of digital technology to support the achievement of the SDGs holistically.

RESULTS AND DISCUSSION

The results of this literature review present findings from 34 research articles identified and reviewed related to the role of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). These articles were selected based on their relevance to the research theme and significant contributions in various sectors of the SDGs. The table below summarizes the title, author, year of publication, journal, DOI, as well as a brief summary of each study reviewed, providing a comprehensive overview of the trends, innovations, and challenges faced in the implementation of digital technologies to support the SDGs.

Table 1. Study highlights 34 research articles on digital technologies for SDGs

No	Title & Author(s)	Journal	Study Highlights
1	A Comprehensive Review on Food Waste Reduction Based on IoT and Big Data Technologies (Ahmadzadeh et al., 2023)	Sustainability	Explain how Internet of Things (IoT) technology and big data can be used to reduce food waste in the supply chain. The study highlights that inefficiencies in the food supply chain and lack of information at every stage of the food cycle contribute to such waste, so the implementation of data-driven systems and appropriate management models is crucial to minimize these negative impacts.
2	A New Green Revolution (GR) or Neoliberal Entrenchment in Agri-food Systems? Exploring Narratives Around Digital Agriculture (DA), Food Systems, and Development in Sub-Sahara Africa (Abdulai, 2022)	The Journal of Development Studies	Discusses the narrative surrounding digital agriculture and food systems in Sub-Saharan Africa, providing insights into the potential for a new green revolution or strengthening neoliberalism in agri-food systems. This article is important to understand the dynamics between technology, food security, and development in the region, as well as their implications for agricultural policy and practices.
3	A nexus between green digital finance and green innovation under asymmetric effects on renewable energy markets: a study on Chinese green cities (Gao et al., 2023)	Environmental Science and Pollution Research	Explain the relationship between green digital finance and green innovation in the context of the renewable energy market in green cities in China. The study shows that diverse policy support can increase the impact of green digital finance, encourage green innovation, and create an emission-free environment for sustainable energy markets, with the average total effect of foreign direct investment (FDI) on significant green innovations.

No	Title & Author(s)	Journal	Study Highlights
4	A review of the blue economy, potential, and opportunities in seven Caribbean nations pre-COVID-19 (Phang et al., 2023)	Ices Journal of Marine Science	Provides a comprehensive overview of the blue economy in seven Caribbean countries prior to the COVID-19 pandemic, highlighting flagship sectors such as shipping and tourism that contribute significantly to GDP. This article also discusses the potential and opportunities of other sectors such as fisheries and aquaculture, which could be the focus of sustainable development in the future.
5	A RoBERTa Approach for Automated Processing of Sustainability Reports (Angin et al., 2022)	Sustainability	Explain the importance of automated processing of sustainability reports using natural language processing (NLP) techniques to classify documents based on their relevance to the Sustainable Development Goals (SDGs). This study shows that a RoBERTa-based approach can effectively identify the linkages between texts and the SDGs, which is crucial to support sustainability integration efforts across various sectors. The results of experiments conducted with the OSDG dataset show high performance in classification, signaling great potential for automation in the processing of extensive sustainability reports.
6	AHP Analyser: A decision-making tool for prioritizing climate change mitigation options and forest management (Soam et al., 2023)	Frontiers in Environmental Science	Explain how AHP (Analytic Hierarchy Process) analysis tools can be used as decision-making tools to prioritize climate change mitigation and forest management options. This study emphasizes the importance of practical methodologies in research and management to improve decision-making, which in turn can lead to better and more managed findings in the context of environmental and forestry research.
7	An Evolutionary Game Analysis on Green Technological Innovation of New Energy Enterprises under the Heterogeneous	Sustainability	Discuss how green technology innovations in new energy companies can be affected by various environmental regulatory tools. Through the analysis of evolutionary game theory, this study shows that

No	Title & Author(s)	Journal	Study Highlights
	Environmental Regulation Perspective (Shi & Li, 2022)		market incentive-based environmental regulatory policies have the most significant impact in driving innovation, while the combination of various regulatory tools can produce optimal strategies to achieve quality economic growth and environmental protection at the same time. These findings emphasize the importance of an integrated approach in regulation to support corporate sustainability.
8	Analyzing the Relationship between Digital Transformation Strategy and ESG Performance in Large Manufacturing Enterprises: The Mediating Role of Green Innovation. (Zhao et al., 2023)	Sustainability	He explained that the digital transformation strategy has a significant positive impact on the company's ESG performance, with two main dimensions, namely business digitalization and platform digitalization. In addition, the company's green innovation plays an important role as a mediator in strengthening the relationship between the company's digital transformation strategy and ESG performance. These findings demonstrate the importance of integrating green innovation in digital strategies to improve corporate sustainability and social responsibility.
9	Artificial Ecosystem-Based Optimization with an Improved Deep Learning Model for IoT-Assisted Sustainable Waste Management (Al Duhayyim et al., 2022)	Sustainability	Describe the proposed AEOIDL-SWM system, which shows significant improvements in sustainable waste management through artificial ecosystem-based optimization and enhanced deep learning models. The comparative analysis conducted in this study underscores the advantages of the technique compared to other deep learning models, confirming its contribution to the development of more effective solutions in the context of the Internet of Things (IoT).
10	Blockchain-Centered Educational Program Embodies and Advances 2030 Sustainable Development Goals (Choi et al., 2022)	Sustainability	Explain the development of blockchain-based education programs that contribute to Goal 4, Quality Education, among the Sustainable Development Goals (SDGs). This article shows that the program not

No	Title & Author(s)	Journal	Study Highlights
			only improves digital literacy, but also has a positive impact on student satisfaction, demonstrating the potential of blockchain in supporting inclusive and quality education. As such, this research provides important insights into how technology can be integrated in education to achieve sustainable development goals.
11	Collaborative Learning Supported by Blockchain Technology as a Model for Improving the Educational Process (Bjelobaba et al., 2023)	Sustainability	Discuss how blockchain technology can support collaborative learning as a model to improve the educational process. In this context, the authors propose a Collaborative Work Evaluation and Learning (CLSW) model that integrates multi-frontal teaching methods and scientific peer-review standards, aiming to create a more student-focused and sustainable learning environment. By utilizing blockchain technology, this model not only protects project data and student assessments, but also facilitates the development of better critical thinking and problem-solving skills among students.
12	Considering inclusion in digital technology: An occupational therapy role and responsibility (Liddle, 2023)	Australian Occupational Therapy Journal	Discuss the roles and responsibilities of occupational therapy in the context of digital technology inclusion, which is increasingly important as the digital revolution transforms the way professionals practice. This article highlights how now-accessible technology can influence therapeutic interventions and increase client participation in various daily activities.
13	Digital Health Technologies Enabling Partnerships in Chronic Care Management: Scoping Review (Wannheden et al., 2022)	Journal of Medical Internet Research	Explain the importance of digital health technologies in supporting partnerships between patients, caregivers, and healthcare professionals in chronic care management. The study identifies six key features of participatory health technologies that can improve communication and collaboration, and highlights the challenges that may arise due to unclear roles and

No	Title & Author(s)	Journal	Study Highlights
			expectations between users. These findings suggest that despite advances in the use of these technologies, there are still knowledge gaps that need to be addressed to maximize the effectiveness of patient-professional partnerships in the context of chronic care.
14	Distributed and scalable platform architecture for smart cities complex events data collection: Covid19 pandemic use case (Basmi et al., 2021)	Journal of Ambient Intelligence and Humanized Computing	Discuss a distributed and scalable platform architecture for the collection of complex event data in smart cities, with a case study of the Covid-19 pandemic. This article provides insights into how technology can be optimized to manage and analyze data in challenging contexts, such as the global health crisis, making it relevant to understand the application of data science and computer security in the development of smart cities.
15	Energy and Exergy Analysis of a Geothermal Sourced Multigeneration System for Sustainable City (Haider et al., 2023)	Energies	Provides an in-depth analysis of geothermal-sourced multigeneration systems, highlighting the energy efficiency and excression resulting from the process. The study shows that the system not only generates electricity, but also provides space heating, cooling, fresh water, and hydrogen, all of which contribute to the sustainability of the city. By integrating the regenerative Rankine cycle and the desalination cycle, this research offers innovative solutions to meet the energy and water needs of the community.
16	Exploring the Potential of iPad-LiDAR Technology for Building Renovation Diagnosis: A Case Study (Mêda et al., 2023)	Buildings	Explains how LiDAR technology integrated in mobile devices, such as iPads, can improve the diagnostic phase in building renovations. This research shows that the application of this technology is in line with the goals of digitalization and sustainability, which support the digital and green transition in the construction sector.
17	Feasibility of digital contact tracing in low-	BMC Public Health	Discusses the feasibility of using location-based digital contact tracing

No	Title & Author(s)	Journal	Study Highlights
	income settings – pilot trial for a location-based DCT app (Handmann et al., 2023)		apps in low-income countries, which shows that despite technical challenges and compliance issues, they can serve as a complement to traditional manual tracing methods. This research highlights the importance of local context in the application of health technology, especially in health crisis situations, where people's acceptance of monitoring technology can increase when they feel threatened by disease.
18	Gameful design for skills development for youths in urban marginalised communities (Obioha & van Zyl, 2022)	Interaction Design and Architecture(s)	Discuss the importance of gamification design in skill development for youth in marginalized communities. The study shows that gamification elements can increase youth engagement and motivation to learn employable skills, especially in the context of digital training that is increasingly prevalent post-COVID-19. As such, these findings provide valuable insights into how to integrate those elements into the learning system to achieve better outcomes.
19	Gender-Inclusive Development through Fintech: Studying Gender-Based Digital Financial Inclusion in a Cross-Country Setting (Tripathi & Rajeev, 2023)	Sustainability	Discuss the importance of digital financial access for women as a means to increase gender empowerment and more inclusive growth. By providing relevant policy advice, the study highlights how financial technology can contribute to gender-based financial inclusion in different countries, which in turn supports sustainable development.
20	Innovation and Optimization Logic of Grassroots Digital Governance in China under Digital Empowerment and Digital Sustainability (Li et al., 2022)	Sustainability	Discuss the importance of digital empowerment at the grassroots level as a key tool to support sustainable social and economic development. In this context, the author highlights how digital resources can function as basic technologies that support sustainability, especially in the midst of global challenges such as the pandemic. As such, this article emphasizes that strengthening digital empowerment in local communities is

No	Title & Author(s)	Journal	Study Highlights
			a crucial step towards achieving broader sustainability goals.
21	Introduction of digital reporting platform to integrate community-level data into health information systems is feasible and acceptable among various community health stakeholders: A mixed-methods pilot study in Mopti, Mali (Kirk et al., 2021)	Journal of Global Health	Discussed the implementation of a digital reporting platform to integrate community-level health data into health information systems in Mali, which shows that the use of tablets by community health workers (CHWs) not only improves the quality and availability of data, but also increases their job satisfaction. This study provides evidence that despite challenges in the use of digital technology, CHWs' preference for digital systems over paper shows great potential to improve the efficiency of health data reporting at the community level.
22	mHealth intervention to improve quality of life in patients with chronic diseases during the COVID-19 crisis in Paraguay: A study protocol for a randomized controlled trial (Escrivá-Martínez et al., 2022)	Plos One	Exploring mHealth interventions as an effort to improve the quality of life of patients with chronic diseases during the COVID-19 pandemic in Paraguay, with an emphasis on achieving the Sustainable Development Goals (SDGs), in particular SDG 3 (Good Health and Well-being). Through randomized controlled trials, these interventions are designed to support remote health monitoring, self-management behavior, and psychological well-being, thereby reducing inequalities in access to health services (SDG 10) and strengthening health system resilience (SDG 9). This initiative has the potential to support sustainable care for vulnerable patients, especially in the context of a global health crisis that exacerbates barriers to health access.
23	NDCmitiQ v1.0.0: a tool to quantify and analyse greenhouse gas mitigation targets (Günther et al., 2021)	Geoscientific Model Development	Discusses the NDCmitiQ v1.0.0 tool designed to quantify and analyze greenhouse gas mitigation targets. This article provides insights into how the tool can be used to evaluate the effectiveness of mitigation policies, which are relevant in the context of

No	Title & Author(s)	Journal	Study Highlights
			climate change and the management of greenhouse gas emissions globally.
24	New Governance Path through Digital Platforms and the Old Urban Planning Process in Italy (Bellone et al., 2021)	Sustainability	Explaining how the 2020 global pandemic has accelerated changes in social and spatial interactions, and encouraged the transition to a new digital era. This article highlights the importance of digital platforms in the urban planning process in Italy, pointing out that the balance between physical and virtual interactions has shifted, with virtual interactions becoming more dominant in a short period of time. This reflects a fundamental shift in the way humans adapt to new, more digitally connected environments.
25	Precision Public Health for Non-communicable Diseases: An Emerging Strategic Roadmap and Multinational Use Cases (Canfell et al., 2022)	Frontiers in Public Health	Explain how precision public health (PPH) can be a strategic solution to overcome the threat of non-communicable diseases (NCDs) globally. This article outlines three digital health transformation horizons that can leverage digital health data to build responsive and data-driven public health systems, which in turn can effectively improve NCD prevention.
26	Promotion of healthy living environments in communities: a digital planning tool for local public health actors (Busskamp, 2022)	European Journal of Public Health	Discuss digital planning tools designed to promote a healthy living environment in the community, as well as evaluate the process of using them. This article uses a mixed approach to explore the effectiveness of the app in a community context, focusing on the additional needs of local actors, especially in socio-economically disadvantaged areas. Initial steps taken include the establishment of a local steering committee and a needs assessment using the tool, which demonstrates the relevance and practical application of this research in improving public health.

No	Title & Author(s)	Journal	Study Highlights
27	Reflections on the ethics, potential, and challenges of artificial intelligence in the framework of quality education (SDG4) (Flores-Vivar & García-Peñalvo, 2023)	Communicate	Discuss in depth the ethical aspects and challenges of using artificial intelligence (AI) systems in the context of education. This article not only highlights the potential of AI in supporting the achievement of the Sustainable Development Goals (SDGs4), but also underscores the emerging concerns regarding the possible replacement of human teachers by AI robots, thus providing a balanced insight into the benefits and risks associated with the integration of these technologies in education.
28	Scrutinizing environmental governance in a digital age: New ways of seeing, participating, and intervening (Kloppenburg et al., 2022)	One Earth	Discuss how the digital age has changed the way we understand and participate in environmental governance. This article highlights innovations in public participation and interventions that can improve the effectiveness of environmental policies, as well as emphasizing the importance of adapting to technological changes in business and economic contexts.
29	Smart Rainwater Harvesting for Sustainable Potable Water Supply in Arid and Semi-Arid Areas (Judeh et al., 2022)	Sustainability	Discussed about smart rainwater collection systems that can improve the safety of drinking water supply in dry and semi-dry areas. This study shows that by implementing a smart RWH system integrated with a dual water supply system, a reduction in drinking water shortage to zero can be achieved, which is much more efficient compared to water supply from municipal sources. These findings emphasize the importance of innovation in water resource management for environmental sustainability.
30	Social innovations and the fight against poverty: An analysis of India's first prosocial P2P lending platform (Ravishankar, 2021)	Information Systems Journal	Discusses the significant strengths of prosocial P2P lending platforms in India that contribute to the development of sustainable business models. With a commitment to deeply engage with the complex offline world of low-income borrowers, this research

No	Title & Author(s)	Journal	Study Highlights
			shows how social innovation can have a positive impact in the fight against poverty.
31	Sustainability in a Digitized Era Analyzing the Moderation Effect of Social Strata and Digital Capital Dependence on Digital Divide (Singh et al., 2022)	Sustainability	Discuss the importance of understanding the impact of the digital divide in the formation of digital capital in the midst of existing social stratification. This study aims to explore the reasons behind the digital divide that reinforces social inequality, as well as statistically measure the impact of the digital divide on digital capital, taking into account the variables of social strata as moderators to achieve sustainability.
32	Sustainability through Resilient Collaborative Housing Networks: A Case Study of an Australian Pop-Up Shelter (Pablo & London, 2022)	Sustainability	Discusses how resilient collaborative housing networks can be systematically built by leveraging digital technologies, without sacrificing adaptive traits that are essential for resilience. The study shows that although the network is often ad hoc, the right application of technology can improve effectiveness and sustainability in the context of emergency housing in Australia.
33	Synergistic Mechanism of the High-Quality Development of the Urban Digital Economy from Blockchain Adoption Perspective—A Configuration Approach (Xia et al., 2022)	Journal of Theoretical and Applied Electronic Commerce Research	Explain how the adoption of blockchain technology can contribute to the development of a high-quality digital economy in cities. This article provides theoretical insights that can be used by local governments in formulating policies that support the growth of the digital economy through the use of blockchain, thereby strengthening the synergy between technology and public policy.
34	The Sustainable Effect of Artificial Intelligence and Parental Control on Children's Behavior While Using Smart Devices' Apps: The Case of Saudi Arabia (Alrusaini & Beyari, 2022)	Sustainability	Discusses the influence of parental controls and artificial intelligence on children's behavior when using smart device apps, with a focus on gaming apps, social media, and video streaming. This study uses a structural equation model (SEM) to analyze the moderation role of artificial intelligence control and parental

No	Title & Author(s)	Journal	Study Highlights
			control, which shows methodological relevance in understanding children's behavioral dynamics in the context of sustainability. These findings provide important insights for the development of more effective management strategies in the use of technology by children.

Analysis and Synthesis of Findings

SDG 1: No Poverty

Digital technology plays a strategic role in supporting the achievement of the first Sustainable Development Goal (SDG 1) which focuses on poverty alleviation. The use of this technology varies widely, from facilitating financial access, increasing agricultural productivity, to improving health services and more affordable housing. Here are some of the key roles of digital technologies in supporting SDG 1:

Facilitating Access to Finance

Digital financial platforms, including peer-to-peer (P2P) lending platforms, such as Rang De in India, allow low-income individuals to gain access to affordable loans that are difficult to access through conventional banks (Ravishankar, 2021). By utilizing this technology, people can obtain capital for small businesses, education, or other urgent needs. The platform also allows prosocial lenders to contribute directly to poverty alleviation.

Increasing Agricultural Productivity through Digital Agriculture

In Sub-Saharan Africa, digital agriculture has a positive impact on improving food security, environmental sustainability, and empowering marginalized groups. This technology includes the use of smart sensors, drones, and data-driven applications that help farmers improve their efficiency and agricultural yields (Abdulai, 2022). With increased productivity and income, low-income rural communities can get out of the cycle of poverty.

Healthcare Improvement

Digital health technologies play a significant role in improving health outcomes, ultimately contributing to poverty reduction. For example, this technology can create partnerships for chronic care management through more affordable and accessible telehealth apps and tools (Wannheden et al., 2022). By reducing healthcare costs and improving access, low-income communities can have better health and more opportunities to improve their standard of living.

Increasing Housing Availability and Affordability

Digital technologies are also playing a role in the housing sector through the creation of resilient networks for collaborative housing solutions, such as pop-up shelters designed to address homelessness and affordable housing (Pablo & London, 2022). These solutions support social sustainability by providing safe temporary shelter for the urban poor, while reducing the risk of extreme poverty.

Improving Strategic Alignment Through Natural Language Processing (NLP)

Natural language processing (NLP) technologies, such as RoBERTa, are used to classify sustainability reports based on their relevance to the SDGs. This helps organizations and companies to be more aligned with the goals of the SDGs, including SDG 1 (Angin et al., 2022). By optimizing the project strategy, this implementation can maximize the impact of poverty alleviation through more efficient and targeted use of resources.

SDG 2: Zero Hunger

Digital technologies play an important role in achieving the second Sustainable Development Goal (SDG 2) which aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture. Various digital innovations can improve efficiency in food systems, reduce food waste, and improve access to agricultural information, especially in regions prone to food crises. Here are some of the key roles of digital technologies in supporting SDG 2:

Optimizing the Food Supply Chain through IoT and Big Data

Technologies such as the Internet of Things (IoT) and big data contribute to increased efficiency in the food supply chain by reducing food inefficiencies and waste (Ahmadzadeh et al., 2023)). IoT can be used to monitor food storage, distribution, and consumption conditions in real-time, helping to reduce food waste. Using big data algorithms, food supply chains can be analyzed to identify patterns and weaknesses, allowing for quick action and better decision-making to reduce food waste and optimize resource use.

Digitalization of Agriculture to Increase Productivity

Digitalization in agriculture, which involves smart sensors, data-driven applications, and other smart technologies, can bridge the information gap that is often an obstacle for farmers in marginalized regions, especially in Sub-Saharan Africa (Abdulai, 2022). This technology allows farmers to gain access to better information about the weather, harvest predictions, and more efficient farming techniques. In addition to improving agricultural yields, digitalization also supports more sustainable agriculture through more economical use of resources and better management.

Sustainable Waste Management through IoT and Deep Learning

The integration of IoT with deep learning models allows for more effective waste management, which indirectly supports SDG 2 by maintaining environmental quality and creating healthy ecosystems (Al Duhayyim et al., 2022). These solutions can be used to efficiently monitor and manage agricultural waste and food production, thereby minimizing negative impacts on the environment and supporting a more sustainable food system.

The Utilization of Digital Health Technology in the Food System

Digital health technologies, which are commonly used for healthcare management, can be applied to the agricultural sector and food systems to improve yields and production efficiency. By facilitating collaboration between farmers, distributors, and related service providers, these technologies help ensure a more equitable distribution of food and reduce hunger (Wannheden et al., 2022). It also

allows for early detection of health risks that can affect agricultural yields, such as the impact of plant or animal diseases that can interfere with food availability.

Nutrient Monitoring and Analysis through AI and IoT

AI technology integrated with IoT can be used to monitor nutritional quality in food production, so as to ensure that the food produced has a higher nutritional value. This is important to address hidden hunger or malnutrition, which refers not only to food scarcity, but also to malnutrition that affects quality of life (Ahmadzadeh et al., 2023). By utilizing this technology, the food system can be monitored and analyzed more comprehensively, thereby enabling a more equitable distribution of food and meeting the nutritional needs of the community.

SDG 3: Good Health and Well-being

Digital technologies play an important role in supporting the third Sustainable Development Goal (SDG 3) which focuses on good health and well-being for all at all ages. This technology enables transformation in the health sector, from improving health education, better health services, to creating a more inclusive and responsive health system. Here are some of the key roles of digital technologies in supporting SDG 3:

Improving Health Education through Blockchain and Digital Literacy

Blockchain technology has been integrated in educational programs aimed at improving digital literacy and numeracy. This contributes to health education by creating a population that is more informed and able to use digital health devices effectively (Choi et al., 2022). Better health education allows people to be more aware of disease prevention, healthy lifestyles, and the use of health technology, which supports the improvement of overall well-being.

Chronic Disease Management through mHealth Intervention

Mobile health technology (mHealth) plays an important role in the management of chronic diseases by facilitating better communication between patients and healthcare workers, supporting better self-care, and improving patients' quality of life (Escrivá-Martínez et al., 2022; Wannheden et al., 2022). The mHealth app allows patients to track symptoms, manage medications, and access medical information directly, which is helpful in managing long-term illnesses and improving health outcomes.

Precision Public Health through Digital Health Data

A precision data-driven public health approach uses digital health data to prevent and manage non-communicable diseases (NCDs). By using sophisticated analytics algorithms, health data can be mapped to identify risks, develop specific prevention strategies, and respond to public health needs more effectively (Canfell et al., 2022). This initiative supports the achievement of SDG 3 by reducing the burden of NCDs, which is one of the leading causes of global mortality.

Digital Planning Tools for Local Public Health

Digital planning tools are designed for local public health actors to help create a health-promoting environment. This tool allows for the identification of health needs at the community level and addresses socioeconomic disparities in access to

health services (Busskamp, 2022). By using this technology, health policies can be tailored to local needs, thereby creating a more inclusive health system.

Digital Contact Tracing in the Handling of Infectious Diseases

Digital contact tracing technology has shown potential in detecting and managing the spread of infectious diseases, such as COVID-19. However, its implementation in low-income areas faces challenges such as limited infrastructure and limited access to digital devices (Handmann et al., 2023). This highlights the need for a locally-context-tailored approach to maximize the benefits of digital tracking.

SDG 4: Quality Education

Digital technologies play an important role in supporting the fourth Sustainable Development Goal (SDG 4) which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. By utilizing digital technology, education can be more accessible, more interactive, and more focused on the skills needed in the digital era. Here are some of the key roles of digital technologies in supporting SDG 4:

Gameful Design for Skill Development

The gameful design approach in education uses game elements to create a more engaging and motivating learning experience, especially among youth from marginalized communities. This design encourages students to learn skills relevant to the Fourth Industrial Revolution (4IR), thus addressing the skills gap in society (Obioha & van Zyl, 2022). Gameful design promotes active engagement and creates an interactive learning environment, which can significantly improve learning outcomes and motivate learners to engage in lifelong learning.

Improving Literacy and Collaborative Learning through Blockchain

Blockchain technology has been introduced in the education system to create a more collaborative learning environment. Blockchain is used to record student achievements, verify skills, and provide digital certificates that are resistant to manipulation. Studies in Korea show that blockchain-based education programs improve digital literacy, general literacy, and numeracy among elementary school students, emphasizing its potential in supporting inclusive and equitable education (Choi et al., 2022). This model supports skill development and facilitates continuous collaborative learning (Bjelobaba et al., 2023).

Blockchain-Powered Collaborative Learning

Learning models powered by blockchain technology allow for more transparent student-based evaluations and encourage collaboration among students and teachers (Bjelobaba et al., 2023). It promotes skills-based learning and allows students to collaborate on real-life relevant projects, which strengthens skill development and supports lifelong learning goals.

Integration of Digital Reporting Platforms in Education

The integration of digital reporting platforms, which has been successfully implemented in health information systems in Mali, shows the potential to be applied in an educational context (Kirk et al., 2021). The platform can be used to collect and integrate education data from the community level, thus enabling better

data-driven decision-making in the education sector. More effective use of data can improve the quality of education and ensure that education policies are more tailored to the needs of students and local communities.

Adaptive Learning and Artificial Intelligence (AI)

Adaptive learning that uses artificial intelligence (AI) allows for educational approaches tailored to the individual needs of students (Flores-Vivar & García-Peñalvo, 2023). AI can analyze students' learning patterns and provide personalized recommendations, helping students learn more effectively and efficiently. . With this personalized approach, students can reach their full potential, which supports quality and inclusive education.

SDG 5: Gender Equality

Digital technologies play an important role in supporting the fifth Sustainable Development Goal (SDG 5) which aims to achieve gender equality and empower all women and girls. By utilizing digital technology, various initiatives can be focused on financial inclusion, access to health services, digital education, and women's economic empowerment. Here are some of the key roles of digital technologies in supporting SDG 5:

Digital Financial Inclusion for Women's Economic Empowerment

Fintech technology has increased women's access to financial services through digital platforms such as mobile banking and e-wallets, which allow women to access financial products directly from their mobile phones. This gender-based financial inclusion makes it easier for women to manage business and household finances, strengthen their economic independence, and support active participation in the economy (Tripathi & Rajeev, 2023). With the existence of a gender-based financial inclusion index, women's financial access gaps can be identified and improved, thereby accelerating the achievement of gender equality.

Digital Health Technologies to Improve Women's Access to Healthcare

Digital health technologies, such as mobile apps and telemedicine, have improved women's access to health services, especially in remote areas. This technology allows women to get medical care without having to travel long distances, thereby improving their health and well-being. The technology also supports chronic care management by facilitating better communication between female patients and healthcare providers (Wannheden et al., 2022). With better access to health, women can be healthier and empowered to participate in social and economic activities.

Gameful Design for Young Women's Education and Skills Development

Gameful design, which incorporates game elements into digital training programs, has emerged as a transformative approach to empowering young women by fostering engagement and motivation in acquiring market-relevant skills, particularly in technology and entrepreneurship (Obioha & van Zyl, 2022). By integrating features such as rewards, challenges, and progress tracking, gameful learning environments create an interactive and enjoyable educational experience, enabling young women to actively participate in skill development. This approach not only helps bridge gender gaps in education and employment by equipping women with the competencies required for modern sectors but also enhances their

confidence and readiness to navigate traditionally male-dominated fields. Ultimately, gameful design serves as a dynamic tool for fostering inclusivity, reducing disparities, and preparing young women to thrive in an increasingly digital and competitive job market.

Blockchain-Based Education Program to Improve Women's Digital Literacy

Blockchain-based education programs that apply gamification techniques encourage the improvement of digital literacy and numeracy among female students (Choi et al., 2022). Blockchain technology can be used to verify women's educational and skills achievements, facilitate collaborative learning, and enable more transparent recognition of their skills. It supports gender equality in education by ensuring that women have equal access to learning and skills development opportunities in the digital age.

Digital Planning for a Healthier and Safer Environment for Women

Digital planning tools for public health help create a healthier environment, which is crucial for women's well-being (Busskamp, 2022). For example, digital tools can be used to design more inclusive cities and communities, including health facilities and basic services that are more accessible to women. With better access to essential infrastructure and services, women can lead healthier and more productive lives.

SDG 6: Clean Water and Sanitation

Digital technologies play a crucial role in supporting the sixth Sustainable Development Goal (SDG 6) which focuses on providing clean water and sanitation for all. By utilizing digital technology, water and sanitation resource management can be improved through smarter, more efficient, and data-driven innovations. Here are some of the key roles of digital technologies in supporting SDG 6:

IoT-Based Waste Management and Deep Learning

The integration of Internet of Things (IoT) technology with deep learning has been implemented in waste management systems to optimize waste classification and reduce hazardous emissions. This solution supports better water quality by preventing contamination of water sources from poorly managed waste (Al Duhayyim et al., 2022). The use of IoT allows for more efficient waste management through real-time monitoring, which helps to ensure that waste treatment is running according to standards and supports a cleaner and healthier environment.

Intelligent Rainwater Harvesting System in Dry Areas

In arid and semi-arid areas, digital technology supports intelligent rainwater harvesting systems. The system uses sensors and automated controls to monitor water quality, measure rainfall, and manage water resources efficiently (Judeh et al., 2022). By optimizing rainwater collection and distribution, these technologies can provide a reliable and safe supply of drinking water, supporting the achievement of SDG 6 by providing sustainable water sources in water-scarce regions.

Digital Planning for a Healthier Environment

Digital planning tools are used by local public health actors to create healthier living environments, which contributes to improving clean water and sanitation standards (Busskamp, 2022). Using these tools, water and sanitation management

can be planned more efficiently and data-driven, allowing for more targeted actions in maintaining water quality and ensuring proper sanitation access.

Digitalization in Agriculture for Sustainable Water Management

Digital technologies applied in agriculture, such as the use of sensors for irrigation monitoring and water management, support sustainable water management practices (Abdulai, 2022). These sensors allow farmers to monitor water use more efficiently, reduce waste, and maximize agricultural yields. This supports SDG 6 by ensuring that agricultural practices do not lead to excessive depletion of water resources.

Integration of Community Data into Health Information Systems

The integration of community-level data into health information systems through digital platforms can help improve the quality and availability of data on water and sanitation (Kirk et al., 2021). This data can be used to detect sanitation and clean water issues more quickly and enable faster intervention and better decision-making in clean water and sanitation projects. The use of accurate data allows for more precise allocation of resources to ensure equitable access to clean water and sanitation.

SDG 7: Clean and Affordable Energy

Digital technologies play an important role in supporting the seventh Sustainable Development Goal (SDG 7), which aims to ensure access to affordable, reliable, sustainable and modern energy for all. Digital innovation helps improve energy efficiency, promote the use of renewable energy, and optimize energy distribution and consumption. Here are some of the key roles of digital technologies in supporting SDG 7:

Green Technology Innovation in the Energy Sector

Digital technologies, including the Internet of Things (IoT) and deep learning, play a role in creating green technology innovations in new energy companies. These innovations are implemented through more efficient energy management, such as in sustainable waste management which helps reduce environmental impact and improve energy efficiency (Al Duhayyim et al., 2022). These green technology innovations are driven by market incentive-based regulatory policies that have proven to be more effective in encouraging the advancement of sustainable energy technologies than traditional regulations (Shi & Li, 2022).

Energy Resource Management in Smart Cities

Digital technology helps manage energy resources in smart cities by using digital platforms to regulate energy use efficiently (Basmi et al., 2021). The platform collects and analyzes data in real-time, enabling better energy management, including in electricity consumption control, distribution management, and energy infrastructure maintenance. This not only improves energy efficiency, but also supports the sustainability of the city through reducing carbon emissions and optimizing the use of renewable energy.

Renewable Energy-Based Multigeneration System

Multigeneration systems that use renewable energy sources, such as geothermal energy, have shown great potential in improving energy efficiency and

producing multiple resources at once. These systems not only generate electricity, but also produce by-products such as hydrogen and fresh water, which are essential to support sustainable urban development (Haider et al., 2023). Digital technology is used in the operation and control of these systems to maximize energy efficiency and reduce waste, supporting the transition to renewable energy.

Automated Processing of Sustainability Reports with NLP

Natural language processing (NLP) techniques, such as the RoBERTa model, are used to automate the processing of sustainability reports. This technology facilitates the alignment of projects with SDG 7 through analysis and adjustment of reports relevant to sustainable energy goals (Angin et al., 2022). This automated processing helps energy organizations and companies evaluate and report their environmental impacts more effectively, and ensure that they are aligned with sustainable energy practices.

The Use of IoT for Smart Energy Management

IoT plays an important role in smart energy management through the installation of smart sensors and meters in buildings and industrial facilities (Al Duhayyim et al., 2022). These sensors monitor energy consumption in real-time, allowing users to identify areas of waste and optimize energy use. This technology also helps in the development of smart grids that integrate various renewable energy sources into the energy distribution system, supporting grid efficiency and stability.

SDG 8: Decent Work and Economic Growth

Digital technologies play an important role in supporting the eighth Sustainable Development Goal (SDG 8), which focuses on promoting sustainable, inclusive economic growth as well as providing decent employment for all. Digital innovation not only improves economic efficiency but also accelerates job creation and strengthens workforce capacity, especially among marginalized communities. Here are some of the key roles of digital technology in supporting SDG 8:

Skill Development Through Game-Based Design

Gameful design is used to develop skills and motivate young people in marginalized communities, especially in urban areas such as South Africa. Through this approach, young people can acquire skills relevant to the digital job market, which supports their participation in the digital economy and reduces unemployment (Obioha & van Zyl, 2022). The game-based design makes the learning process more interactive and engaging, encouraging the development of skills necessary for future employment, including digital skills, soft skills, and entrepreneurship.

Improving Digital Literacy and Numeracy with Blockchain

Blockchain-based education programs play a role in improving digital literacy and numeracy, which are essential skills in the future digital economy (Choi et al., 2022). By using this technology, students can engage in more collaborative and transparently verified learning. This supports upskilling the workforce and expanding access to more decent jobs in the digital sector, which overall drives more inclusive economic growth.

Digitalization of Agriculture to Increase Economic Growth and Job Creation

In Sub-Saharan Africa, agricultural digitalization helps bridge the information gap among farmers, increase agricultural productivity, and create new jobs (Abdulai, 2022). Digital technologies allow for better access to market information, weather, and sustainable agricultural practices. By supporting skills development in the agricultural sector, these technologies encourage the empowerment of local economies and provide wider employment opportunities, especially for youth in rural areas.

Applying Digital Twins and AI in Resource Governance

Digital twins and artificial intelligence (AI) technologies are used in natural resource and environmental governance, which supports more sustainable economic practices (Kloppenburg et al., 2022). This technology allows for real-time monitoring and management of resources, which has the potential to improve economic efficiency and reduce waste. By improving resource management, digital technology can create a more productive and sustainable business environment, supporting better economic growth.

Automation and Operational Efficiency in the Economic Sector

Digital technologies, such as robotics, data analytics, and process automation (RPA), are improving efficiency in various sectors of the economy. The use of this technology in manufacturing, services, and the agricultural sector can speed up production processes, increase productivity, and reduce operational costs (Abdulai, 2022). In addition, automation creates opportunities for new jobs related to the management, maintenance, and development of such technologies, supporting the creation of more sustainable jobs.

SDG 9: Industry, Innovation, and Infrastructure

Digital technologies play an important role in supporting the ninth Sustainable Development Goal (SDG 9), which focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. The use of digital technologies has accelerated the development and transformation of industries, infrastructure, and governance, which directly supports the achievement of SDG 9. Here are some of the key roles of digital technologies in supporting SDG 9:

Blockchain Adoption for Innovation and Resilient Infrastructure

Blockchain technology plays a crucial role in improving the quality of the digital economy and building a resilient infrastructure by addressing data privacy and security issues. In China, the use of blockchain has driven the development of a high-quality urban digital economy, in line with innovation efforts and sustainable infrastructure development (Xia et al., 2022). Blockchain improves data transparency and integrity across various sectors, from finance to supply chain management, strengthening a more secure and efficient digital infrastructure.

IoT-Based Waste Management and Deep Learning for Sustainable Industrialization

The integration of the Internet of Things (IoT) and deep learning models in waste management has supported sustainable industrialization by optimizing the efficiency of real-time waste monitoring and classification (Al Duhayyim et al., 2022). These technologies enable better waste treatment, reduce environmental impact,

and increase the productivity of industrial processes, which supports the construction of resilient infrastructure and the promotion of greener industrial practices.

Digital Platform for Data-Driven Decision Making in Infrastructure Development

The use of digital platforms such as the District Health Information System (DHIS2) in Mali shows how digital technologies can improve the quality and availability of data for better decision-making in infrastructure development (Kirk et al., 2021). The use of this real-time data allows for more efficient planning and allocation of resources, strengthens infrastructure resilience and ensures that development is inclusive and based on the needs of local communities.

Digital Technology-Based Environmental Governance for Sustainable Infrastructure

Digital technologies enable better collection, analysis, and use of environmental data, which is essential for sustainable infrastructure planning and management (Kloppenburg et al., 2022). With the use of digital twins, environmental data can be used to predict risks, plan disaster mitigation, and support urban planning that is more resilient to climate change and other natural threats.

Supply Chain Optimization with Digital Technology

Digital technologies such as big data analytics, AI, and IoT help optimize industrial supply chains by increasing transparency, speed, and efficiency in distribution and logistics processes (Al Duhayyim et al., 2022). Better use of data allows companies to respond quickly to market changes, reduce waste, and improve industry competitiveness. This technology supports the development of more resilient and efficient industrial infrastructure, in accordance with the principles of sustainable industrialization.

SDG 10: Reducing Inequality

Digital technologies play an important role in supporting the tenth Sustainable Development Goal (SDG 10), which aims to reduce inequalities within and between countries. These technologies enable broader access to resources, services, and opportunities, empower marginalized groups, and support the reduction of economic and social inequalities. Here are some of the key roles of digital technology in supporting SDG 10:

Blockchain-Based Education to Reduce Educational Inequality

Blockchain technology is applied in educational programs to improve digital literacy and numeracy among marginalized groups. Blockchain-based programs not only improve basic skills, but also provide manipulation-resistant digital certificates, which can help marginalized individuals gain recognition for their skills and fairer access to job opportunities (Choi et al., 2022). By empowering underserved groups, these technologies support the reduction of inequalities in the education and employment sectors.

Sustainable Waste Management with IoT and Deep Learning for Environmental Justice

Internet of Things (IoT) technologies and deep learning are applied in sustainable waste management, which helps create a cleaner and healthier

environment for all communities, including the underserved (Al Duhayyim et al., 2022). The use of these technologies ensures that better environmental conditions can be enjoyed by all levels of society, which supports environmental justice and reduces inequalities in access to a decent quality of life.

Agricultural Digitalization for the Empowerment of Marginalized Groups

In Sub-Saharan Africa, agricultural digitalization supports smallholder farmers, especially women and youth, by providing access to market information, better agricultural techniques, and access to digital-based financial services (Abdulai, 2022). By providing broader access to these resources, digital technologies help reduce socio-economic inequalities, improve food security, and empower economically marginalized groups.

Digital Financial Inclusion for Women's Empowerment

Digital-based financial services, such as mobile banking and e-wallets, allow women to access financial products and services that were previously difficult to reach. This financial inclusion not only increases women's economic independence, but also supports gender equality and reduces inequality in terms of economic and social access (Tripathi & Rajeev, 2023). This gender-based financial inclusion encourages women to participate more actively in the economy and reduce the gender gap.

Digital Health Technology for More Equitable Access to Healthcare

Digital health technology facilitates partnerships between patients and healthcare providers, especially in underserved communities. By providing telemedicine services, online health consultations, and mobile-based health apps, these technologies expand access to health services, reduce disparities in health outcomes, and support the reduction of inequalities in access to health services (Wannheden et al., 2022).

SDG 11: Sustainable Cities and Communities

Digital technologies play an important role in supporting the eleventh Sustainable Development Goal (SDG 11) which aims to create inclusive, safe, resilient, and sustainable cities. This technology accelerates innovation in urban planning, infrastructure, and governance, thereby creating a more efficient and livable urban environment. Here are some of the key roles of digital technologies in supporting SDG 11:

Developing a Collaborative Network for Sustainable Housing Solutions

In the housing sector, digital technologies are being used to create resilient collaborative networks that support sustainable housing solutions. An example is pop-up shelters in Australia that use digital tools to strengthen distributed leadership and adaptive features (Pablo & London, 2022). These shelters not only address housing affordability and homelessness issues but also leverage digital technology to respond to the needs of residents more quickly and appropriately, supporting the inclusiveness and sustainability of the city.

IoT-Based Waste Management for a Cleaner and More Sustainable City

The integration of the Internet of Things (IoT) and deep learning in urban waste management has improved efficiency in real-time waste monitoring and

classification. For example, the AEOIDL-SWM system that uses IoT sensors and deep learning models is able to optimize waste management and reduce environmental impact (Al Duhayyim et al., 2022). By improving environmental cleanliness, this technology supports the creation of healthier and livable cities.

Strengthening the City's Digital Economy Through Blockchain

Blockchain technology plays an important role in improving data security and privacy in smart cities, which supports the development of a high-quality urban digital economy (Xia et al., 2022). Blockchain enables the implementation of digital payment systems, secure data management, and more efficient management of urban resources. This supports technology-based economic development in cities and increases transparency and accountability in urban governance.

Use of Digital Platforms for Data-Based Urban Planning

Digital platforms such as the District Health Information System (DHIS2) in Mali show how real-time data can be used for more efficient and informed urban planning (Kirk et al., 2021). The use of this platform allows city governments to better understand the needs of the community, allocate resources more appropriately, and plan for the development of more responsive and resilient urban infrastructure.

Digital Inclusivity in Urban Environments

The use of digital technology must pay attention to the inclusivity aspect to ensure that all citizens, including the digitally marginalized, can take advantage of it. Occupational therapy, for example, plays a role in supporting digital technology accessibility for vulnerable groups, supporting the development of digital skills, and reducing digital exclusion in urban environments (Liddle, 2023). By encouraging digital inclusion, cities can provide more equitable access to information, services, and opportunities.

SDG 12: Responsible Consumption and Production

Digital technologies play an important role in supporting the twelfth Sustainable Development Goal (SDG 12), which focuses on responsible consumption and production. This technology allows for more efficient use of resources, waste reduction, and the implementation of more sustainable production and consumption practices. Here are some of the key roles of digital technology in supporting SDG 12:

NDCmitiQ Tool for Greenhouse Gas Mitigation Target Measurement

Digital tools such as NDCmitiQ are used to measure greenhouse gas mitigation targets and help countries align their emission pathways with the goals of the Paris Agreement (Günther et al., 2021). By supporting a more precise analysis of carbon emissions and mitigation policies, these technologies help the manufacturing sector implement more sustainable practices, which are essential for achieving SDG 12.

IoT-Based Waste Management and Deep Learning for Resource Efficiency

The AEOIDL-SWM technique, which combines the Internet of Things (IoT) and deep learning, enables more efficient waste management through real-time monitoring and classification of waste (Al Duhayyim et al., 2022). These

technologies support responsible production practices by reducing environmental impact, recycling raw materials, and promoting a circular economy, which is in line with the goals of SDG 12.

Digitalization of Agriculture to Improve Sustainability and Efficiency

In the agricultural sector, digitalization helps improve food security, optimize the use of natural resources, and promote environmental sustainability (Abdulai, 2022). The use of digital data allows farmers to monitor the use of water, fertilizers, and pesticides more precisely, which reduces waste and negative impacts on the environment. However, the application of this technology must pay attention to political and economic factors to avoid increasing inequality and ensure that the technology is accessible to all parties.

Using AI to Drive Responsible Consumption

Artificial Intelligence (AI) is used in smart devices to encourage more responsible consumption behavior. For example, AI can be applied to moderation of app usage on children's devices, which helps regulate screen time and promote healthier and sustainable consumption behaviors (Alrusaini & Beyari, 2022). By changing individual consumption patterns, these technologies can support the achievement of SDG 12 by encouraging better consumption awareness and practices.

LiDAR Technology for Waste Audit and Efficient Renovation Diagnostics

In the construction sector, LiDAR technology embedded in mobile devices allows for more precise and efficient waste audits and renovation diagnostics (Mêda et al., 2023). The technology supports circular economy practices by identifying areas that can be optimized to reduce the waste of building materials and promote the sustainable use of materials. This helps reduce the environmental impact of the construction sector, which is one of the main contributors to carbon emissions.

SDG 13: Climate Action

Digital technologies play an important role in supporting the thirteenth Sustainable Development Goal (SDG 13), which focuses on action on climate change. With the ability to monitor, analyze, and optimize various processes, digital technologies support climate change mitigation and adaptation efforts through data-driven decision-making, better resource management, and increased climate policy effectiveness. Here are some of the key roles of digital technologies in supporting SDG 13:

Measurement and Analysis of Greenhouse Gas Mitigation Targets with NDCmitiQ

The NDCmitiQ tool is used to measure and analyze greenhouse gas mitigation targets, helping countries align their Nationally Determined Contributions (NDCs) with the goals of the Paris Agreement (Günther et al., 2021). The tool enables monitoring and assessment of emissions pathways as well as the identification of ambition gaps in current NDCs. By supporting more data-driven policy planning, these technologies help countries design and implement more effective climate strategies.

IoT-Based Waste Management for Climate Change Mitigation

The AEOIDL-SWM technique integrates the Internet of Things (IoT) and deep learning in waste management, which significantly reduces pollution and environmental impacts (Al Duhayyim et al., 2022). By monitoring and classifying waste in real-time, these technologies minimize greenhouse gas emissions from waste and support climate change mitigation strategies, in line with efforts to achieve SDG 13.

Environmental Governance with Digital Twins of the Earth

The European Union's "Destination Earth" project aims to create a digital twin of the Earth, which is a comprehensive digital model that monitors environmental conditions in real time (Kloppenburg et al., 2022). These technologies support better climate policymaking by providing accurate environmental data, predicting the impacts of climate change, and designing more appropriate adaptation strategies. This digital twin also facilitates global collaboration in climate mitigation efforts by providing data that can be accessed by many countries.

Better Decision Making with AHP Analyzer

AHP Analyzer is a decision-making tool used to prioritize climate change mitigation options (Soam et al., 2023). These technologies allow for a more systematic analysis of various policy options, such as forest management or industrial emission reduction, and help policymakers determine the most effective interventions in addressing climate change.

IoT-Based Natural Resource Management for Emission Reduction

IoT is used in the monitoring and management of natural resources, such as water and forests (Al Duhayyim et al., 2022). IoT sensors can monitor soil moisture, plant growth, and forest conditions, which helps prevent forest fires, maximize carbon sequestration, and reduce deforestation. By maximizing the sustainable use of natural resources, this technology supports the reduction of greenhouse gas emissions.

SDG 14: Ocean Ecosystems

Digital technologies play an important role in supporting the fourteenth Sustainable Development Goal (SDG 14), which focuses on the conservation and sustainable use of marine resources. Through this technology, efforts to conserve the ocean, reduce pollution, and improve the management of marine ecosystems can be carried out more effectively and efficiently. Here are some of the key roles of digital technologies in supporting SDG 14:

IoT-Based Waste Management for Marine Ecosystem Protection

The integration of IoT technology and advanced methods like deep learning has revolutionized waste management, offering innovative solutions to mitigate pollution and protect marine ecosystems. One such technique, AEOIDL-SWM, leverages IoT sensors to monitor, classify, and manage waste in real time, significantly reducing the likelihood of hazardous materials entering aquatic environments (Al Duhayyim et al., 2022). By enabling precise and efficient waste categorization and disposal, this approach not only enhances waste management systems but also minimizes the detrimental effects of pollution on marine biodiversity. Moreover, the deployment of digital technologies in waste management underscores their critical role in safeguarding water quality,

preserving marine life, and promoting sustainable practices to address the escalating challenges of environmental conservation.

Implementing the Blue Economy for Marine Resources Conservation

The concept of the blue economy emphasizes the wise and sustainable use of marine resources. In the Caribbean region, digital technologies are being applied for marine ecosystem assessment and more efficient resource management (Phang et al., 2023). These technologies support more sustainable extraction practices of marine resources, promote the balance of marine ecosystems, and encourage more responsible fisheries and aquaculture practices.

Digital Innovation in Green Finance to Reduce Marine Environmental Impact

Digital technologies in green finance support investments in renewable energy and other green projects, which have a positive impact on the health of the marine environment (Gao et al., 2023). For example, funding for renewable energy can reduce pollution from burning fossil fuels, ultimately reducing ocean acidification and damage to marine ecosystems.

Digital Transformation in the Manufacturing Sector to Improve ESG Performance

Digital transformation in the manufacturing sector is contributing to improved Environmental, Social, and Governance (ESG) performance, which includes more sustainable and responsible practices for marine ecosystems (Zhao et al., 2023). This technology supports better production efficiency and resource use, reduces industrial waste that has the potential to pollute the ocean, and promotes the use of environmentally friendly materials.

Digital Empowerment for Community Involvement in Marine Conservation

Digital technologies support digital governance and digital empowerment at the grassroots, which strengthens community involvement in the implementation of marine conservation policies and sustainable practices (Li et al., 2022). With the use of digital platforms, communities can participate in monitoring and reporting on marine environmental conditions, as well as take an active role in local initiatives to protect marine ecosystems.

SDG 15: Terrestrial Ecosystems

Digital technologies play an important role in supporting the fifteenth Sustainable Development Goal (SDG 15), which focuses on the protection, restoration and sustainable use of terrestrial ecosystems. This technology supports forest conservation, land degradation reduction, and biodiversity conservation efforts through monitoring, better resource management, and data-driven decision-making. Here are some of the key roles of digital technology in supporting SDG 15:

IoT-Based Waste Management to Reduce Pollution in Terrestrial Ecosystems

Internet of Things (IoT) technology and deep learning are used in waste management systems to optimize waste classification and monitoring. By reducing pollution that harms terrestrial ecosystems, these technologies help preserve biodiversity and encourage more sustainable practices (Al Duhayyim et al., 2022). IoT enables real-time detection of pollutants, which supports the prevention of land and groundwater pollution.

Digitalization of Agriculture for the Sustainability of Land Ecosystems

Digital platforms in the Sub-Saharan Africa region play a role in bridging the information gap in the agricultural sector, helping to improve food security and environmental sustainability (Abdulai, 2022). This digital technology supports sustainable agricultural practices through monitoring water use, soil management, and more efficient use of fertilizers. In this way, digital technologies help reduce the negative impact of agriculture on terrestrial ecosystems and support better land management.

Using NLP to Align Projects with SDGs

Natural language processing (NLP) techniques, such as RoBERTa, are used to classify sustainability reports and evaluate the extent to which projects support the SDGs (Angin et al., 2022). By utilizing NLP, project evaluations can be carried out faster and more accurately, ensuring that the project is in line with the goal of preserving terrestrial ecosystems and supporting sustainable management of natural resources.

Digital Platform in Smart Cities for More Efficient Resource Management

Smart city initiatives use digital platforms to improve resource management and data-driven decision-making, which supports the sustainability of urban ecosystems (Basmi et al., 2021). These technologies enable more effective management of urban forests, parks, and other green areas, supporting the preservation of biodiversity in urban environments and improving air quality and the health of local ecosystems.

Green Finance and Technological Innovation for Terrestrial Ecosystem Protection

Digital finance combined with green technology innovations supports conservation efforts by promoting investment in renewable energy and other environmental projects (Gao et al., 2023). These technologies help reduce emissions, reduce the impact of human activities on terrestrial ecosystems, and support the preservation of forests and biodiversity.

SDG 16: Peace, Justice, and Strong Institutions

Digital technologies play a critical role in supporting the sixteenth Sustainable Development Goal (SDG 16), which aims to create peaceful, inclusive societies and provide equitable access to justice and build effective and accountable institutions. Through the use of this technology, institutions can increase transparency, accountability, and public participation in governance, which ultimately supports more equitable and inclusive development. Here are some of the key roles of digital technologies in supporting SDG 16:

Blockchain to Improve Digital Literacy and Citizen Engagement

Blockchain technology has been applied in educational programs to improve digital literacy and encourage inclusive education (Choi et al., 2022). By equipping citizens with better digital skills, these technologies support more active participation in democratic processes, thereby creating a more informed and engaged society. Blockchain is also used to ensure transparency in elections, digital voting, and the recording of important documents, strengthening public trust in the system of justice and accountable governance.

Digital Platform for Public Participation and Inclusive Governance

Digital platforms play an important role in increasing public participation in urban planning and governance (Bellone et al., 2021). Through data collection from social media and sentiment analysis, government agencies can better understand people's needs and preferences, which supports the development of more responsive and accountable policies. This technology allows citizens to participate in the decision-making process, thereby encouraging more inclusive and open governance.

Digital Health Technologies to Increase Trust in the Health System

Digital technologies in healthcare, such as telemedicine and chronic care management applications, help strengthen partnerships between patients and healthcare providers (Wannheden et al., 2022). By strengthening communication and collaboration between patients and healthcare professionals, these technologies create a more transparent and reliable healthcare system, supporting equity and equitable access to health services, which is aligned with SDG 16 goals.

IoT and Deep Learning for Waste Management and Public Health

Internet of Things (IoT) technology and deep learning are applied in waste management to improve the efficiency and effectiveness of waste collection and classification (Al Duhayyim et al., 2022). By reducing health risks and environmental impacts, these technologies support better public health, which in turn contributes to the creation of more peaceful and inclusive societies. Effective waste management also creates a safer environment, improves quality of life, and promotes social stability.

Cybersecurity to Protect Digital Rights and Public Privacy

Cybersecurity plays a crucial role in protecting people's digital rights and privacy. By preventing cyberattacks and protecting personal data, these technologies ensure that individuals can participate in digital life without fear of privacy breaches (Singh et al., 2022). This supports the basic rights of individuals and strengthens public trust in the use of digital technology in governance and public services.

SDG 17: Partnerships to Achieve the Goals

Digital technologies play an important role in supporting the seventeenth Sustainable Development Goal (SDG 17), which focuses on strengthening global partnerships for sustainable development. These technologies facilitate collaboration between countries, better data collection and sharing, and evidence-based decision-making that can support the achievement of the overall sustainable development goals. Here are some of the key roles of digital technologies in supporting SDG 17:

Blockchain for Global Education Collaboration

Blockchain technology has been used in educational programs to improve the quality of education globally. Blockchain-based educational programs that integrate gamification techniques not only improve digital literacy, but also enable educational collaboration in different countries (Choi et al., 2022). By providing secure and transparent educational records, blockchain facilitates the recognition

of international credentials, supports student mobility, and strengthens partnerships in the global education system.

Game-Based Design for Skills Development and Economic Empowerment

Gameful design elements are used to engage youth in marginalized communities, helping them develop skills relevant to the job market and increase employment opportunities (Obioha & van Zyl, 2022). These technologies support inclusive economic growth in different countries and encourage cross-sector collaboration to address skills gaps and unemployment, which is an important part of global partnerships in more equitable economic development.

Data Analytics for Evidence-Based Decision Making

Digital technologies support better data-driven decision-making, which is essential for the planning and implementation of sustainable development policies. Through big data analysis and artificial intelligence, governments and international organizations can monitor development indicators more accurately and design more effective interventions (Kloppenburg et al., 2022). This technology supports the development of more strategic partnerships by providing accurate and real-time information on socio-economic and environmental conditions.

Technology Partnerships for Sustainable Financial Development

Partnerships in digital finance and green technology contribute to the achievement of SDG 17 by accelerating sustainable economic growth. Technologies such as fintech, digital finance, and green innovation support broader access to financial services, more inclusive investments, as well as collaboration in the development of global green solutions (Gao et al., 2023). These initiatives create stronger partnerships between the public and private sectors, facilitating a more efficient exchange of knowledge and resources.

Digital Inclusion to Reduce the Global Divide

However, digital technology also faces challenges, especially related to the digital divide. Inequalities in access to technology and digital literacy can exacerbate global inequalities if not addressed appropriately (Singh et al., 2022). To effectively support SDG 17, efforts are needed to expand access to technology in developing countries and marginalized communities, as well as increase digital literacy capacity to ensure that all parties can use technology equally.

Practical Implications

More Effective Adoption of Technology

This study shows that digital technology has great potential in supporting efficiency and innovation in various sectors relevant to the SDGs, such as education, health, and the economy. The use of technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT) has a real impact in improving processes and improving sustainable development outcomes. Thus, the application of this technology needs to be designed in a more focused and integrated manner so that the benefits can be felt optimally and sustainably. The digital transformation that occurs must be monitored with the right policies, so that it can increase the capacity of the public and private sectors in accelerating the achievement of the SDGs targets that have been set.

Multisectoral Collaboration

One of the most prominent practical implications is the importance of cross-sector collaboration in making the most of digital technology. Collaboration involving the government, the private sector, and civil society is essential to strengthen the positive impact of digital technology on inclusive development. In addition, this synergy allows for the development of policies that are more responsive to local needs and the implementation of more adaptive technologies, especially in less developed areas. The application of this collaborative approach can also encourage the creation of digital solutions that are in accordance with the local context, which in turn supports efforts to achieve the SDGs targets effectively and efficiently.

Strengthening Digital Infrastructure

Adequate digital infrastructure is the main prerequisite for digital technology to be used equally across the region, especially in developing countries. This study emphasizes that unequal access to digital infrastructure is still a major obstacle in supporting the achievement of the SDGs, especially related to social and economic inequality. Therefore, strengthening and expanding digital infrastructure needs to be the focus of policies at the global and local levels. These efforts include the development of internet networks, the provision of digital devices, and inclusive digital literacy programs, so that all levels of society can actively participate in digital transformation.

Theoretical Implications

Conceptual Framework Development

From a theoretical perspective, this study provides a solid basis for the development of a new conceptual framework regarding the integration of digital technology in sustainable development efforts. The findings of this study can serve as a reference for further research focusing on strategies for the holistic and cross-sectoral application of digital technologies for the achievement of the SDGs. With a clearer theoretical framework, researchers and policymakers can understand the specific role of digital technologies in supporting sustainable and more equitable development in various fields.

Contribution to the Sustainability Literature

The study also enriches the sustainability literature by identifying how digital technologies can have a positive impact across sectors on social, economic, and environmental sustainability. In many ways, this study clarifies the relationship between digital technologies and various areas related to the SDGs, thus providing a new perspective on how technology can be optimized for the achievement of broader sustainable development goals. These findings add insight into the implementation of more efficient and sustainable digital technologies in the future.

Advanced Research

Although this study has successfully illustrated the role of digital technology in supporting the SDGs, there is still a gap in understanding the long-term impact of these technologies, especially in the context of cross-sector sustainability. Therefore, more research is needed to explore how digital technologies can be better integrated in various fields, such as education, health, and the environment,

in order to make a more comprehensive contribution to sustainable development. Further research is also expected to provide deeper insights into the challenges faced in the implementation of digital technology in various sectors, as well as the right solutions to overcome them.

Review Limitations

This literature review reveals the various important roles of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). However, some limitations need to be acknowledged to clarify the limitations of this study and provide direction for future research.

Less Systematic Review Approach

This review uses the Narrative Literature Review (NLR) approach, which, although it offers flexibility and more in-depth descriptions, has limitations in terms of systematization of literature selection and presentation. This approach tends to produce a more subjective narrative, as literature selection relies more on thematic relevance than strict inclusion and exclusion criteria, as commonly used in Systematic Literature Review (SLR). As a result, there is a potential for bias in the emphasis on certain literature that is considered important, so the interpretation of the findings may not fully reflect the completeness of knowledge in this area.

Limited Availability and Coverage of Literature

One of the significant limitations of this study is the limited availability of relevant literature in several SDGs sectors, especially in the context of developing countries. Many studies focus on developed countries, which have better digital infrastructure and access to technology. This has led to a gap in understanding how digital technologies can be optimally adopted and integrated in different regions with different social, economic, and infrastructure characteristics. This limitation also has an impact on the generalization of findings, so that not all study results can be applied directly at the global level.

Lack of Long-Term Data on the Impact of Digital Technology

Most of the literature analyzed in this study emphasizes the short-term impact of digital technology on the achievement of the SDGs, such as increased efficiency, accessibility, and innovation. While these findings are relevant, there is a need for more in-depth research on the long-term impacts of digital technologies, especially in the context of social, economic, and environmental sustainability. Further research needs to focus more on aspects of sustainable digital technology adaptation and integration, so as to provide a more comprehensive understanding of the contribution of technology to inclusive and equitable development in the long term.

Limitations in Cross-Cultural and Local Perspectives

Another limitation that needs to be noted is the lack of representation of cross-cultural perspectives in the literature reviewed. Most existing studies are based on specific local contexts, which may not reflect the social, economic, and cultural dynamics of other regions. This lack of cross-cultural perspective can limit understanding of how digital technologies can be modified or adapted according to local needs. Therefore, future research needs to consider the diversification of

geographical and cultural contexts, so that the application of digital technology can be more effective and responsive to the specific needs of different regions.

CONCLUSION

This review succeeded in providing a comprehensive overview of the role of digital technology in supporting the achievement of the Sustainable Development Goals (SDGs). Overall, the findings show that digital technology has significant potential in accelerating the achievement of various SDGs targets in various sectors, such as education, health, economy, and the environment. The adoption of digital technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain has been proven to improve efficiency, transparency, and broader access to basic services, including education and healthcare.

One of the important findings is how digital technology can reduce poverty (SDG 1) by facilitating financial access and increasing agricultural productivity through digitalization. In terms of education (SDG 4), digital technology supports more inclusive learning approaches, such as AI-based adaptive learning, tailored to student needs. In the health sector (SDG 3), digital technology makes it easier to access medical services, especially in remote areas, through telemedicine and mobile-based health applications.

In support of gender equality (SDG 5), fintech and digital health technologies help improve women's access to financial and health services, strengthening their economic independence and well-being. In the economic and employment sector (SDG 8), digital innovation not only improves economic efficiency but also creates new job opportunities, especially among marginalized communities. Digitalization of agriculture also supports environmental sustainability (SDG 13) by minimizing the inefficient use of natural resources, supporting climate action, and reducing emissions.

However, behind this potential, there are major challenges that need to be overcome. Inequality of access to digital technologies, especially in developing countries, is a major obstacle that can exacerbate social and economic disparities. In addition, digital ethics issues, such as data privacy and cybersecurity, also require more attention so that the application of this technology can be carried out fairly and responsibly.

RECOMMENDATION

Based on the findings and analysis in this review, several recommendations can be proposed to enhance the role of digital technology in achieving the Sustainable Development Goals (SDGs). These recommendations aim to address the key challenges and leverage opportunities for digital technology to be a force for equitable, sustainable development.

Strengthening Inclusive Digital Infrastructure

To bridge the digital divide and foster equitable access to digital resources, especially in developing nations, substantial investment in digital infrastructure is paramount. This involves expanding internet coverage, ensuring the affordability of digital devices, and providing digital literacy training across all societal levels. By focusing on inclusive infrastructure, digital technology can be utilized as a tool to achieve SDGs more uniformly, allowing communities in underserved areas to

access education, healthcare, and economic opportunities that foster long-term development. Investment in robust digital infrastructure will create a foundational support system for sustainable growth, especially in regions with limited connectivity, and help ensure no one is left behind in the digital era.

Stronger Multisectoral Collaboration

To fully harness the potential of digital technology for sustainable development, robust collaboration across government, private sector, and civil society is essential. A multi-sectoral approach allows for the creation and implementation of adaptive digital solutions tailored to meet the unique needs of each community. By engaging diverse stakeholders, resources and expertise can be pooled to develop innovative, context-sensitive digital tools that contribute meaningfully to the SDGs. Such collaboration can enhance transparency, efficiency, and accountability, ensuring that digital initiatives are well-targeted, inclusive, and have a lasting positive impact on society.

Improving Evidence-Based Policy Frameworks

The development of responsive, evidence-based policies is critical to supporting the adoption of digital technologies across various sectors. Policy frameworks should accommodate advances in AI, blockchain, IoT, and other digital innovations while emphasizing digital ethics, data privacy, and information security. Evidence-based policies help policymakers respond dynamically to technological trends, balance risks and opportunities, and implement regulations that foster innovation while safeguarding public interests. By grounding policies in evidence, governments and organizations can support sustainable technological growth that aligns with ethical standards and public safety, ultimately contributing to more responsible digital transformations aligned with SDG objectives.

Follow-up Research to Deepen Understanding of Long-Term Impacts

As digital technology continues to evolve, further research is needed to understand its long-term implications on social, economic, and environmental sustainability. Follow-up studies could focus on examining cross-sectoral synergies and challenges, exploring how digital innovations impact diverse development contexts over time. Such research can provide a deeper understanding of the benefits and risks associated with digital technology integration, allowing policymakers, practitioners, and researchers to make informed decisions that maximize positive outcomes. A long-term research approach helps establish a solid evidence base for refining digital strategies, ensuring they remain relevant and beneficial in the context of sustainable development.

Ethical Integration in the Implementation of Digital Technology

Ensuring that digital technologies are implemented responsibly requires clear ethical standards across design, development, and usage stages. This includes prioritizing data privacy, information security, and social impact considerations to protect users' rights and welfare. By integrating ethical principles into every stage of technological development, organizations can foster trust and accountability in digital solutions, ensuring that technology benefits all sectors of society. Ethical integration also reinforces responsible digital practices, minimizing negative consequences and promoting technology as a tool for positive change in achieving

the SDGs. This ethical commitment ensures that digital advancements align with both societal values and development goals.

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