Chapter 3
Aligning Digitalization and Sustainability: Opportunities and Challenges for Corporate Success and the Achievement of Sustainable Development Goals

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Abstract Digitalization provides valuable benefits for entities and offers unique opportunities to strategically address challenges associated with the United Nations Sustainable Development Goals (SDGs) to ensure a sustainable society. This chapter discusses potential cross-fertilization effects between digitalization and sustainability to catalyze the benefits and challenges of digital transformation on the corporate level and SDGs' perspective by focusing on sustainable practices. This chapter provides valuable insights for professionals and policymakers on the trends of digitalization and how they can support the SDGs that become a global compass for navigating sustainability challenges.

Keywords Digital transformation · Digitalization · Sustainability · Sustainable development goals

3.1 Introduction

Digitalization and sustainability are two of the most powerful global megatrends that dominate the policy agenda and corporate landscape. The complexity and speed of digitalization, paired with the challenge of achieving the United Nations Sustainable Development Goals (UN SDGs), change the business environment and society (Kiron & Unruh, 2018). Although there is an increasing academic interest in the interactions of digitalization and sustainability (e.g., Del Río Castro et al., 2021;

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Seele & Lock, 2017; Song et al., 2017), the interplay between these megatrends is largely unexplored. Therefore, more attention should be devoted to grasping how these dynamics combine to shape market conditions for corporate success and environmental circumstances for the achievement of the UN SDGs.

Conceptually, digitalization affects how entities operate and how people interact through innovative technologies. It transforms the industry, improves productivity, enhances social well-being, and provides agility, transparency, connectivity, and continuous product availability (OECD, 2018). Digital technologies provide new value-producing opportunities by changing business models and making workflows easier and more efficient. Given its complex nature, digitalization also has an impact on socioeconomic and environmental applications (Ceipek et al., 2020). These impacts have been extremely felt during the COVID-19 outbreak. The pandemic process has shown how digital skills are vital in affecting the quality of life (Ragnedda & Ruiu, 2021). In this sense, the multidimensionality of digitalization poses challenges to move toward a sustainable future.

In order to manage this outlook, countries shape their economic, social, and environmental activities in a digitalized manner. By the same token, companies work out to ground new products and business models to adopt a digital culture to survive. A similar approach applies to sustainability in which nature, society, and business are interconnected in complex ways. Companies integrate environmental, social, and governance (ESG) policies into their strategies and business models to enhance sustainability performance. In this context, they adopt advanced digital instruments, i.e., artificial intelligence (AI), machine learning (ML), predictive analytics, and Internet of Things (IoT), to achieve SDGs and to manage the pressure of stakeholders in meeting social and environmental responsibility expectations (Avila-Gutierrez et al., 2020).

The interactions of digitalization and sustainability offer opportunities and create challenges across economic agents in the society. For instance, companies employ digital instruments to identify their environmental footprint and assess the impact of social and environmental shifts on their business. In a recent study, Ha et al. (2022) analyzed the impact of digitalization on environmental performance, using a database of 25 European countries between the period of 2015 and 2020 to show that digital transformation enhances environmental performance. Digital technologies also improve sustainable innovation even though they lead to vulnerabilities like cybercrime and privacy loss. Hence, the potential positive and negative consequences that digitalization will have on businesses, societies, and human lives are not yet clearly understood (Beier et al., 2021). Therefore, without discussing the benefits and risks of digitalization that may lead to new social and ecological problems, it will be difficult to actively shape the path of sustainable digitalization in the business environment and in the achievement of the SDGs.

This chapter examines the interplay between digitalization and sustainability with a broad-minded view on the corporate and the UN SDG levels. This chapter endeavors a twofold purpose. First, it assesses whether the implementation of digitalization is an accelerator for corporate success. Second, it examines the contribution of digitalization to the achievement of the SDGs that tackle the most important

global challenges. Finally, this chapter sheds light to the challenges of digitalization and makes suggestions to find ground rules for sustainable digitalization, strengthening the dialogue between the three pillars of sustainability and digital applications. Then, the last section concludes and draws attention for future research avenues.

3.2 Digital Transformation and Sustainability

3.2.1 Digitalization and Sustainable Corporate Management

Digitalization is a dynamic process, and it plays a pivotal role in shaping the competitiveness and internationalization of companies. Mobile technologies, storage solutions, learning algorithms, advanced data analytics, and technological solutions, i.e., blockchain, AI, and IoT, create new opportunities (Loebbecke & Picot, 2015; Pereira et al., 2022). Digital tools help companies to optimize business processes, develop new business fields, increase efficiency, reach new clients/markets, and enable them to provide new solutions for customers and other stakeholders (Haefner et al., 2021). Companies with a high level of digitalization could also manage crisis more efficiently (Warner & Wäger, 2019).

Digitalization in the business environment has shown remarkable growth in the world. The global digital transformation market size is USD 737 billion in 2020 and is projected to reach USD 3546 billion by 2028 (www.fortunebusinessinsights.com). Global spending on digital transformation has also increased since 2017 and is expected to reach USD 2.8 trillion by 2025 compared to 0.96 trillion in 2017. Institutions that have highly completed their digitalization process are forecasted to contribute to more than half of the global gross domestic product by 2023, accounting for USD 53.3 trillion (IDC, 2020). More companies take action to digitalize their processes and operations in a sustainable manner and deliver more value to stakeholders. In this sense, corporate digitalization represents a cultural shift to more agile, intelligent, and transparent ways of doing business, powered by digital tools. This transition requires the merging of production and ICTs whose market size reached USD 3.8 trillion by 2020 (TUBISAD, 2021).

With a business-centered approach, companies use digital data collection and processing to support business decisions. Digital networks also enhance information flows and provide means to record the social and environmental impacts of business activities along the value chain and make them transparent for stakeholders. Many companies use digitalization to carry out their sustainability commitments. For instance, within the environmental dimension, companies provide motivational games for employees to reduce plastic waste or create platforms for analyzing resource consumption. Digital tools may also be employed to enhance internal communication and external cooperation via social intranet and feedback tools like whistle-blower systems.

Regarding sustainable production, companies can make smart production by applying digital technologies (Liu et al., 2019). They may also reduce operating costs, improve worker safety through sustainable mechanisms, and reduce resource use and degradation (Roy & Singh, 2017; Zhang et al., 2017). This would in turn facilitate the calculation of ecological footprints and consequently support the development of resource-efficient products (Agez et al., 2020). The electronic product passport recently being developed in the European Union (EU) is a good starting point for applying this approach. However, these benefits must be analyzed with the potential negative impacts of digitalization. Two examples are job losses due to automation and increased energy and raw material consumption caused by the intensified use of ICTs (Jepsen & Drahokoupil, 2017; Lange et al., 2020). In this respect, sustainable digital transformation should be executed by building on its key strengths, i.e., innovative companies and business ecosystems, to overcome the negative effects of digital solutions. In this frame, companies should be prepared to dynamically configurate their innovation processes to profit from long-term impact that the digitalization-sustainability interdependency will likely have on business activities (Lichtenthaler, 2021).

3.2.2 Digitalization and Sustainable Development Goals (SDGs)

Digitalization plays a vital role in promoting and supporting economic, social, and environmental goals to realize a prosperous global society (Horn & Grugel, 2018; Sparviero & Ragnedda, 2021). In this frame, it uses innovative technologies to balance environmental protection, social well-being, and economic growth (Rosario & Dias, 2022). In a recent study, Camodeca and Almici (2021) revealed a positive relationship between digitalization and SDGs in the Italian listed companies. The World Economic Forum (2018) reports that 84% of IoT deployments have the potential to address the UN SDGs. Table 3.1 shows the potential ecological effects of digitalization on the selected SDGs and indicates that accelerating progress toward SDGs needs data-driven systemic and context-inclusive approaches derived from digitalization (Gupta et al., 2020; Van der Velden, 2018).

In this respect, opportunities offered by digitalization can be aligned with the achievement of the SDGs. Academic studies provide evidence to support this fact. Several scholars claim that digitalization makes production less wasteful, less resource intensive, and more energy efficient to achieve the SDGs (Bai et al., 2020; Chiarini, 2021). Ghobakhloo et al. (2021) showed that digitalization can foster sustainable innovations through green product development competencies and product life cycle management. Some studies recognize the relevance of encouraging multi-stakeholder collaboration to support sustainable development with digitalization (Dalby et al., 2019; Messerli et al., 2019), while other works stress the lack of guidelines for reporting an imbalanced alignment among corporate policies, leading to counterproductive outcomes for digitalization and sustainable development

Table 3.1 Potential ecological effects of digitalization on selected SDGs

SDG goals	Potential synergies	Potential conflicts
SDG 9: Industry, innovation, and infrastructure	Dematerialization and resource efficiency by Industry 4.0 Digital innovation for societal and ecological challenges	Increased consumption of resources and electricity by digital technologies
SDG 11: Sustainable cities and communities	Increased reliable data through real-time data collection Saving energy and resources and reducing GHG emissions and air pollution through smart city mobility and smart logistics More efficient supply of drinking water	Increased direct and indirect impacts as well as e-waste Vulnerability of urban infrastructures to cyber attacks
SDG 12: Responsible consumption and production	Increased environmental awareness through more data on the sustainable production and consumption Monitoring of environmental impacts using "intelligent" products and sensors More efficient use of resources via smart production and dematerialization via virtuality Improved production and supply chain management	Increased direct and indirect impact, e.g., demand for critical raw material and natural resources Increased volumes of e-waste and related pollution Short-lived software and increasing computing capacities raise product obsolescence Possible increase in consumption due to more marketing, e.g., online shopping

Source: German Advisory Council on Global Change (WBGU, 2019)

(Lopez, 2020; Pimonenko et al., 2020). All these findings show that careful alignment of digitalization with the SDGs is crucial for the inclusive sustainable development (Gupta & Rhyner, 2022).

3.2.3   How Does Digitalization Contribute to Sustainable Industrialization?

Digitalization causes revolutionary structural changes in value creation by affecting technological development in the production processes and the social and environmental intensity of industrialization. Thus, digitalization and industrialization must be carried out environmentally and socioeconomically sustainable if UN SDGs are to be met (Kunkel & Tyfield, 2021). This process necessitates the smartization of factories, supply chains, distribution channels, and value chains in the industrialization process. According to The World in 2050 Report (SDSN, 2021), the major impacts of digitalization on production consist of dematerialization and shared economy. Dematerialization is associated with the reduction of resources, i.e., energy, raw materials, and lower carbon emissions, while the shared economy

targets the real-time matching of demand and supply, thus improving the quality of services, continuous availability of products, and better asset utilization. In this respect, smart automation of production using robots, and AI, enables customized products in production and allows to make flexible manufacturing (Palacká et al., 2021).

While new business opportunities can arise through digitalization, concerns exist about the potential of employment-intensive industries to absorb a growing workforce given decreasing labor intensity due to automation in various industries. Regarding environmental sustainability, digital technologies require energy and resources in the production, use, and disposal, e.g., manufacturing-related emissions and the creation of electronic waste, while they have an impact on energy and resource efficiency in production (Kunkel & Tyfield, 2021).

Digital technologies can facilitate industrially sustainable approaches by improving planning processes and allowing companies to experiment with new business models (Frank et al., 2019). For instance, sensor networks improve production processes' adaptability and flexibility. However, achieving these outputs requires companies to increase awareness and transformation of the manufacturing processes to achieve sustainability-related goals such as optimizing materials and energy consumption through high-level digitalization. For example, industrial IoT and data analytics can gather data from the design stage to the recycling stage to improve energy efficiency and product life cycle (Nnorom & Osibanjo, 2008). Thus, the digital transition can enhance industrial sustainability through intelligent management systems that can achieve multiple functions, i.e., improving resource efficiency and reducing waste. In this context, market participants across the networks should interact using an innovative mindset to address social and environmental problems to achieve competitiveness in the global business environment (Vincent, 2016).

3.3   Challenges of Digitalization for the Sustainability Dimensions

The digital transformation causes a deep change in industry and consumer preferences and requires a strong remodeling of how stakeholders interact. From this perspective, the interdependency between digitalization and sustainability brings several occasions for figuring out the sustainable transformation of the economy, industry, and society, paving the way toward the achievement of the SDGs. Nevertheless, digitalization creates several challenges in this hyper-dynamic environment. To make digitalization a success, all parties should be closely engaged to advance a governance framework that is compatible with the ESG dimensions (Renn et al., 2021). This approach requires a special focus on the interdependencies between digital technologies and environmental, social, and governance impacts, and it constitutes a reference point for the impact assessment of digitalization on all

dimensions of sustainability. The following part discusses these interdependencies on each sustainability dimension.

3.3.1 Environmental/Ecological Dimension

Digitalization involves the application of digital technologies to bring solutions in areas such as waste management, production efficiency, and pollution control. The main objectives are decarbonization, dematerialization, and denaturalization by shifting to renewable energy sources (Dalby et al., 2019). Digitalization optimizes production processes and minimizes resource consumption. AI, IoT, and data analytics enhance sustainability practices by reducing waste and carbon emissions (Birat, 2020).

However, these benefits are not automatically realized. Due to the growing number of devices and increasing use of cloud services, energy consumption and e-waste accumulation rise (Andrae, 2019). For instance, blockchain technologies rely on servers that require a huge amount of energy to power them, thus having an increasingly negative impact on the environment. Some studies show that modernizing production processes does not really lead to significant efficiency gains, particularly in material and energy consumption (Fritzsche et al., 2018). For instance, many companies use digital technologies in videoconferencing, e-commerce, and transport route optimization, but the gains sometimes entail opposite effects, i.e., e-commerce may lead to increased packaging or higher energy use.

Looking forward the providers and operators of digital technologies should show a clear commitment to combining the potential benefits of digitalization with the management of environmental concerns. In this frame, binding targets for saving energy and material and reducing non-recyclable waste should be set.

3.3.2 Social Dimension

There are three objectives under this caption of the social dimension in digital transition: equivalent living conditions, digital sovereignty, and active participation in the digitalization process as well as social and cultural identification (Weingärtner & Moberg, 2011). Digital services are provided free of charge for most users to make these services accessible to majority of the population. This opportunity has, however, some drawbacks. For instance, many autocratic systems may use digital means to impose surveillance methods for people (Renn et al., 2021). In addition, a gap may occur between those who benefit from digitalization and those who are left behind. For example, small companies may have difficulties dealing with the digital transition, putting them at a competitive disadvantage (Kumar et al., 2020). Similarly, older adults may be unable to use digital tools, leading to a two-tier digital society (Brenner & Hartl, 2021).

Other important issues are data security and digital sovereignty. The most important challenge here is data protection and cybersecurity. Practices violate the protection of privacy, reduce transparency on data usage, and foster an illegitimate use of data leading to significant threats. In this context, digital sovereignty is important. It shows the degree of control that institutions and individuals have over the data they generate and use. This includes self-control to decide what and how to consume, to make informed choices, and to not be subject to manipulative forms of website advertising and personalized profiling.

Another challenge in the social dimension is the lack of digitally skilled specialists. In this context, companies should spend their efforts to train employees to enable them in digital transformation. Other topics related to the work include the acceptance of new technology in the workplace and health risks like high-stress levels due to digitalization or nomophobia associated with the intensive use of technological devices. Therefore, companies should develop policies and firmly anchor them in managing potential challenges within the organization.

3.3.3   Governance Dimension

Managing digital transition requires organizational leadership to implement actions for achieving a sustainable competitive edge. In this context, business leaders may evaluate several options in digitalization and scale up a working option rapidly. Another approach may involve splitting large-scale digital projects into more manageable strategic investments. This method empowers companies to implement digital transformation while minimizing potential risks and achieving sustainability goals (Gerlitz & Meyer, 2021).

The governance of data flows in digital transformation is also very important. Companies must determine who should provide what data, how the data should be processed, and who should have access to which data sets. In addition, completeness, quality, and security of the data must be ensured (Pietron et al., 2022). In this respect, the different steps, i.e., data collection, sharing, usage, and standardization, should be structured along the value chain (Li et al., 2019).

To sum up, companies should wisely use digital tools to promote universal values in the ESG sphere (Helbing, 2012). To manage the challenges, companies should primarily encourage all departments to participate in the digital transformation and anchor digitalization in people's minds as corporate culture. For instance, they may introduce a digital talent network program to support employees in actively shaping digitalization processes. Companies should also ensure data protection, privacy, and sovereignty to build trust for the stakeholders. Finally, entities should include society and external stakeholders in the digitalization process. Within this approach, they may give lectures and hand out learning materials to manage ethical issues about the application of digital tools.

3.4 Conclusion and Discussions

Digitalization will contribute to a sustainable future if it is applied wisely to reach universal values in the sustainability perspective. In this sense, institutions should leverage digitalization to successfully manage ecological and social crises. There are many interconnections between digitalization and sustainability. Digital technologies lead to multiple opportunities and risks and require an inclusive decision-making style to favor the UN SDGs. In this context, companies may move toward a sustainable world with smart digital solutions by not harming environments and achieving socioeconomic advances. However, the interplay between digitalization and sustainability is still evolving. This necessitates the inclusion of more sustainability parameters into digitalization in the next years. In this vein, companies should adopt a holistic approach in employing digital instruments to protect the environment, empower employees and customers, and guide digital transformation in line with the UN SDGs.

Another important focus area is digital literacy. Enhancing digital literacy in the population, assisting companies with digital modernization, and designing digital products that reduce resource consumption are critical targets for a sustainable digital future. In this sense, digital literacy includes competencies in the ICTs. It is the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely through digital devices. In this respect, it is important to put up explicit rules and guidelines for data security.

Many of these issues can be handled if all parties across the globe work together in setting up targets, rules, and intelligent policies in line with the UN SDGs and ESG targets (Renn et al., 2021). If these challenges are not adequately addressed, then the acceptance of digital innovations is likely to erode, and efforts toward sustainable digitalization may be jeopardized. Thus, to create a sustainable digitalized world, all parties should put the well-being of people and social and environmental factors at the center of the debate and ensure that digitalization is guided every step of the way by the UN SDGs. In this context, the sustainable global gap between countries should be carefully managed. Thus, policymakers should define a convergence mechanism to harmonize different policies in the implementation of digitalization and sustainability around the globe. Last but not least, to tackle these challenges, academicians, practitioners, and local communities should engage in close cooperation, bring comprehensive solutions, and outline an inter- and transdisciplinary agenda for the next years.

The present research only provides a holistic view, pointing out environmental, social, and governance issues, along with digitalization which deserves further research. For future work, a broad empirical basis may be used, including different countries, sectors, and longitudinal studies to assess the direction of sustainable digitalization and develop innovative measurements to advance the quantification of digitalization and sustainability nexus.

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