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ARTIFICIAL INTELLIGENCE AND INNOVATION IN THE FIRM: CHALLENGES AND THREATS

Artificial Intelligence (AI) is reshaping the competitive landscape and increasingly functions as a crucial driver of innovation and organizational transformation. The interaction between AI and innovation management raises several critical questions concerning strategic business decisions, ethical considerations, and the long-term sustainability of innovative activities. This research aims to develop a conceptual framework that outlines the key challenges and risks associated with the

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ШТУЧНИЙ ІНТЕЛЕКТ ТА ІННОВАЦІЇ НА ПІДПРИЄМСТВІ: ВИКЛИКИ ТА ЗАГРОЗИ

Штучний інтелект (AI) трансформує конкурентне середовище й дедалі більше виступає ключовим чинником інновацій та організаційних змін. Взаємодія між AI та управлінням інноваціями порушує низку критичних питань, що стосуються стратегічних бізнес-рішень, етичних аспектів та довгострокової стійкості інноваційної діяльності. Це дослідження має на меті розробити концептуальну рамку, яка окреслює основні виклики та ризики, пов'язані з впровадженням

adoption of AI technologies in innovation-oriented firms. The guiding research question is as follows: to what extent does current scholarly literature address the challenges posed by the risks associated with implementing AI solutions in the context of sustainable innovation? The foundation of this work is the risk-based approach outlined in the EU AI Act, with particular attention to its differentiated levels of regulatory requirements applied to distinct categories of AI systems. To investigate the existing academic landscape, we conducted a scoping review in accordance with PRISMA standards and established methodological guidelines, relying on the Scopus and Web of Science databases. The research concludes with a discussion of the theoretical and managerial implications derived from the review.

Keywords: Artificial Intelligence, sustainable innovation, EU AI Act.

технологій AI у компаніях, орієнтованих на інновації. Керівне дослідницьке питання сформульоване таким чином: у якій мірі сучасна наукова література розглядає виклики, зумовлені ризиками, пов'язаними з упровадженням рішень AI у контексті сталих інновацій? Підґрунтям дослідження є підхід, заснований на оцінці ризиків, запропонований у Законі ЄС про штучний інтелект (EU AI Act), з особливим акцентом на диференційованих рівнях регуляторних вимог, що застосовуються до різних категорій систем AI. Для аналізу наявного академічного дискурсу проведено скоупінгогляд відповідно до стандартів PRISMA та усталених методологічних настанов, з використанням баз даних Scopus і Web of Science. Дослідження завершується обговоренням теоретичних та управлінських наслідків отриманих результатів.

Ключові слова: штучний інтелект, сталий розвиток інновацій, Закон ЄС про штучний інтелект.

JEL Classification: M13, K34, L21.

Introduction

In recent years, Artificial Intelligence (AI) has become an increasingly relevant force, reshaping business models, industrial dynamics, and innovation systems. The pervasiveness of AI technologies and solutions across heterogeneous sectors has generated unprecedented and unexplored opportunities for productivity, creativity, and innovation, sustainability, and competitiveness, while simultaneously introducing different forms of risk and uncertainty (Brynjolfsson & McAfee, 2017; von Krogh, 2018). Indeed, the existing literature on AI has also stressed its important role in addressing digital transformation and competitiveness (Lee & Falahat, 2019), even if recent studies call for a more responsible approach, by recognizing that technological evolution must align with ethical, social, and environmental imperatives (Stilgoe, 2020; von Schomberg, 2013).

In the field of innovation management, AI is mainly observed as both a technological driver and a source of disruption, by challenging firms to balance efficiency and sustainability (Cockburn et al., 2018; Nambisan et al., 2019) and to face the inevitable transformations. The complex relationship between AI and sustainable innovation is controversial. On one hand, AI supports sustainability goals through process improvement, predictive analytics, and data-driven decision-making (Rohde et al., 2023; Kanellopoulou et al., 2025). On the other hand, its adoption introduces several risks, ranging from ethical bias to environmental externalities, that can undermine its potential to foster long-term sustainability (Floridi & Cowls, 2022; Bolte & van Wynsberghe, 2025). As firms increasingly rely on AI technologies, managing these pressuring tensions is becoming central to

defining and implementing innovation strategies and to adopting governance mechanisms (Stahl, 2021; Owen et al., 2013). In this respect, AI is no longer viewed as a performance-enhancing technology but as a governance challenge by requiring transparency, accountability, and trust (Floridi & Cowls, 2022; Stahl, 2021).

From this underlined perspective, this study aims to provide a conceptual framework for understanding the key challenges and threats associated with AI applications in innovative firms. The research question is as follows: to what extent does current literature delve into the challenges posed by the risk associated with the implementation of AI solutions in sustainable innovation? The starting point of this work is the risk-based framework of the European Union AI Act, which introduces a graduated system of regulation proportional to the level of risk posed by different AI applications, ranging from minimal oversight for low-risk systems to important requirements for high-risk technologies that may affect several rights, safety, and trust (European Commission, 2025). This framework positions the EU as a global pioneer in AI regulation, promoting transparency, accountability, and sustainability.

The study conducts a scoping review based on PRISMA standards and appropriate guidelines (Page et al., 2021), using academic databases Scopus and Web of Science. By analyzing co-occurrence patterns in keywords, abstracts, and titles from a corpus of 314 peer-reviewed papers indexed in Scopus and Web of Science, the research identifies four main thematic clusters:

- ethical and social risks;
- economic and structural risks;
- environmental risks;
- security and governance risks.

The remainder of the paper is structured as follows. Section 1 presents the theoretical background, while Section 2 describes the methodology, outlining the scoping review design. Section 3 discusses the research context and legal aspects, focusing on the EU AI Act and its implications for firms. Section 4 reports the findings, highlighting thematic clusters. Finally, Section 5 discusses the theoretical and managerial implications and outlines directions for future research.

1. Theoretical background

The starting point of our work is twofold, concerning AI challenges and threats (Abbate et al., 2025). By moving from a theoretical perspective, several scientific contributions in the stream of the socio-technical transition theories (Talaviya et al., 2020; Floridi & Cowls, 2022) suggest that innovation systems are shaped not only by technological potential but also by institutional, cultural, and regulatory factors. AI has the potential to accelerate sustainable innovation more than traditional methods (Kanellopoulou et al., 2025; Rohde et al., 2023). This integration could also

introduce critical challenges. While numerous studies have highlighted the positive potential implications of AI technologies and solutions, there remains a pressing need to critically examine its "dark side" (Abbate et al., 2025). In this respect, it concerns particularly how risks, such as ethical, social, or environmental impacts, are theorized, framed, and addressed at the intersection of AI and sustainable innovation (Stahl et al., 2023; Zhao & Gómez Fariñas, 2023; Bolte & van Wynsberghe, 2025). The effective integration of AI within sustainability-oriented frameworks requires navigating these related tensions by balancing efficiency gains with mechanisms of risk anticipation and mitigation (Bolte & van Wynsberghe, 2025).

By assuming a practical perspective, the EU AI Act proposes a risk-based regulatory approach, establishing progressively stringent requirements depending on the potential risks that AI systems pose to fundamental rights (European Commission, 2025). Low-risk applications are subject to minimal rules, whereas high-risk systems must comply with robust measures oriented to ensure transparency, accountability, and trustworthiness (*Figure 1*).

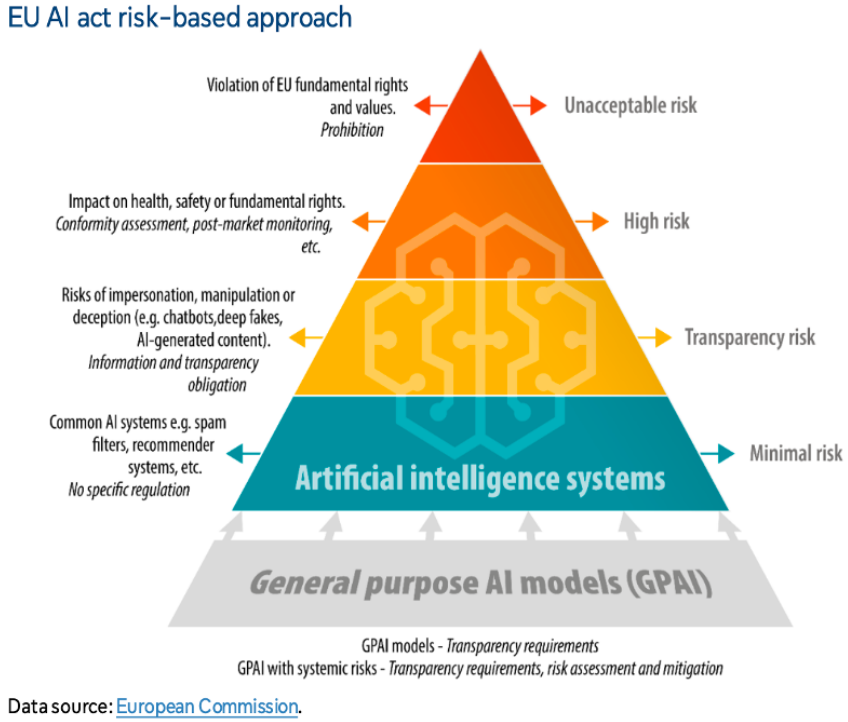

Figure 1. The European AI Act

Source: (European Parliamentary Research Service, 2025. https://epthinktank.eu/2021/11/18/artificial-intelligence-act-eu-legislation-in-progress/ artificial-intelligence).

The responsibilities imposed on developers and users are proportionate to the assessed level of risk, with a clear priority placed on safeguarding individuals' health, safety, and fundamental freedoms. Additionally, trust in AI systems is fostered through documentation requirements and specific disclosure obligations. For instance, users must be explicitly informed when they are interacting with AI technologies and solutions rather

than human beings. By assuming this clear position, the EU can be considered a pioneer in AI governance, potentially shaping international standards and regulatory best practices. Nevertheless, several critical aspects remain, particularly the effective implementation and enforcement of the Act across different EU member states. Divergences in national interpretations and administrative practices may hinder uniform compliance, thus challenging the effectiveness of the risk-based approach and its harmonization across the European single market.

Both theoretical and practical perspectives here underlined converge in highlighting multiple dimensions characterizing the relationship between AI solutions and sustainability. While AI offers transformative potential for advancing sustainable innovation, the associated risks remain scarcely examined within the existing literature. Specifically, the challenges arising from ethical, environmental, social, and technical risks are often acknowledged but rarely investigated in depth. This suggests the existence of a critical gap in current research, by underlining the need for more analyses that consider the dual nature of AI as both an enabler and a potential source of risk. Addressing this gap is essential for improving our understanding of how current studies engage with the complexities of AI implementation in sustainability-oriented contexts. This is directly aligned with the research question addressing our study, oriented to assess the extent to which current researchers theorize, contextualize, and respond to the risks embedded in the adoption of AI-driven solutions for sustainable innovation.

2. Methodology

We conducted a scoping review based on PRISMA standards and guidelines revised for this typology of review (Tricco et al., 2018; Page et al., 2021). The choice here assumed is due to our exploratory research question aimed at mapping key concepts by systematically searching, selecting, and synthesizing existing knowledge (Colquhoun et al., 2014). For data collection, we used academic databases such as Scopus and Web of Science, searching for the string (TITLE-ABS-KEY (risk OR threat) AND TITLE-ABS-KEY (AI solution) AND TITLE-ABS-KEY(sustainable innovation) (last access, Oct. 2025). These databases were opportunistically selected for data collection because they are widely recognized as the most authoritative and comprehensive sources for peer-reviewed research in management and innovation literature. Their rigorous indexing criteria, extensive journal coverage, and citation-tracking capabilities can ensure access to high-quality publications (Podsakoff et al., 2005; Archambault et al., 2009). In addition, their combined use enhances the robustness, transparency, and reproducibility of the scoping review.

The keywords used are strictly related to the research question, and the choice of scoping review is in line with mapping the key occurrences in the study of risks of AI and sustainable innovation research.

We adopt a search strategy designed to ensure access to all relevant publications, without any restrictions in terms of language, publication year, or document type. After an initial screening, based on titles and abstracts, after excluding duplicates, a total of 314 papers were identified.

Then, we used Vos Viewer (Van Eck and Waltman, 2010, 2017) to identify and analyze the main co-occurrences and picture the network. A text – mining analysis of the co-occurrences (using binary counting) in the titles and abstracts was carried out. Out of 9,131 extracted terms, 181 co-occur at least 10 times. Among them, those with greater relevance (60%) were 109. To enhance the interpretability of the map, 14 generic terms were excluded because they provide very little information, such as *topic*, *way*, *focus*, *contribution*, and/or decrease the usefulness of the map, highlighting academic descriptors, such as *article, book, case, chapter, comprehensive review, literature, and future directions*.

2.1. Data visualization

Based on text data (title and abstract), presented in *Figure 2*, the co-occurrence map highlights the issues related to the risks of AI solutions for sustainable innovation that can be traced back to four strongly interrelated clusters.

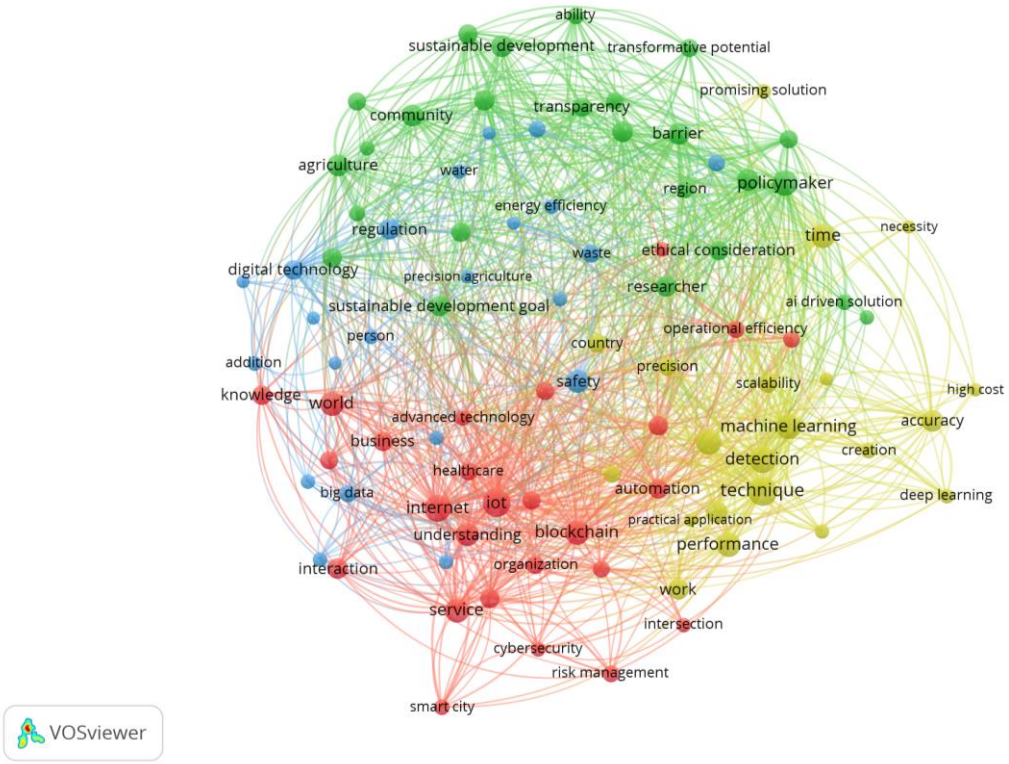

Figure 2. Map of the co-occurrences

Source: elaboration by VOS viewer software.

Each cluster captures specific thematic areas by reflecting the key challenges that innovation for sustainability through AI seeks to address. However, the analysis presented underlines a high degree of interconnection among clusters, suggesting an overarching and integrated research domain rather than isolated clusters.

The central themes that emerged here are broad, encompassing ethical and sustainable development goals (green cluster), safety (blue cluster), precision (yellow cluster), AI application, and advanced technology (red cluster). Surrounding these underlined themes, in recent years, specific fields – such as education, healthcare, finance, and agriculture – have fertilized their studies and practices by adopting digital technologies. These studies show the practical implementations of AI in different contexts and contribute empirical evidence that enriches the studies' conceptual developments and theorizations.

The text analysis here conducted and related to titles and abstracts, illustrated through the overlay visualization of *Figure 3*, reveals how chronologically the focus on AI has progressively shifted from issues strictly connected to technical implementation and development, to issues related to user interaction and the ethical and environmental implications, and more recently to the growing emphasis on *accuracy* (*Figure 4*). This evolution reflects a relevant maturation of the research field, by moving from a technology-oriented perspective to a more holistic, social, and technical understanding of AI within a sustainable innovation context.

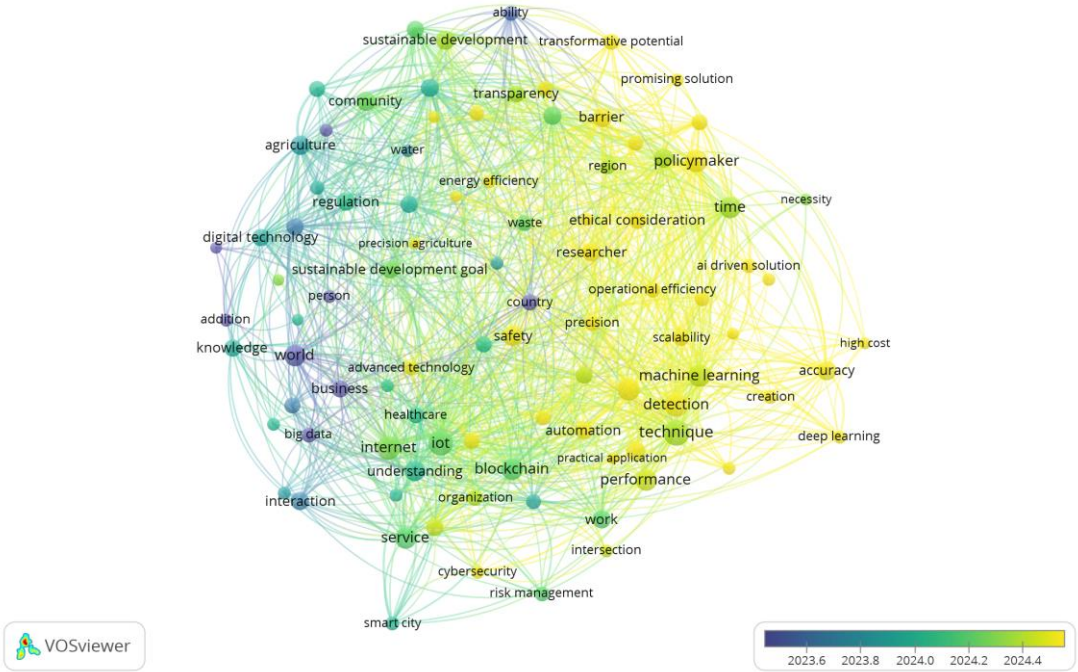

Figure 3. Overlay visualization

Source: elaboration by VOS viewer software.

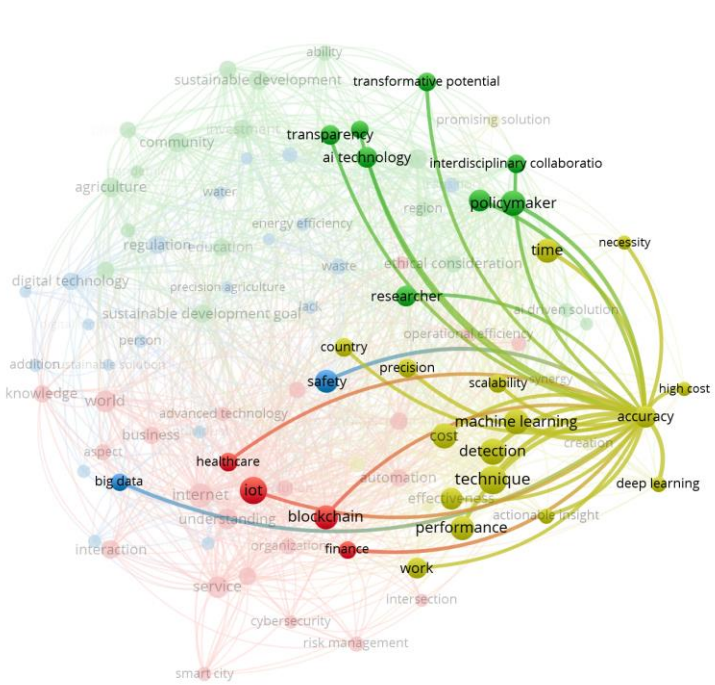

Figure 4. Focus on Accuracy and its links

Source: elaboration by VOS viewer software.

We have chosen to emphasize the term "accuracy" because it seems to characterize the most recent stream of studies, particularly within sectors such as healthcare and finance. This concept frequently emerges in connection with themes including big data processing, the Internet of Things (IoT), security, machine learning, and data-driven policymaking. Building on this observation, the next step of our analysis focuses on the role of regulation and policymaking, addressing the delicate task of governing AI adoption in sustainability-oriented innovation contexts.

3. Research context and legal aspects

The application of AI in tax management and policy highlights both opportunities and challenges (Fidelangeli & Galli, 2021). In general, opportunities are linked with the capacity of AI to examine intricate interactions, helping tax policymakers define more effective strategies and address economic behaviors. Regarding the business ecosystem, there is a connection to the possibility of predicting tax management levels by using models such as decision trees, random forests, and neural networks, while maintaining sustainable tax practices. More precisely, automation can evaluate intricate tax legislation, regulations, and case law to uncover opportunities to optimize and evaluate the tax consequences of business choices, detecting transactions that pose a high risk, forecasting the results of audits, and aiding in crafting efficient defense strategies. In addition to this, data extraction and tax return preparation reduce errors and free tax

professionals for strategic work. In other words, sustainable tax management reduces costs, freeing resources for operational activities (Han et al., 2025). Finally, AI contributes to corporate digital innovation. At the same time, it is important to underline that there are challenges and risks in the variety of corporate behaviors. Indeed, paying attention to the impact on the efficiency of Tax Authorities, the data collected from online users enriches the information technology services, due to the possibility of registering transactions and analyzing them, creating forms of predictive analytics by identifying patterns useful in managing tax assessment. Therefore, tax authorities worldwide have begun to incorporate AI into their auditing and management processes. In fact, those adopting digital technologies early could gain a significant competitive advantage in terms of efficiency by detecting tax fraud and optimizing the revenue collection system. Nevertheless, this peculiar possibility impacts on taxpayers' lives and legal spheres, especially firms, creating a risky challenge because the framework resulting involves their performances and affects a loyal relationship with the Tax Authorities. It is also important to underline the social value of privacy due to the fact that protecting personal data is considered a fundamental right. To summarize, the intersection of artificial intelligence and tax policy creates a sort of connection, where the quest for effectiveness inevitably meets long-standing societal principles regarding fairness and transparency. In this context, the social significance of privacy is not merely an individual concern but affects society as a whole. The European Union's General Data Protection Regulation (GDPR) upholds the essential principle that protecting individuals in relation to their data processing is a fundamental right. The European Union established an innovative regulatory system on artificial intelligence systems (commonly referred to as the AI Act) in early December 2023. The recent intervention balances innovation and rights protection and proposes suitable safeguards to uphold the fundamental rights of taxpayers, considering these new modalities. This cooperative choice guarantees that AI acts as a resource for collective economic benefit by enforcing a uniform interpretation of fairness, instead of serving to unintentionally strengthen current disparities in the interaction.

4. Findings and discussions

The scoping review clearly reveals an interesting evolution trajectory in academic research on AI within the context of sustainable innovation. Recent scientific contributions underline a growing emphasis on the accuracy of evaluation, observing a multidimensional construct encompassing reliability, validity, and quality of the information. Accuracy emerges as a critical bridge between technical performance, ethical governance, and sustainability objectives. However, while existing literature prioritizes accuracy, the broader systemic risks remain scarcely addressed in relation to accuracy, highlighting several gaps for future inquiry.

Consequently, accuracy may become the central lens through which AI is currently theorized and debated in sustainable innovation, providing several opportunities for diverse explorations in terms of methodologies and approaches.

In this perspective, the conceptual framework in this research (*Figure 5*) illustrates the evolving relationship between Artificial Intelligence, Risks/Threats, and Sustainable Innovation. Both AI and Sustainable Innovation contribute to and are shaped by the Risks/Threats (i.e., ethical, economic, environmental, and governance). The arrows show the bidirectional influence: AI enables sustainability goals, yet the risks constrain its potential and implementation.

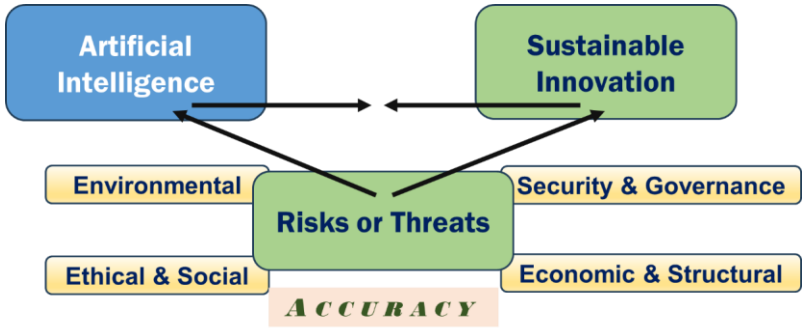

Figure 5. Conceptual framework

Source: elaboration by the authors.

Additionally, AI acts as a strategic enabler. Risks & threats (ethical, economic, environmental, governance) emerge from its implementation. Sustainable innovation applications (energy efficiency, supply chains, agriculture, urban systems) are the outcomes. A bidirectional tension exists between risks and sustainability goals, at the intersection between categories of AI-related risks and the three pillars of sustainability: social, economic, and environmental.

Ethical and social risks, such as unequal access to AI technologies and solutions, lack of social sustainability, can weaken accountability. The "black-box" nature of AI complicates responsibility for decisions with social impact.

Economic and structural risks, including job displacement and market concentration, threaten economic sustainability by constraining inclusive growth and fostering technological dependence on a small number of dominant players.

Environmental risks, such as high energy consumption and e-waste AI infrastructure, challenge environmental sustainability by conflicting with carbon reduction targets and circular economy principles.

Security and governance risks, from data privacy concerns to weak regulatory frameworks, cut across all dimensions by impacting trust and governance mechanisms essential for sustainable development.

5. Conclusions, implications, and future directions

By mapping the existing body of literature, this study contributes to a deeper understanding of how AI interacts with sustainable innovation. The findings underline that while AI can accelerate and drive progress toward sustainability goals, such as optimizing energy use, advancing circular economy practices, or enabling smarter urban planning, its adoption introduces several risks that have concrete implications beyond the technical side. These implycations consider ethical, economic, environmental, and governance domains.

From a theoretical perspective, the study underlines a need for an integrated approach that links technological innovation, ethical governance, and sustainability outcomes. In this respect, accuracy is observed as a core dimension of risk evaluation in sustainable innovation processes and activities.

From a managerial point of view, the results highlight the importance of governance and risk integration to ensure that accuracy supports sustainnability outcomes. Managers must implement governance structures that ensure monitoring and evaluation of accuracy. This requires interdisciplinary teams combining technical, ethical, and sustainability expertise. Companies need to monitor these interactions to implement effective strategies.

Policymakers should focus on regulatory frameworks that ensure transparency and promote equitable access to the benefits of AI.

Future research should deepen the conceptualization of accuracy within the broader framework of sustainable innovation. This entails exploring how accuracy interacts with other dimensions, such as transparency and inclusiveness, and how firms can manage these interdependencies through strategic and operational mechanisms. Further empirical work is needed to assess how accuracy-based risk management influences organizational performance, innovation outcomes, and stakeholder trust across sectors.

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