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HOW ARTIFICIAL INTELLIGENCE (AI) HAS CONTRIBUTED TO SOCIAL PROJECTS AND GENERATED VALUE: A SYSTEMATIC LITERATURE REVIEW

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1. Introduction

The advancement of artificial intelligence (AI) technologies has led to profound transformations in various social, economic, and environmental spheres. Initially focused on industrial, commercial, and military applications, AI tools have been expanding their reach to social, educational, and healthcare contexts, with the potential to reduce inequalities and promote inclusion (Brynjolfsson & McAfee, 2014). Despite this expansion, significant gaps remain in the systematic understanding of how such technologies have been effectively applied in social projects around the world.

The literature on technological innovation has frequently prioritized the economic impacts of AI, such as productivity gains and process optimization (Cockburn, Henderson, & Stern, 2018). However, authors like Calvo, Dinan, and Peters (2020), in the journal AI & Society, warn of the urgent need for an ethical and humanized perspective on AI, with a focus on tangible social benefits, particularly in marginalized communities. This concern has stimulated debates about the role of AI in promoting the common good, which requires interdisciplinary approaches sensitive to local vulnerabilities.

The understanding of sustainability as a multidimensional concept was initially proposed by Elkington (1998), through the *Triple Bottom Line* model. This framework suggests the integration of economic, social, and environmental dimensions as pillars for evaluating the performance of sustainable projects, serving as a conceptual foundation for analysing the social impact of artificial intelligence.

Studies on the use of emerging technologies for environmental sustainability are already well established (Bocken, Short, Rana, & Evans, 2014), but the same cannot be said for their application in social projects focused on equity and human development. According to Rai et al. (2021), there is a mismatch between the disruptive potential of AI and its actual implementation in solutions addressing complex social problems such as poverty, mental health, access to education, and digital exclusion. This reveals a theoretical and practical gap that remains unexplored.

The relevance of this topic is heightened by the 2030 Agenda and the Sustainable Development Goals (SDGs) proposed by the United Nations (UN, 2015), which aim to eradicate poverty and reduce inequalities by promoting more inclusive societies. Authors such as Vinuesa et al. (2020), in Nature Communications, emphasize that AI could accelerate the achievement of up to 79% of the SDG targets, provided it is applied ethically, responsibly, and equitably. However, they also warn of the risk of exacerbating inequalities if its application is not guided and monitored by principles of social justice.

George et al. (2016) argue that AI can act as a catalyst for projects aimed at social transformation, provided it is incorporated into collaborative management models focus on the real needs of communities. This view aligns with the concept of technology for social good, as discussed by authors in the Academy of Management Journal.

Despite these promising perspectives, the academic production that systematically synthesizes the experiences of applying AI in social projects is still incipient. The absence of a consolidated critical review on the topic hinders both the identification of best practices and the recognition of associated limitations and risks. Therefore, a systematic literature review can significantly contribute to mapping the state of the art, highlighting gaps, and proposing pathways for future research and the practical adoption of intelligent solutions in favor of sustainable and equitable development.

In this context, this article aims to investigate, through a systematic literature review,

how artificial intelligence has been applied in social projects in the international scenario. The goal is to identify the experiences, approaches, and impacts of these initiatives, considering their contribution to reducing social inequalities, strengthening vulnerable communities, and promoting more just and sustainable societies. It is hoped that this will provide both theoretical and practical support for the advancement of socially oriented practices based on intelligent technologies, aligned with the principles of the 2030 Agenda.

2. Theoretical Framework

The integration between technology and sustainability has gained significant prominence in contemporary research, especially considering the climate emergency and changes in corporate behaviour toward more responsible practices. The international literature shows a growing trend of investigations that connect digital tools, social innovation, and shared value strategies, challenging the traditional understanding of return on investment (ROI). As highlighted by Krogstie (2024), the emergence of technologies such as the "Artificial Intelligence of Things" enhances the ability to monitor and analyse indicators in real time, contributing to smarter management models that are integrated with sustainability goals.

In this context, Elkington's (1998) Triple Bottom Line approach offers a framework for assessing the impact of sustainable technologies. Considering economic, social, and environmental dimensions, this perspective supports value creation, which is essential for understanding how artificial intelligence can contribute to social transformation within sustainable development strategies.

2.1 Artificial Intelligence and Sustainability

Artificial intelligence (AI) has proven to be a strategic ally in advancing sustainable projects, not only due to its capacity for analysis and automation but also because it enables the development of adaptive, data-driven systems. Moise (2024) states that AI, when incorporated into sustainable management systems, promotes operational efficiency and contributes to the mitigation of environmental risks. This approach allows organizations to adopt more precise preventive measures based on scenario predictions and historical patterns, enhancing their resilience in the face of climate change and resource scarcity.

In this context, Sánchez-García et al. (2024) highlight the role of neural networks and machine learning in revolutionizing circular economy models. These technologies enable data-driven decisions and support the redesign of production chains with a focus on reuse, recycling, and energy efficiency. This not only improves environmental performance but also creates new opportunities for sustainable and regenerative business models.

The concept of "sustainable AI" introduced by Tabbakh et al. (2024) reinforces that, beyond computational efficiency, it is necessary to consider the social and environmental impacts of technology. The authors suggest ethical guidelines, algorithmic transparency, and a commitment to collective well-being. These elements are essential to ensure that technological solutions do not deepen inequalities or compromise ecological boundaries but instead contribute to a just transformation.

Additionally, Silvius et al. (2017) expand the traditional view of sustainability by arguing that projects must integrate ethical, social, and environmental aspects from the outset. They emphasize that sustainability cannot be an afterthought but must serve as a guiding principle throughout all project phases. By adopting this perspective, AI-based initiatives can be designed to maximize social and environmental value, enhancing their transformative impact in vulnerable and low-equity contexts.

2.2 Innovation and Human Perspective in Sustainable AI

Technological innovation, particularly in the field of artificial intelligence, must be constantly reassessed from a human-centered perspective. In sustainability-related projects, this reassessment becomes even more relevant, given the ethical, cultural, and social implications involved. Tabbakh et al. (2024) argue that truly sustainable AI must be built on human values, promoting inclusion, diversity, and mitigating algorithmic biases that historically reinforce inequalities.

Abulibdeh (2024) emphasizes the importance of ethical and governance principles in algorithm development, especially in sensitive contexts or when working with vulnerable populations. The author highlights that transparency, accountability, and respect for civil rights are the minimum conditions for AI innovation to be considered responsible. Without these principles, technology runs the risk of perpetuating or even intensifying existing social inequalities.

In this regard, George et al. (2016) propose the incorporation of collaborative technology governance models in which users and communities actively participate in defining the goals and success metrics of AI projects. This participatory approach aligns with the concept of "technology for social good," strengthening the role of communities as co-creators of solutions rather than passive recipients. It reinforces the idea that sustainable innovation must be built on dialogue, cultural diversity, and the recognition of local knowledge.

Therefore, thinking of AI from a human and sustainable perspective also requires the strengthening of public policies, corporate practices, and educational models that foster critical and ethical use of technology. This collective construction involves not only engineers and scientists but also sociologists, educators, public managers, and, most importantly, citizens themselves. By integrating these diverse perspectives, it becomes possible to promote innovations that respect human rights and generate shared value.

2.3 Measuring ROI in AI Projects

The evaluation of return on investment (ROI) in AI-based projects has evolved beyond purely financial indicators. Trota et al. (2024) introduce the idea of composite indicators that include financial, social, and environmental impacts, contributing to the development of shared value frameworks. This broader vision redefines traditional ROI by recognizing that, in sustainable projects, both tangible and intangible benefits are equally important.

Patrício et al. (2025) advance this discussion by proposing analytical models that integrate economic, reputational, and socio-environmental dimensions using smart dashboards and real-time monitoring. With the support of AI, it becomes feasible to predict impacts, proactively adjust strategies, and provide concrete data on the results of initiatives. This contributes not only to transparency but also to the legitimacy of projects in the eyes of stakeholders.

However, as Calvo, Dinan, and Peters (2020) point out, the definition of value in AI projects must go beyond operational efficiency. Variables such as digital inclusion, community empowerment, and capacity building must be taken into account, even though they are often not captured by traditional metrics. Overlooking these dimensions can lead to the underestimation of projects that are socially transformative but may yield indirect or long-term financial returns.

Finally, as highlighted by Vinuesa et al. (2020), measuring ROI in AI initiatives aligned with the SDGs requires not only innovative indicators but also a paradigm shift. It is necessary to incorporate values such as social justice, equity, and long-term sustainability into evaluation processes, recognizing that the most meaningful returns are not always immediate profits but rather structural transformation.

2.4 Industry 4.0 and 5.0: Technological Transformations and Sustainability

Industry 4.0 is characterized by the adoption of advanced technologies such as artificial intelligence, collaborative robotics, big data, and the Internet of Things (IoT), all of which promote automation and operational efficiency. Pârv (2024) argues that these innovations, when well implemented, contribute to more sustainable industrial practices, including waste reduction, rational use of natural resources, and greater transparency in production processes. This movement lays the technical foundation for a data-driven production paradigm.

Conversely, Industry 5.0 emerges as a critical response to the limitations of impersonal automation and technical efficiency, prioritizing the human dimension in production. Santhi & Muthuswamy (2023) argue that this new phase seeks to balance technology with empathy, fostering mass personalization, inclusion, and the integration of social values. The convergence of machine intelligence and human creativity redefines digital transformation goals, placing collective well-being at the center of innovation.

In this transition process, authors such as Beier (2024) and Raghavan (2024) emphasize the connection between 4.0 technologies and ESG principles, proposing collaborative, conscious, and resilient supply chains. AI solutions, in this context, are not only aimed at increasing productivity but also ensuring that economic growth aligns with environmental preservation and social equity.

Sátyro et al. (2022), in their analysis of Industry 4.0 implementation in Germany, Brazil, and Portugal, identify barriers related to technical training, digital infrastructure, and public policy. Despite the potential benefits, the lack of coordinated strategies and unequal access to technology undermine the effectiveness of these transformations. Therefore, the shift from Industry 4.0 to 5.0 depends not only on technological innovation but also on a collective commitment to sustainability, social justice, and human development.

3. Research Methodology

The main objective of this study is to investigate, through a systematic literature review, how artificial intelligence (AI) has been applied in social projects in diverse global contexts, with the aim of identifying initiatives that significantly contribute to the development of sustainable social solutions through intelligent technologies.

In the next section will be presented the two objectives will answer the question of the in this paper:

1. What are the benefits of applying artificial intelligence (AI) in social projects, as identified in the academic literature?
2. What are the main challenges and research gaps identified in the literature regarding the use of AI in social projects?

3.1 Justification

Systematic Literature Review: The study proposes a structured research approach, based on the main constructs of the article's theme: Artificial Intelligence (AI) and Social Projects. Initially, a reliable scientific database with approximately 2,200 articles that explore how AI has impacted the development of social projects should be analysed.

The increasing integration of artificial intelligence (AI) across multiple sectors underscores the need to understand its impact beyond economic and industrial applications (Brynjolfsson & McAfee, 2014). In the context of social projects, AI presents significant opportunities to foster inclusive innovation, enhance decision-making, and address multidimensional social challenges (George et al., 2016). However, its application in this field remains underexplored in academic research, with few studies examining how AI technologies are implemented to support social transformation (Rai et al., 2021). Investigating the intersection of AI and social initiatives is thus essential to ensure that

emerging technologies contribute meaningfully to reducing social inequalities and advancing the goals of equity and justice (Vinuesa et al., 2020; Calvo, Dinan & Peters, 2020).

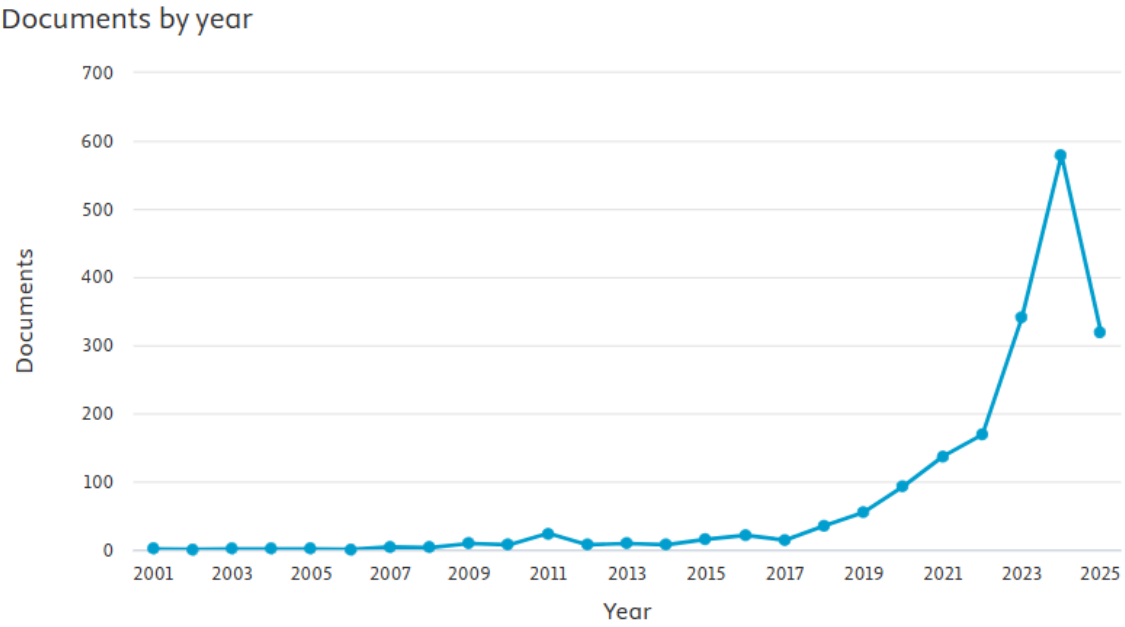
3.2 The process of systematic review protocol

The next step will stablish how the search was conducted, defining the strategy to answer the questions. In order to find the relevant articles in literature, the search in SCOPUS database was realized.

As strategy, the first of all, a search based on keywords provided the final search string is as follow:

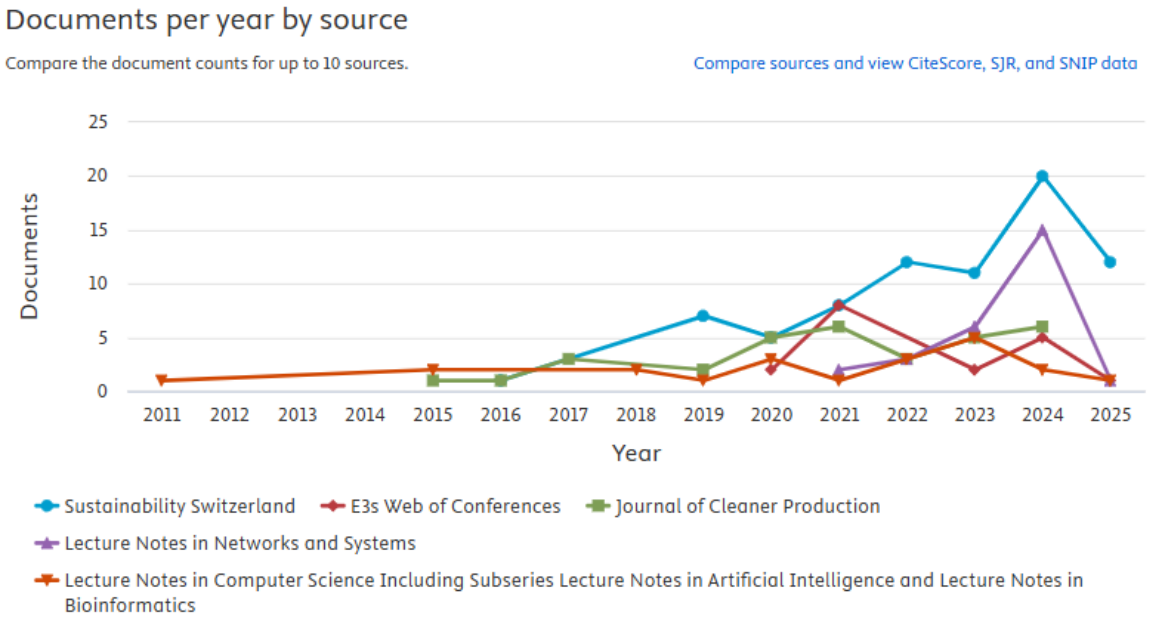
("Artificial Intelligence" OR "AI") AND ("Benefits" OR "Opportunities") AND (“Sustainable Development” OR SDG)

The Figure 1 presents the ‘Documents by Year’ an increased number of documents published in recent years.



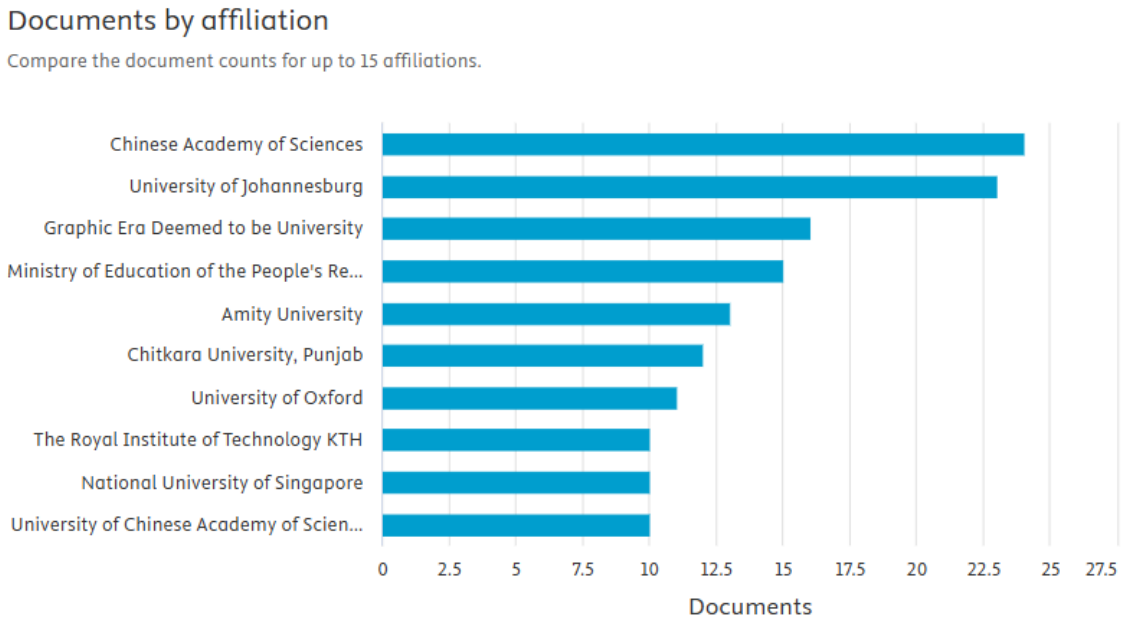
Source: Figure 1: Document by Year – Scopus Database

Another interesting view is presented in Figure 2, 'Documents per Year by Source,' shows that Sustainability Switzerland steadily increased its number of publications up to last year.



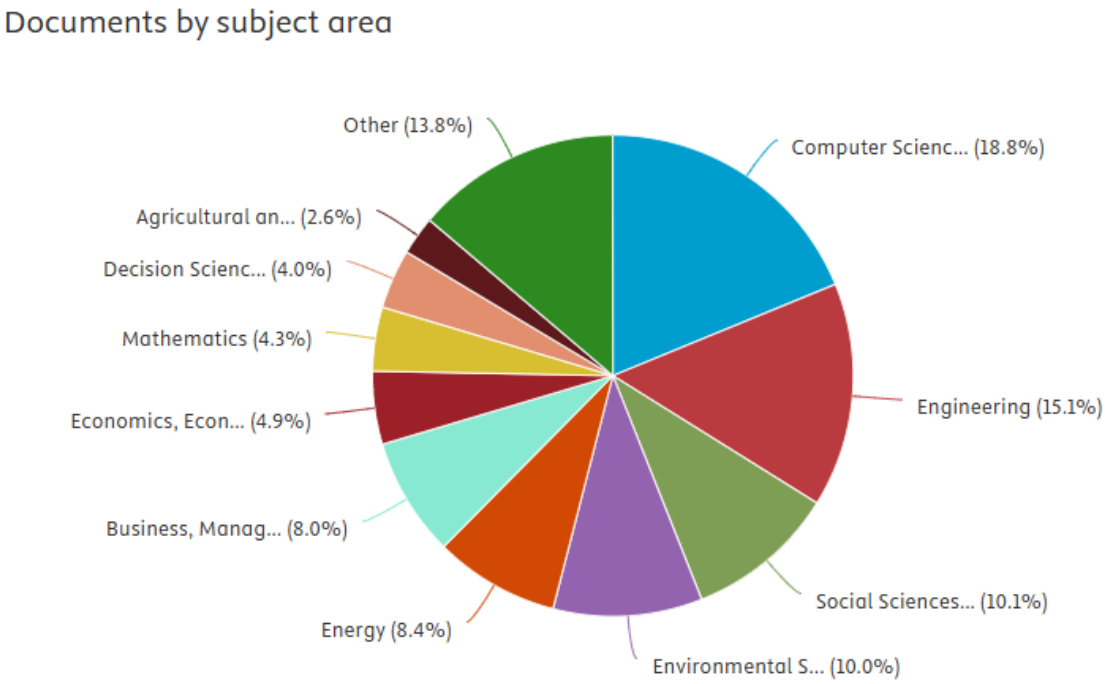
Source: Figure 2: Documents per Year by Source – Scopus Database

In Figure 3, 'Documents by affiliation', the largest producers of publications since 2000 can be observed, and it is possible to see how China has been increasing its document output.



Source: Figure 3: Documents by affiliation – Scopus Database

Additionally, the "Documents by Subject Area" in figure 4 shows that Computer Science is the most field contributing to the selected topic in the search.

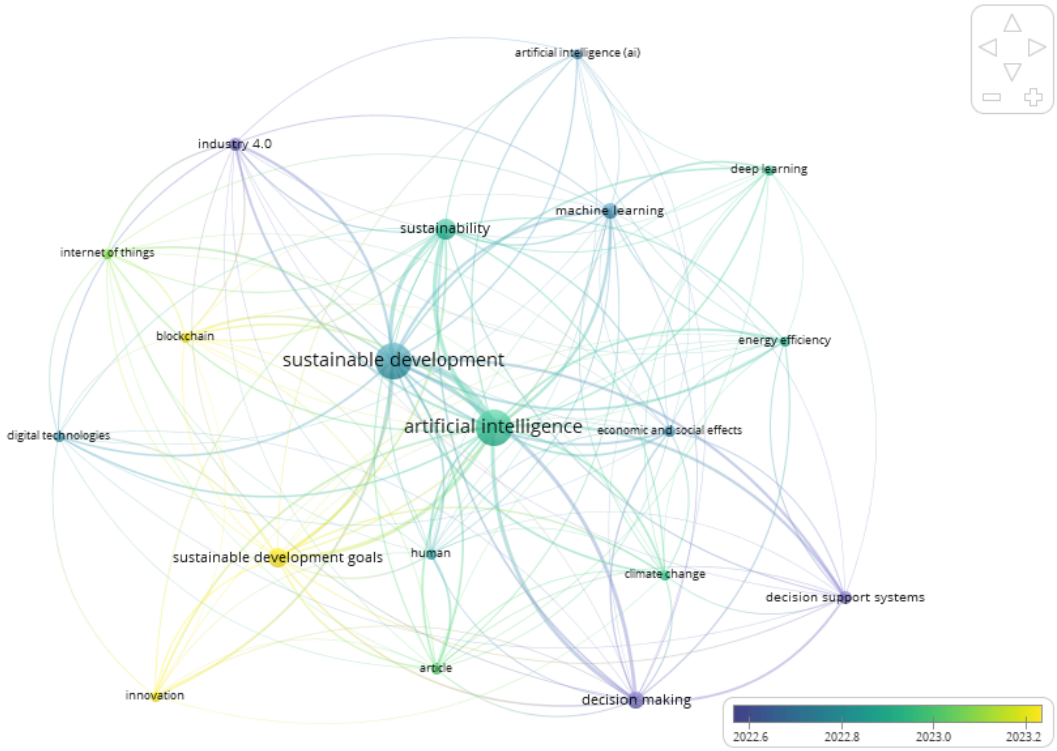


Source: Figure 4: Documents by Subject Area – Scopus Database

In addition, the initial search returned 1,852 documents, which required refinement. To identify the most relevant papers for this study, several filters were applied, as detailed below:

- Year: From 2020 to 2025 -> 1638 documents
- Type of document: only “articles” -> 1638 articles
- Language: English and Portuguese -> 596 articles
- Open Acccess: Gold, Hybrid, Green, Bronze -> 299 articles

The query returned 299 results, which made it possible to generate a map using data extracted from Scopus through the VOSviewer software. This map supports the analysis by helping to identify patterns, trends, and knowledge networks within the specific field of study addressed in this systematic literature review. The map below illustrates the co-occurrence of terms.



Source: Figure 5: Co-occurrence of Terms – VosViewer

What the map represents:

Each node (circle) represents a keyword extracted from the analysed articles. The size of the circle indicates the frequency with which the term appears: the larger the circle, the more frequent the term. The lines between the terms indicate co-occurrence – that is, how often the two terms appear together in the same article, title, or abstract. The proximity between terms shows how strongly they are related. The colour follows a temporal scale, as shown in the legend at the bottom right (from dark blue to yellow):

- Dark blue: older terms in the analysed dataset (around 2022.6).
- Light green/yellow: more recent terms (up to 2023.2).

The Figure 5 presents the most relevant topics identified which was grouped by topics:

- Artificial intelligence and sustainable development are the main terms, with greater prominence and connections to several other terms, indicating that they are the most recurrent and interconnected topics.
- Sustainability, machine learning, climate change, and blockchain also appear with relevance, linking technological and environmental areas.
- Terms such as decision making, energy efficiency, and economic and social effects demonstrate practical applications or impacts of AI in sustainability.

4. Interpretative Findings

The Overlay Visualization Map shows how the topic of artificial intelligence applied to sustainable development has evolved over time in the scientific literature. Additionally, more recent concepts are associated with emerging technologies such as Internet of Things, blockchain, and innovation (in yellow). Furthermore, the main and consolidated terms, such as artificial intelligence, sustainable development, and machine learning, appear in blueish green, indicating their consistent presence over the years.

The connections suggest that studies tend to address AI in relation to sustainability from

multiple perspectives (environmental, social, and technological). The analysis of 1,852 articles extracted from the Scopus database, filtered by relevance criteria (language, document type, open access, and year of publication), made it possible to identify patterns, trends, and gaps in the field of artificial intelligence applied to social projects with a focus on sustainability. Using the VOSviewer tool, four main thematic clusters were mapped, each representing a structural axis of the knowledge produced in this area.

Based on the VOSviewer figure, the clusters represent structured subthemes within the field of artificial intelligence applied to sustainability. Each different colour represents a cluster, that is, a group of keywords that frequently appear together in the analysed articles. These clusters indicate distinct thematic within the set of publications.

Four main clusters were identified, each representing a distinct thematic area within the field of studies on Artificial Intelligence (AI) applied to Sustainability. Below is an interpretation of the meaning of each cluster:

Cluster 1 – AI Technologies and Applied Sustainability

Terms: Artificial Intelligence (AI), Deep Learning, Energy Efficiency, Machine Learning, Sustainability, and Sustainable Development.

This cluster represents the technological foundation of artificial intelligence applied directly to sustainability. It focuses on how techniques such as machine learning and deep learning are used to promote energy efficiency and sustainable practices. It is the technical-operational core of AI aimed at achieving concrete results in sustainability.

The technological focus of this cluster underscores AI's central role in operationalizing sustainability through data-driven optimization. In particular, the use of deep learning for predictive analytics enables early detection of environmental risks and more efficient resource management, contributing to a circular economy (Moise, 2024; Sánchez-García et al., 2024). Moreover, the integration of machine learning with environmental sensors supports real-time monitoring of emissions, energy consumption, and biodiversity indicators, enabling organizations to adopt more proactive and adaptive sustainability strategies (Bocken et al., 2014; Krogstie, 2024).

Cluster 2 – Innovation and Human Perspective in Sustainable AI

Terms: Artificial Intelligence, Human, Innovation, and Sustainable Development

This cluster connects the human and social perspective of AI with innovation and sustainable development. It suggests discussions on ethics, social impact, open innovation, and the role of humans in AI-mediated decision-making. It represents the interface between technological innovation and social responsibility.

This cluster highlights a necessary shift from purely technical innovation to human-centered design in AI systems. The literature increasingly emphasizes that innovation must include ethical deliberation, cultural sensitivity, and social equity (Tabbakh et al., 2024; Abulibdeh, 2024). In this sense, inclusive AI is not only about reducing algorithmic bias but also about fostering democratic participation in technological decision-making. By placing the human experience at the center of innovation, this cluster promotes the design of AI systems that empower communities and enhance collective agency in sustainable transitions (George et al., 2016; Calvo, Dinan, & Peters, 2020)

Cluster 3 – Decision-Making and Socioeconomic Impact

Terms: Climate Change, Decision Making, Decision Support Systems, Economic and Social Effects.

This cluster focuses on the application of AI as a decision-support tool in areas with significant environmental and social impact, such as climate change and economic

development. It highlights the strategic use of AI for public policies and sustainable planning, measuring socioeconomic effects.

The cluster focused on decision-making shows how AI can serve as a strategic tool for governments, NGOs, and private institutions aiming to create more effective and targeted public policies. For example, AI-powered decision support systems can assist in simulating the outcomes of climate policies or in prioritizing social investments based on multidimensional poverty indexes (Vinuesa et al., 2020; Rai et al., 2021). Furthermore, this cluster aligns with the Sustainable Development Goals by showing how AI can measure and forecast socioeconomic outcomes, such as income distribution, education access, and healthcare service delivery (United Nations, 2015; George et al., 2016)

Cluster 4 – Emerging Technologies Integrated with AI

Terms: Blockchain, Digital Technologies, Industry 4.0, and Internet of Things

This cluster represents the convergence between AI and other emerging technologies such as blockchain, IoT, and Industry 4.0. Together, these technologies create sustainable digital ecosystems with intelligent monitoring, transparency, and automation. It is a cluster focused on technological infrastructure and sustainable digitalization.

This final cluster reflects the increasing convergence of AI with other frontier technologies, such as blockchain, IoT, and Industry 4.0, resulting in intelligent digital ecosystems (Pârv, 2024; Gavrus, Petre, & Pârv, 2024). These integrations enable greater transparency and traceability in sustainability efforts, especially in complex supply chains (Beier, 2024; Kunkel et al., 2024). For instance, blockchain combined with AI can verify sustainability certifications, while IoT devices generate high-frequency environmental data that feed AI models for smart city management. As highlighted by Sátyro et al. (2022), the effective implementation of such technologies requires overcoming institutional, infrastructural, and educational barriers, particularly in emerging economies

5. Conclusion

This systematic literature review has demonstrated that artificial intelligence (AI) is consolidating itself as a strategic tool for the development of social projects aligned with the Sustainable Development Goals (SDGs). The analysis of scientific production revealed the emergence of four main thematic cores: technologies applied to sustainability, human-centered innovation, decision-making with socioeconomic impact, and the integration of AI with emerging technologies such as blockchain and the Internet of Things (IoT). These findings show that AI has the potential to drive social transformation through process automation, service personalization, and increased efficiency in public policies and impact-oriented programs.

At the same time, the reviewed literature reinforces that the adoption of AI in social contexts requires an ethical, transparent, and inclusive approach, sensitive to local vulnerabilities. Authors such as Calvo, Dinan, and Peters (2020) and Tabbakh et al. (2024) emphasize the need for algorithm development and implementation to avoid reproducing systemic biases and inequalities. The human-oriented vision proposed by these authors aligns with Industry 5.0 principles, which prioritize personalized, ethical, and socially responsible interactions between humans and technology (Abulibdeh, 2024).

Despite research advancements, several challenges remain. The lack of consolidated indicators for measuring social return on investment (SROI), the fragmentation of methodologies, and the scarcity of empirical studies in underrepresented regions such as Latin America and Africa are significant gaps (Vinuesa et al., 2020; Rai et al., 2021). Moreover, there

is still a notable absence of holistic evaluation models capable of integrating economic, social, and environmental value. In response, authors such as Trota et al. (2024) and Patrício et al. (2025) propose more comprehensive frameworks based on data and supported by intelligent technologies, including dashboards and real-time monitoring tools.

The findings of this review highlight the urgency of establishing robust, interdisciplinary frameworks that guide the application of AI in social projects with an emphasis on ethical responsibility and sustainability. Public and private institutions are encouraged to adopt governance models that include diverse stakeholders, ensuring that AI systems are not only efficient but also equitable and transparent. This approach is essential for the development of inclusive technologies capable of addressing complex societal challenges while promoting long-term, multidimensional value.

Future research should further explore context-specific applications of AI, particularly in regions with low technological penetration and high social vulnerability. Comparative studies between countries or sectors can offer insights into best practices and adaptation strategies. Moreover, there is a need to develop standardized and holistic impact assessment tools that capture both tangible and intangible outcomes. By fostering collaboration between researchers, policymakers, and communities, it will be possible to maximize the transformative potential of AI as a catalyst for sustainable development

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