

The use of technology by organisations to enhance social and environmental sustainability: Framing and research agenda

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Abstract

Purpose – This paper explores the current state of research into the use of technology by organisations to enhance social and environmental sustainability, and develops a research agenda.

Design/methodology/approach – We discuss the types of technology that can be used by organisations to enhance social and environmental sustainability. We then introduce and discuss eleven papers selected for this Special Issue, which cover a wide range of social and environmental issues and reflect a variety of different organisational, cultural and economic settings. We reflect on these papers in terms of their overall contribution to literature and practice, develop a conceptual framework for how they link to the firm life cycle and develop a research agenda.

Findings – Three themes emerge which reflect how and why technology is being used within organisations: to improve efficiency and innovation, to improve governance, and to improve decision-making. We reflect on these themes in the context of recent exponential advances in Artificial Intelligence (AI) and consider and discuss the social and environmental risks posed by such technological advances.

Practical implications – We discuss the practical implications of using technology for enhancing social and environmental sustainability in organisations, providing insights relevant to practitioners and policymakers.

Social implications – Our discussion considers the broader social implications of integrating technology into business practices, highlighting risks and emphasising the need for further research in this area.

Originality/value – We provide an overview of the current research landscape on the use of technology for social and environmental sustainability, categorise and discuss the special issue contributions, and propose future research directions. We present a new conceptual framework that links the topics addressed in this Special Issue to the lifecycle of the firm.

Keywords – Technology, Artificial Intelligence (AI), Social Sustainability, Environmental Sustainability

Paper type – Research article

1. Introduction

There is a growing debate on the role of technology and how it can be used to enhance social and environmental sustainability (Al-Emran, 2023; Lodhia et al., 2025; Rana et al., 2023). Over the last decade, businesses have been characterised by a rapid diffusion and adoption of innovative technologies. Such technological advancements bring both opportunities and unprecedented challenges (Vial, 2019; Veldhoven and Vanthienen, 2019). The importance of using technology to enhance social and environmental sustainability increased with the uncertainty that derived from the Covid-19 pandemic (Marie et al., 2024). This unique experience expedited the adoption and implementation of digital technology and a focus on the United Nations Sustainable Development Goals (SDGs), while simultaneously reducing the interactions and mobility of human beings (Barnes, 2020). Following this crisis, many entrepreneurial entities have shown interest in transformative change, aiming for a higher quality of life as well as a more sustainable future (Linnenluecke et al., 2017; Lee and Trimi, 2018). By harnessing technology, organisations can be more proactive in their contribution to improved corporate social responsibility (CSR) (Teh and Rana, 2023). The aim of this paper is to explore the current research in this rapidly developing area, introduce and discuss the papers that contribute to this Special Issue on the topic, develop a new conceptual framework and develop a research agenda.

Digital transformation, in particular, has been a key element in the development of a sustainable approach, involving several actors such as national governments (European Commission, 2021), international institutions (i.e. World Bank, 2023) and consultancy companies (Majster et al., 2023). The adoption of digital technological tools, such as the internet-of-things (IoT) and blockchain technology, can help to create a sound base for a more socially and environmentally sustainable future (De Villiers et al., 2021). In a European context, the European Commission presents Industry 5.0 as a policy to encourage human-centric digital technologies and a socio-technical perspective within organisations, as well as a wider focus on the achievement of the SDGs (European Commission, 2021). At an international level, the attention to digital transformation and sustainability is also highlighted by the UN's Global Partnership for Sustainable Development Data (GPSDD) which called for "a data revolution for sustainable development" (Yayboke, 2017 p.10).

Against this backdrop, advancing technologies - which include artificial intelligence (AI), data analytics, social media and other related platforms – have become the subject of considerable attention in the academic as well as in the managerial community. These technologies have unique and specific characteristics that have a profound influence on the way organisations operate (Bailey et al., 2019). In addition to traditional information technology systems such as Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM), organisations are implementing a growing number of new technologies such as the Internet of Things, robotics, remote working technologies, digital platforms and generative Artificial Intelligence (AI). Technologies such as blockchain, data analytics, digital twins and AI are crucial in automating data collection, providing real-time reporting, and raising the traceability of information across supply chains (i.e. Castka et al., 2020; Kuruppu et al., 2024; Lehner et al., 2022). For both private and public organizations, this implementation requires an overhaul of their procedures, operations, activities and tasks and necessitates a new exploration of benefits and costs. For example, social media provides a significant degree of openness, presenting a distributed innovation for a heterogeneous sample of actors (Nambisan et al., 2017). AI presents a high degree of autonomy, meaning that it can reduce human action in both task generation and execution, and, consequently, result in humans finding it more difficult or even impossible to access and understand AI procedures and results (Berente et al., 2021).

Interest in the relationship between technological advancements and sustainability is a central theme of recent management literature (Guandalini, 2022). Sustainability is now part of core business

models and performance (Adams and McNicholas, 2007), and involves the harmonisation of financial, environmental and social objectives to create value. Organisations are constantly looking at possible changes, challenges and opportunities in this area (Flyverbom and Garsten, 2021). Some scholars (i.e. Brenner and Hartl, 2021) underline a positive impact of digital technology on sustainability. Such research provides insights on technology's interplay with organisational features such as structures and processes (Kretschmer and Khashabi, 2020), business model setting (Broccardo et al., 2023) and the work environment (Braña, 2019).

However, it is important to consider both positive and negative effects of the technological advancements in terms of sustainability-related outcomes (i.e. Fossen and Sorgner, 2022; Niehoff, 2022; Benlian et al., 2022; Cheng et al., 2022ab; Chu et al., 2024; Leng and Zhang, 2024; Scholze and Hecker, 2024; Sun et al., 2025). For example, whereas digital transformation is associated with an improvement in productivity and entrepreneurship (Ghazy et al., 2022), it is also seen as a driver of work displacement (Lazaroiu and Rogalska, 2023). Automation and AI-driven processes can potentially replace humans in several business fields, creating job losses and discrimination (Kulkov, 2021; Svetlana et al., 2022). Whereas digital transformation may augment accessibility to information, enhancing knowledge democratisation and learning opportunities, it also serves to highlight inequalities in terms of access to technology (Lythreatis et al., 2022). The development of digital infrastructure can also create environmental costs that may or may not be offset by an associated decrease in consumption (Jabbour et al., 2023; Kopp and Lange, 2019; Muñoz-Villamizar et al., 2021). These developments underline the need to better understand how technologies are being used to enhance environmental and social sustainability.

Technological advancements create a challenging context which requires a deep analysis of organisational structures, practices, routines and business models (Brenner and Hartl, 2021). In the next section, we summarise the current literature in this field. This is not designed as a structured literature review, but rather as a reflection on trends and developments in the field and a way to introduce the new papers in this Special Issue. We then introduce and discuss each of the eleven contributions that make up this special issue, discussing their implications both for research and practice. These eleven papers highlight how technology can enhance efficiency and innovation, improve governance and benefit decision-making. They show how leveraging technology can contribute to the achievement of the SDGs, specifically SDG 12 'Responsible consumption and production'. Given the rapid advances in AI, these developments come with major ethical concerns and risks that we also raise and discuss. While the papers in this special issue focus on *what* technology can be used, *where* it is being used, and *why* and *how* it is being used, there is little focus on *when* it might be of most benefit to firms. Our paper contributes to the literature by developing a conceptual framework that links the findings of this Special Issue to the life cycle of the firm. To conclude, we outline a research agenda that relates new research topics specifically to the different stages of the firm life cycle.

2. Literature Review

Organisations face a new era in terms of the rapid development and deployment of new technologies (Bai et al., 2020). In particular, digital transformation is regarded as fundamental to achieving technological benefits (Cheng et al., 2023). Digital transformation leads to a rethinking of business models and operational processes, leading companies towards improved efficiency and adaptability (Wu et al., 2024). For instance, in the manufacturing field, thanks to the Cloud and Big data, companies can improve their production lines, business processes, and teams' collaboration with the creation of super lean manufacturing entities, able to connect goods worldwide (Bányai et al., 2019). Digital technologies can also transform accounting and accountability practices (Al-Htaybat & von Alberti-Alhtaybat, 2017; De Villiers et al., 2023; Yigitbasioglu et al., 2023).

Information transparency and the access to information in organizations are fundamental for business activities such as accounting, decision support, planning, control and governance (Aral et al., 2007). For instance, platform based organizations such as Uber and eBay shifted from hierarchical towards heterarchical structures through technological innovation (Kornberger et al., 2017). However, technological development brings new and challenging perspectives to the notion of sustainable growth (Cancino et al., 2018). Research has found that digital transformation can help business growth and performance by enhancing resource allocation efficiency and decreasing production costs, which may in turn address certain environmental and social issues (Frick et al., 2021). For example, the implementation of digital technologies can improve corporate transparency, decision-making processes, and management efficiency, leading to an overall improvement in governance (Wang and Su, 2021). In different fields, technologies such as AI and Machine Learning are used to provide solutions to improve social as well as environmental issues such as waste control, resource optimisation, and carbon emissions (Maresova, et al., 2018; Tiwari, and Khan, 2020). This highlights the potential for technologies, particular digital transformation, to improve ESG performance (Bag et al., 2023).

In this context, Hack and Berg (2014) argue that technologies can have a positive effect on sustainability. They propose a conceptual framework that highlights three aspects of information technologies' role in sustainability, namely: technological capabilities, the impact of technology and the sustainability value of technology. Their framework is a useful reference for our research as it considers how technology can be used for improved sustainability performance in a business setting. Our paper develops this framework by considering technology capabilities as a starting point to structure our literature review. In our subsequent discussion, we split developments in technological capability into a further three categories, which reflect not only different types of technology, but also different levels of human interaction: digital technologies focused on efficiency and innovation, digital technologies focused on governance, and digital technologies for enhanced decision-making (including artificial intelligence). By proposing this classification, we introduce the notion of human interaction with the technology as a key differentiator, a factor of critical importance considering the advances in AI. For each of our three categories, we consider the use of these technologies in enhancing environmental and social sustainability, contributing to the third aspect of Hack and Berg's (2014) framework. In addition, we discuss risks associated with these technologies later in the paper.

2.1 Technologies focused on efficiency and innovation

Technological developments are a fundamental driver of economic worldwide economic evolution, creating new opportunities and challenges for traditional industries while setting the ground for new sectors. Digital transformation is a crucial element in economic development strategies to survive global competition. The debate on the role of the digital economy in innovation dates back to the introduction of the Internet, which transformed knowledge and information diffusion. The internet decreased the costs of finding information while simultaneously promoting innovation (Goldfarb and Tucker, 2019). Gaglio et al. (2022) show that digital communication technologies (i.e. social media) have a positive influence on innovation and also on labour productivity. Other scholars such as Jun et al. (2021) suggest that the capability of digital platforms play a role in innovation performance. Digital transformation necessitates a change in an organisation's strategy, business model, management approach and organisational culture. A growing discussion looks at the positive as well as at the hidden effects of different subsidies given at the government level which have a relevant impact at the company level, specifically in terms of technological innovation (see Alam et al., 2020; Liu et al., 2020; Wu et al., 2022).

Digital transformation also influences the innovation processes of many organisations. Digital innovation refers to the implementation of digital technology in the innovation process of an

organisational entity (Nambisan, 2017). The latter highlights a modification of numerous elements of an organisation such as its products' nature, its process development, its typology or/and its business model (Ciriello et al., 2018). Thus, on the one hand, within and across organisations, digital technologies represent the sources that help a digitally innovative company to overcome barriers and boundaries within their industry. On the other hand, digital technologies are inherently dynamic elements that build a digital innovative environment which can increase self-growth (Yoo et al., 2012). This means that digital technologies have a double profile: they serve as the base as well as the outcome of digital innovations (Yoo et al., 2010). In addition, digital innovations differ from the traditional ones that are described as more discrete, linear and sequential processes (Tajeddini, 2016).

In this context, the rapid implementation and development of innovative technology provides an interesting setting for sustainability issues. An interesting example technology use in the financial system (Kumar et al., 2022; Omarini, 2018; Dicuonzo et al., 2024). Indeed, financial technology (FinTech) has positive effects on different features of sectors that are related to financial as well as to non-financial performance. FinTech provides improvements in bank efficiency and productivity (Wang, et al., 2019) and financial inclusion (Banna and Rashid, 2021). Financial technology is, therefore, an interesting phenomenon that shifted the focus of shareholder value to a wider perspective based on a stakeholder approach (Freeman, 1984). The latter may be more able to address stakeholders' concerns, decreasing transparency and efficiency problems. Many financial institutions have integrated the three dimensions of sustainability (ESG) into their business models to better deal with ethical concerns (Campanella et al., 2023).

2.2 Technologies focused on governance

The fast and widespread implementation of digital technologies has led to the advent of completely new forms of organisation, due to the quantity of information and knowledge circulating at an individual as well as at a company level (Hanelt et al., 2021; Verhoef et al., 2021). This phenomenon provides new challenges in the definition of appropriate governance mechanisms. In this scenario, attention has shifted to so-called 'digital governance' favoured by the diffusion of digital technologies i.e., alternative combinations of information, data and communication (Bharadwaj et al., 2013; Hanisch et al., 2022; Vaia et al., 2022). Digital governance brings changes in terms of task automation, process control, allocation of resources and coordination practices. For instance, AI-supported analysis provides automatic checks on accounting information and, consequently, it improves company monitoring activity (Commerford et al., 2022). In addition, open-source AI enhances transparency, while decentralised autonomous organizations (DAOs) evidence new collaborative dynamics concerning governance decisions due to the publication of algorithmic protocols using open-source software (Taulli, 2022).

Today's businesses need to be aware of the role of digital technologies in processing the vast amount of data needed to realise value-added exchanges. As an example, Arnaboldi et al. (2017), provide an investigation on the role of social media and big data in transforming performance indicators, governance practices -making. Nowadays, exchanges such as platform-based transactions have a digital profile that involves multiple simultaneous interactions. This means a shift of 'traditional' governance mechanisms toward alternative approaches. Digital technologies can be employed using a range of approaches, from augmenting to fully automating governance Raisch and Krakowski (2021). This suggests that digital governance is not limited to the augmentation of traditional governance mechanisms (Constantinides et al., 2018; De Reuver et al., 2018); it considers digitalisation as a solution to providing automated governance. Therefore, the use of technology can result in the automation of traditional features of our organisations (Bellesia et al., 2023).

Automated governance can provide different positive outcomes such as, for example, the improvement of efficiency with repeated or rule-based transactions or the enhancement of transparency with the creation of digital identities among the exchange participants. On the downside, its unique programmatic dimension can promote rigidity, damaging adaptability (Zhu et al., 2006). While automated governance underlines the importance of exact information, analogue governance does not. As an example, the use of machine learning algorithms needs human intervention in certain situations to balance possible biases related to automated workflows (Kordzadeh and Ghasemaghaei, 2022). This highlights the necessity for automated governance to be compliant, as demonstrated by the European Union's General Data Protection Regulation (GDPR). Given the above, businesses usually consider digital governance as a complement to traditional analogue governance models, with a strong effort made to balance technological and interpersonal dimensions (Strich et al., 2021; Tarafdar et al., 2023).

Technological tools are drivers of a significant change in current organisations toward new business models that require a deep regulation of data management (i.e. storage, transfer, access, etc.). This implies a clear shift of decision-making in the hands of those actors that develop digital governance solutions (Benlian et al., 2022). In conclusion, there is a need to revisit governance theories and approaches in this digital era, as governance is not only fundamental for performance issues, but also a strategic differentiator (Chen et al., 2022).

2.3 Technologies focused on improved decision-making (inc AI)

Artificial intelligence (AI)'s disruptive profile opens new approaches and frontiers in the management, corporate and governmental spheres. AI provides machines able to think and make decisions like humans (Marr, 2018), coupled with improved efficiency and strong predictive powers. At the same time, the rapid adoption of AI emphasises the need for adequate legal and regulatory frameworks (Munoz and Naqvi, 2018). New issues and questions arise concerning the relationship between human beings and their coexistence with these advanced technologies.

This unique context creates opportunities and challenges for sustainability issues. Indeed, various authors have studied 'sustainable AI' (i.e. van Wynsberghe, 2021; Vinuesa et al., 2020) which has been defined as "a movement to foster change in the entire lifecycle of AI products (e.g., idea generation, training, retuning, implementation, governance) towards greater ecological integrity and social justice. As such, sustainable AI is focused on more than AI applications; rather, it addresses the whole sociotechnical system of AI" (van Wynsberghe, 2021, p. 217). The scientific community is mainly interested in two matters. On the one hand, it focuses on analysing how to apply AI to improve sustainability in organisations (i.e. focusing on the Sustainable Development Goals – SDGs). On the other hand, other scholars address how to make AI sustainable in different areas such as business model transformation (Duan, et al., 2019), decision-making processes (Paschen, et al., 2020), talent acquisition (Maity, 2019), employee engagement (Bankins and Formosa, 2020) and global trade environment practices (Pournader et al., 2020; Nishant et al., 2020; Dwivedi et al., 2022). Hence, public and private organizations are developing different strategies to redefine sustainable development issues (Hummels and Argyrou, 2021).

Organisations need to consider many aspects related to global environmental sustainability and to resources management. For example, energy emission and reductions, CO2 issues, greener transportation, deforestation are important targets in the 2030 SDGs agenda. AI can play a fundamental and crucial role here (Kopka and Grashof, 2022), potentially reaching 79% of SDGs (Vinuesa et al., 2020). AI provides a new viewpoint on social and environmental sustainability with an innovative usage of the overall supply chain in terms of volumes of work, resource allocation, coordination practices etc (Toorajipour et al., 2021). As a matter of illustration, in the healthcare field,

AI-enabled medical drones can enhance action towards the SDGs from a climate perspective (Damoah et al., 2021). Moreover, AI allows the usage of a large amount of data predicting consumer purchasing attitudes which can help a more efficient inventory management (Shinde et al., 2022).

There is growing debate about AI’s negative impacts (Kambur and Akar, 2022) - the so-called dark side - which relate to its trustworthiness and ethics (Galaz, 2021; Holzinger, 2021) and the anxiety deriving from technology adoption and AI’s potential to replace humans (Pillai et al., 2023). AI presents a complex and disruptive profile that should be in line with human values and principles but may not be. In addition, AI’s processing power alone demands substantial energy. This implies innovative approaches are needed to store, analyse and visualise data to enhance social and environmental sustainability.

3. Contributions to the Special Issue

In this section, we introduce and discuss the eleven papers included in this Special Issue, which were selected, following a peer-review process, from over fifty submissions in total. These papers illustrate how researchers are tackling the intersection of technological developments and sustainability. They were selected as they cover a diverse range of topics and come from contributors across the globe. A variety of methodologies are employed, from quantitative analysis through to case studies and conceptual papers. The studies cover a variety of firms and organisations within different cultural contexts, exploring issues at a macro and micro level. We discuss these papers according to the three themes addressed in the literature review: technologies that enhance efficiency and innovation, technologies that improve governance and technologies that improve decision-making. Naturally, some of the papers may cover more than one theme, so we discuss them in relation to the primary theme they address. For each paper, we highlight how the authors contribute to the aim of the special issue and how their findings may apply in practice. We summarise the contributions in Table 1, providing author names and a short summary of the focus of each paper:

Table 1: Papers in the Special Issue categorised into topic focus

| Technologies focused on efficiency and innovation | Technologies focused on governance | Technologies focused on improved decision-making |
|---|--|--|
| Müller, Kazantsev, Allmendinger, Salehi-Amiri, Zonichenn, Shaden, Bartolo & Da Silva Bartolo. <i>How organisations can ‘engineer’ sustainability using Industry 4.0 technologies, facilitating a shift from mass production to mass customisation</i> | Mormile, Piscopo & Adinolfi <i>How high-growth start-ups in Italy address ESG issues, exploring the intersection between entrepreneurship and sustainability through interviews with entrepreneurs and business founders</i> | Aureli, Mersico & Foschi <i>The use of digital platforms in promoting value co-creation, centering on municipal solid waste management systems in Italy.</i> |
| Kashif, Za & Smacchia <i>A bibliometric analysis of the technologies available to promote sustainability, including those that are less researched</i> | Rahmatdi <i>The adoption of digital platforms for corporate whistleblowing systems, providing insights into how developing technologies can be used to improve governance.</i> | Abu Afifa, Vo Van & Saleh <i>The role of technology in SMEs in an emerging economy (Vietnam). The authors focus on the effectiveness of cloud-based accounting information systems (AIS) to improve decision-making, deriving results from a survey.</i> |
| Wang & Lin <i>How increasing disclosure is associated with increased green innovation</i> | Abdulmuhsin, Alkhwalidi, Dbesan & Tarhini <i>The focus of this study is on the integration of technology into communities of</i> | Bian & Li <i>This study considers the relationship between artificial intelligence and ESG performance. The authors find that AI technology can enhance ESG</i> |

| | | |
|---|--|--|
| | <i>practice through the use, for example, of real-time collaborative digital platforms and cloud-based knowledge management systems.</i> | <i>performance by improving green innovation capabilities and reducing agency costs.</i> |
| Saini, Kharb, Shri & Kumar <i>A country-level study of twin (green and digital) transitions in India, highlighting how aggressive strategies are needed to accomplish green growth objectives at a country level</i> | | |
| Grassa, Boulanouar, & Bakhouché <i>An exploration of the relationship between FinTech and overall ESG rating using GCC countries in the banking sector</i> | | |

Source: Authors' own work

3.1 Papers focused on technologies that improve efficiency and drive innovation

The first two papers in this Special Issue provide an overview of technological developments towards sustainability and the current state of research in the area. In the first paper, Müller et al. (this issue) present a conceptual paper showing how organisations can ‘engineer’ sustainability using the nine fundamental technologies of Industry 4.0, focusing on how these technologies can be used to facilitate a paradigm shift from mass production to mass customisation. Their article addresses the difficulties associated with insufficient data quality and traceability and considers how digital technologies might improve this, thereby enhancing innovation and efficiency. While most literature on Industry 4.0 focuses on the benefits inside a manufacturing system, considering optimal factory layouts for example, Müller et al. (this issue) consider how these technologies can enable sustainability beyond the manufacturing system. They propose that Industry 4.0 technologies can engineer society, providing environmental and social impacts over the mid- and long term. Their paper highlights the benefits and challenges associated with Industry 4.0 and the economic, environmental and social dimensions of sustainability and provides food for thought for practitioners in their adoption of such technologies. In addition, their four propositions on the future of Industry 4.0 consider how developments are likely to prioritise societal needs, leading to the transformation of supply chains into ecosystems, and the need for fundamentally different business models. They note the importance of data governance and AI integration for this to be successful.

In the second paper, Kashif et al. (this issue) explore the relationship between digital transformation and sustainability through a bibliometric and topic analysis of 226 research papers, providing an overview of the field. Their article highlights the different types of digital technologies that can be used to enhance sustainability, including fintech, ergonomics and digital supply chain developments. The authors identify themes that have been under-researched to date, including blockchain, the Internet of Things (IoT), FinTech and social media. The authors stress the need for an integrated, multi-disciplinary approach to research, highlighting the high number of papers published in operations and technology journals compared to social science journals. These two introductory papers provide a useful overview of recent technological developments and how researchers are approaching the topic of technology relating to environmental and social issues. Both papers approach the topic less from an accounting perspective and more from a broader scientific perspective, encouraging other researchers to take the same approach towards understanding how technology can drive efficiency and innovation in ESG.

The next two papers consider the relationship between technology and sustainability at a country level, reflecting on the importance of cultural context and government action and intervention to maximise the benefit of technology in environmental and social progression. Wang and Lin (this issue) consider the influence of ESG disclosure on green innovation in China, finding that increasing disclosure is positively associated with innovation. The Chinese government has implemented policies to develop the ESG ecosystem, including the promotion of green finance and ESG disclosure requirements for listed companies. This paper, using data from A-share listed companies in China, highlights how firms with better ESG disclosure are more likely to receive government subsidies and environmental investment, both of which encourage green innovation. This effect is more pronounced for carbon-intensive firms and those faced with stronger environmental regulation. The study explores the impact of disclosure on innovation, revealing the impact of disclosure on the firm itself and its external environment. It contributes to a literature on how developments in reporting can help to drive other developments towards sustainability, in this case green innovation. Saini et al. (this issue) provide a country-level study of twin (green and digital) transitions in India. They use a series of matrices (SWOT, SPACE and QSPM) to highlight how aggressive strategies are needed to accomplish green growth objectives at a country level, taking full advantage of the twin transition phenomenon. The authors highlight the importance of taking advantage of international finance to develop green technological innovation at the country level. They provide multiple insights for practitioners and policy makers, including a series of practical frameworks to consider the optimal strategy for pursuing a twin transition.

FinTech's combination of technology with financial services has disrupted traditional banking models, improving efficiency and inclusion (Gomber et al., 2018). The next paper in this issue, Grassa et al. (this issue) considers how FinTech can advance sustainability objectives. FinTech can demonstrate positive ESG impacts by reducing carbon footprint, driving financial inclusion and enhancing transparency. The authors use data from Gulf Cooperation Council (GCC) companies in the banking sector, using an ordered logit model to explore the relationship between FinTech engagement and ESG performance. The authors find a significant positive relationship between FinTech and the overall ESG rating, including a positive and significant relationship with each of the underpinning elements of ESG. In additional analysis, they highlight a negative correlation between ESG and bank age, with newer younger banks leading the way in both FinTech and ESG performance. Surprisingly, Islamic banks, despite operating under a strong ethical framework, show lower ESG ratings than conventional banks in this study.

3.2 Papers focused on technologies that improve governance

Mormile et al. (this issue) focus on entrepreneurs. Their paper considers how high-growth start-ups in Italy address ESG issues, exploring the intersection between entrepreneurship and sustainability through interviews with entrepreneurs and business founders. For practitioners, the study provides a roadmap for incorporating sustainability into the business models and governance processes of start-ups, starting at the seed stage, with multiple insights provided from the interview data. High-growth start-ups can play a transformative role in addressing social and environmental challenges, modelling more socially and environmentally friendly practices to drive broader change. The focus on Italy highlights the focus in Europe on being world-leading in ESG practices and reporting. Many of the entrepreneurs interviewed were developing new technologies focused on social and environmental impact and were pursuing green finance. The majority considered ESG factors as central to business strategy development, not just for competitiveness but also to meet their overall goal of having a positive direct impact on the environment and society.

The next two papers consider specific governance mechanisms and how they may be strengthened using technology. Focusing on Europe, Rahmatdi (this issue) discusses the adoption of

digital platforms for corporate whistleblowing systems, providing insights into how developing technologies can be used to improve governance. Digital platforms for corporate whistleblowing highlight a commitment to improving corporate social responsibility. In particular, the study focuses on organisational motivation for the adoption of such platforms, and whether this motivation is part of an overall CSR strategy or is more due to the influence of certain peer groups. The study finds that companies are more likely to adopt digital corporate whistleblowing systems if their country peers have done so, and that industry peers are not as significant an influencer. Therefore, the study highlights the importance of country norms in the process of technology adoption. Abdulmuhsin et al. (this issue) consider the interaction of humans and technology in their study around the influence of communities of practice. Their focus is on the oil and gas sector in the Middle East, where they use survey data to inform their regression model. The focus of the authors is on the integration of technology into communities of practice through the use, for example, of real-time collaborative digital platforms and cloud-based knowledge management systems. In this study, technologically enabled communities of practice facilitate knowledge exchange, dissemination and application, enhancing the effectiveness of employees who use them. The case focuses on how technology can enable the interaction of humans to pursue ESG goals, encouraging the kind of knowledge sharing that can lead to the furthering of the environmental and social agenda.

3.3 Papers focused on technologies that improve decision-making (including AI)

Using a case study, Aureli et al. (this issue) consider the use of digital platforms in promoting value co-creation. Theirs is one of the few papers that considers the impact of technology on both social and environmental matters and addresses the engagement of stakeholders in decision-making. Their case study centres on municipal solid waste management systems in Italy. Solid waste management requires both citizen engagement in recycling and a well-established waste collection infrastructure. Their study shows how a diverse group of stakeholders (municipalities, local governments, citizens and businesses) can come together to co-create value. Co-creation of value recognises that value should benefit multiple stakeholders and should be both economically feasible and socially legitimate. While much attention in the waste management literature has been given to innovations such as smart recycling bins, this paper focuses on social engagement with citizens as recyclers. The authors find that the introduction of digital platforms generated multiple benefits for waste management, including reduced operating and environmental costs and improved citizen awareness and stewardship.

Abu Afifa et al. (this issue) consider the role of technology in SMEs in an emerging economy. They focus on the effectiveness of cloud-based accounting information systems (AIS) to improve decision-making. The paper's results derive from a survey of 193 accountants working in SME firms in Vietnam. The authors find that cloud-based AIS usage improves the effectiveness of AIS overall, enhancing information quality and improving system use, satisfaction and performance. The efficiency gains made through adopting cloud-based AIS can be used directly or indirectly to improve social and environmental outcomes, even within SMEs, who often receive less research attention. Improved data quality and comprehensiveness can improve the reporting on sustainability-related information, whereas the economic gains made through improved AIS efficiency can be used to fund broader social and environmental initiatives.

Bian and Li (this issue) is the only paper that directly addresses AI. The authors consider Chinese evidence from A-share listed companies. AI technology has received significant attention from the Chinese government over the past decade, as has the ESG ecosystem. The authors' quantitative study considers the relationship between artificial intelligence and ESG performance. They find that AI technology can enhance ESG performance by improving green innovation

capabilities and reducing agency costs. Although this is a quantitative study at a country level, the findings highlight the rising importance of AI and the potential for it to enhance ESG performance.

4. Reflections and future research directions

Our review of the literature and the themes emerging from the submissions to this Special Issue present a largely positive outlook on the role that technology can play in embedding social and environmental sustainability matters into organisational and governmental decision-making. The papers cover a variety of topics across a variety of industries and cultural settings. It is notable that the majority of papers in this Special Issue focus on improvements in efficiency and innovation, rather than improvements in governance or decision-making. This was a feature of all papers submitted, not just those selected for this Special Issue. This suggests that technological developments may still be seen as primarily economic choices, with social or environmental benefits as an add-on benefit rather than central to the initial choice. The majority of benefits discussed were also environmental rather than social benefits, a feature typical of much of the literature on ESG. Both of these observations suggest that organisations have not necessarily connected technological investment with their ESG strategy, regarding the two as distinct concepts. This may be due to short-termism, which can lead to a prioritisation of immediate spend with immediate benefits to shareholders (such as technology to improve efficiency) rather than longer-term spend on projects with longer-term benefits that may include benefits to a broader stakeholder group. This finding aligns with the literature on accountability, which suggests that organisations do not know how to go about incorporating longer-term outcomes into their strategy (see Tregigda & Laine, 2022). It also suggests a lack of integrated strategic thinking about the potential to approach ESG challenges through technological solutions. Given the rapid developments in AI, it was interesting and perhaps surprising to only see one article addressing this point directly (although we note that the call for the Special Issue was in 2024, when businesses were still grappling with the significance of AI for their organisations). We would anticipate a rapid growth of academic research into the implications of AI on sustainability over the coming decade. In addition, as AI becomes more widely used and accepted, its social and environmental costs, in particular job replacement and energy requirements, are likely to become features of more critical research.

The majority of papers in this Special Issue focused on *what* technology was introduced, *how* it was introduced, *where* it was introduced and *why*. To progress future research into this topic, we also consider *when* technology should be introduced. This is partly inspired by reflections on the contributions in this Special Issue, which consider actions by start-ups (Mormile et al., this issue) and more established organisations (Rahmatdi, and Abdulmuhsin et al., this issue), and those involving private and public stakeholders in value creation (Aureli et al., this issue). To do this, we consider the firm life cycle using Levitt (1965)'s four stages: introduction, growth, maturity and decline. We also consider options for rejuvenation in the final 'decline' stage. These four stages were originally conceived of to represent a product life cycle but are also now widely used to represent the life cycle of a firm. Agarwal (1997) highlights the importance of technology at all stages of a firm's evolution, highlighting the links between technology and product innovation, the technological landscape and firm survival. Our motivation for including this temporal aspect is not only to inspire new research directions, but also to provide questions and reflections for practitioners.

In Table 2 below, we derive an agenda for future research based on the topics emerging from this Special Issue. In particular, we highlight the need for research that focuses on the risks of such technologies, and the use of technologies at different stages of the firm life cycle. We structure our research agenda into the three themes that have emerged as central to this Special Issue, namely: technologies focused on efficiency and innovation, technologies focused on governance and technologies focused on improved decision-making. Our table is structured as a series of outstanding

questions. These could be addressed by a variety of quantitative and qualitative methodologies, as highlighted in the papers introduced in this Special Issue.

Table 2: Future research directions

| Technologies focused on efficiency and innovation | Technologies focused on governance | Technologies focused on improved decision-making |
|---|--|---|
| Introduction | Introduction | Introduction |
| <p>How can innovative technologies help new businesses embed social and environmental sustainability goals from the start-up stage onwards?</p> <p>How can emerging technologies help with the efficient use of resources in new firms?</p> | <p>How are new forms of governance emerging for new organisational forms?</p> <p>How can new firms implement governance technologies to ensure compliance with social and environmental regulations?</p> <p>How do firms identify the potential benefits and risks of adopting governance technologies early in the firm life cycle?</p> | <p>How can AI and decision-making technologies support strategic planning in new firms?</p> <p>How can AI tools help with scenario and resource planning in the early stages of a firm's life?</p> <p>How can firms assess the ethical considerations and risks of using AI in the early stages of a firm's life cycle?</p> |
| Growth | Growth | Growth |
| <p>How can innovative technologies enhance social and environmental outcomes?</p> <p>What are the challenges and risks associated with integrating new technologies during rapid growth, and how can these be overcome?</p> | <p>How can governance technologies support sustainable growth and ethical practices in expanding firms?</p> <p>What challenges might firms face in scaling governance technologies, and how can these be overcome?</p> | <p>How can AI enhance decision-making processes during a firm's growth phase?</p> <p>What are the potential risks and biases associated with AI use in rapidly expanding firms, and how can these be overcome?</p> |
| Maturity | Maturity | Maturity |
| <p>How can mature firms leverage technologies to maintain efficiency and innovation?</p> <p>What are the long-term environmental impacts of sustained use of these technologies, and how can these be assessed?</p> | <p>How can mature firms use governance technologies to enhance transparency and accountability?</p> <p>What are the risks of over-reliance on governance technologies in established firms, and how can firms assess this risk?</p> | <p>How can mature firms leverage AI to optimize decision-making and maintain competitive advantage?</p> <p>What are the long-term risks of AI dependency in established firms, and how can firms assess this risk?</p> |
| Decline / Rejuvenation | Decline/Rejuvenation | Decline/Rejuvenation |
| <p>How can declining firms use technology to manage resources more efficiently to</p> | <p>What are the risks of relying on outdated technologies in the decline phase, and how can these risks be mitigated?</p> | <p>How can AI assist declining firms in making strategic decisions to manage decline and potential recovery?</p> |

| Technologies focused on efficiency and innovation | Technologies focused on governance | Technologies focused on improved decision-making |
|--|---|--|
| <p>mitigate their environmental and social impact?</p> <p>What are the risks of relying on outdated technologies in the decline phase, and how can these be reduced?</p> <p>How might declining firms use technology to reinvent themselves, refocusing on more socially and environmentally friendly practices?</p> | <p>How can declining firms use technology to manage resources more efficiently and mitigate their environmental and social impact?</p> <p>How might governance technologies be used to transform and rejuvenate an organisation in decline?</p> | <p>What are the ethical and practical risks of using AI in the decline phase, and how can these be overcome?</p> <p>How might technology be used to determine a rejuvenation strategy, rather than managing a decline?</p> |

Source: Authors' own work

5. Conclusion

This paper advances our knowledge on how technology can be used proactively to improve social and environmental embeddedness within organisations, supporting Teh and Rana (2023). The latest technologies can drive transformative change in terms of what products and services organisations offer, how organisations are structured and how they make decisions. This special issue presents and discusses eleven papers that contribute to our understanding of the relationship between technological advances and social and environmental sustainability. They explore different types of technology across different countries, cultures and industries, presenting compelling evidence of the multiple opportunities that new technologies present to embed social and environmental matters into decision-making. They highlight how developments in technology can enhance efficiency and innovation, improve governance and benefit decision-making. The majority of papers expressed enthusiasm for how technologies could be used for good, to improve quality of life and strive for a more sustainable future, as highlighted by Brenner and Hartl (2021), Linnenluecke et al. (2017), Lee and Trimi (2018) and De Villiers et al. (2021). It is notable that the young entrepreneurs interviewed by Mormile et al. (this issue) considered social and environmental issues to be central, non-negotiable features of their strategy, supporting Adams and McNicholas (2007).

These rapid developments in technology come at a time when ESG matters are increasing in importance and attention. Even though 'sustainability' is becoming an increasingly polarised topic politically, from a strategic perspective most organisations realise that it is not possible to neglect social and environmental issues if they hope to reduce risk and remain competitive. Using the latest technologies to achieve that goal is likely to be of significant interest to practitioners, and this Special Issue provides relevant insights for SMEs, start-ups, established listed companies and the public sector. Müller et al. (this issue) provide an overview of the variety of technologies that can be used to engineer sustainability, with Kashif et al. (this issue) providing an overview of current research in the area. Evidence of value creation across broad stakeholder groups presented by Aureli et al. (this issue) provides food for thought in terms of how the private sector, public sector and the general public can work together to achieve social and environmental goals. Policy makers will be interested in country level data from the studies by Wang & Lin (this issue), Saini et al. (this issue) and Bian and Li (this issue), all of which indicate positive relationships between technology and ESG matters.

While this paper focuses on the positive uses of technology, it is important to note the major ethical concerns raised by the introduction of technologies, particularly AI, and also their environmental impacts (Niehoff, 2022). Such technological developments present unprecedented challenges to the business environment (Vial, 2019; Veldhoven and Vanthienen, 2019). Although both Rahmadti (this issue) and Abdulmuhsin et al. (this issue) present approaches for using technology to improve governance, major concerns remain around data security and the accountability for decision-making in an era of advanced AI.

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