Digitalization and Sustainable development in firms: A Systematic Literature Review

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Résumé:

Les concepts de digitalisation et de développement durable, ainsi que leur coexistence au sein des entreprises, font l'objet d'un intérêt croissant de la part des chercheurs et des professionnels. Cet article vise à mettre en évidence et à identifier les relations entre ces deux concepts. Jusqu'à présent, la littérature liant le développement durable et la digitalisation est peu développée et un appel à davantage d'études a été observé. À cette fin, une revue systématique et une analyse de 66 articles sélectionnés dans quatre bases de données différentes ont été réalisées. Cette revue vise à établir un état de l'art de la digitalisation et du développement durable en tant que sujet unique. Elle nous permet de renforcer les recherches actuelles qui incluent les deux concepts, de saisir les liens thématiques entre les différents travaux et d'identifier les lacunes théoriques. Cet article contribue à la littérature en dévoilant quatre grands types de relations structurant la digitalisation et le développement durable.

Mots-clés : digitalisation, développement durable, durabilité, entreprises, revue systématique de la littérature.

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Abstract:

Concepts of digitalization and sustainable development, as well as their coexistence within firms, are receiving a growing attention from both researchers and practitioners. Therefore, this article has for an objective to highlight and identify the relationships between the two concepts. Until now, there is a gap in the literature linking them and a widespread call for more studies. For this purpose, a systematic review and analysis of 66 articles selected from four different databases were conducted. This review aims to achieve a state of art of digitalization and sustainable development as a single topic. It allows us to strengthen current research that includes both concepts, capture the thematic links between the different works and identify theoretical gaps. This article contributes to the literature by unveiling four main types of relationships structuring digitalization and sustainable development.

Keywords: digitalization, sustainable development, sustainability, firms, systematic literature review.

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1. INTRODUCTION

A series of recent studies have indicated that today two major megatrends exist among others, which are sustainable development and digitalization. These latter shape economies and business activities for coming years (Castro, Fernandez & Colsa, 2021). In fact, both of them constitute key topics of many companies' strategic agendas (Lichtenthaler, 2021). This is motivated by the complexity and rising level of digitalization, as well as the basic difficulty of achieving sustainable development goals. In addition, scholars' interest in these themes are increasing lately. This is noticeable from the new emerging terms mentioned in the literature such as digital economy, digital technologies, innovations, etc. We note as well that sustainable development, climate change, preservation, and protection of the environment are also topics that raise many concerns (Tiron-Tudor, Kolisnyk & Savrina, 2021).

It's also important to mention that several academic articles have been published to explore various points of view on sustainable development and digital-related concepts, but in an isolated way (Nidumolu, Prahalad & Rangaswami, 2009). In fact, research on the intersection of digitalization and sustainable development is still in its early stages (Bohnsack, Bidmon & Pinkse, 2022). These two topics appear to be unrelated (George, Merrill & Schillebeeckx, 2021) but they are currently being explored and combined in a variety of new research, representing new areas of interest to many firms, such as digital sustainability, sustainable digitalization, and other variations of these two concepts (Tiron-Tudor, Kolisnyk & Savrina, 2021). In the same line, some authors affirm that little attention has been paid to study the link between them (El

Hilali, El Manouar & Idrissi, 2020; Gupta, Motlagh, & Rhyner, 2020). Therefore, researchers have yet to perform rigorous, systematic research that completely examines that nexus and provide a comprehensive understanding of it (George, Merrill & Schillebeeckx, 2021).

Adding to that, despite the fact that the majority of firms' actions have concentrated, up to this point, only on one of the two concepts (Gupta, Motlagh & Rhyner, 2020), actions simultaneously integrating digitalization and sustainability have only recently begun and they still do not cover the majority of sustainability and digitalization-related activities in most firms. For our part, we think that such a topic is crucial, considering that governments, as well as managers, are increasingly required to adjust to the emergence of a digitalized world, while still pursuing sustainable development goals.

With the intention of uncovering how the interplay between the studied concepts is structured in the literature, a systematic review was conducted in order to answer these following research questions: Is there a relationship between digitalization and sustainable development? What is its nature? How is it articulated within firms?

In other words, this work aims to reveal the link that might potentially exist between digitalization and sustainable development and will help clarify current depictions of it at a firm level. We identify four main types of relationship: positive, negative, positive and negative, independent.

In the following sections, we first present the definitions of the studied concepts. Second, we expose the methodology followed to carry out this systematic review. Finally, we discuss the nature of the relationship between the two concepts and address the different research gaps, through a profound analysis of the selected articles.

2. CONCEPTS' DEFINITION

In the purpose of addressing our research questions, we started first of all by dedicating this section to outline the definitions of each concept, namely digitalization and sustainable development. Through this, the concepts of this research study will be clarified.

2.1 SUSTAINABLE DEVELOPMENT

Many definitions of sustainability have been exposed over time, with more than 100 interpretations explaining it depending on various contexts (Eizaguirre, García-Feijoo & Laka, 2019). According to Castro, Fernandez & Colsa (2021), the term sustainability has usually been exploited, combining several points of view that have weakened the genuine meaning, and therefore a unified definition is needed. In fact, due to its multidisciplinary and transdisciplinary character, impacting socio-economic organizations at all levels via decisions, behaviors, and actions (Caputo, Del Giudice, Papa & Scuotto, 2020), the term sustainability remains challenging to define. In fact, it can be considered from various angles (Rosário & Dias, 2022).

It is important to mention that sustainability is frequently used with the term sustainable development in an interchangeable way. Thus, in the context of our research, we affirm that we use the terms sustainable development and sustainability interchangeably. In this regard, sustainability was defined by the UN Brundtland Commission (1987) as the *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. By now, this represents the most widely recognized definition among scholars and practitioners (Stuermer, Abu-Tayeh & Myrach, 2017). Within this regard, Van der Velden (2018) claims that sustainability represents the phenomenon of ensuring the social base for people everywhere, both today and in the future while remaining within the bounds of the planet. It addresses each aspect of the world in which we live as humans (Gupta, Motlagh & Rhyner, 2020). Specifically, it is a long-term objective of our society that covers topics like

economic and resource efficiency, social equity, and environmental responsibility (Demartini, Evans & Tonelli, 2019).

Moreover, in order to operationalize this broad definition of sustainability, the Triple Bottom Line (TBL) approach has been used (Elkington, 1994). According to the TBL, businesses ought to not only consider the economic value, but also the social and environmental value they create or destroy (Isensee, Teuteberg, Griese, & Topi, 2020). As a result, each company can look into these three dimensions of its business model: economic, environmental, and social sustainability. Concerning the economic sustainability, it occurs when a balance is achieved between the search for economic performance and its sustainable development (Abson, Fischer, Leventon, Newig, Schomerus, Vilsmaier, ... & Lang, 2017). As for the environmental sustainability of an organization, it refers to the impact of its processes, operations, and activities, which can be positive or negative, on its natural environment (Mishra, Akman & Mishra, 2014). And last but not least, social sustainability is about achieving sustainable development through a strong partnership between business and society. In this sense, with the social dimension, a win-win situation is aimed (Gil-Gomez, Guerola-Navarro, Oltra-Badenes & Lozano-Quilis, 2020).

In line with what has been said, Di Vaio, Palladino, Hassan & Escobar (2020) stipulate that in order to reach sustainable development, three fundamental features must be balanced: profit, people welfare, and planet protection. In fact, most authors divide sustainability into three main pillars, which may be depicted as the 3E's (economy, environment, and equity) or as the 3P's (people, prosperity, and profits). Some scholars take the multidimensional approach a step further, incorporating moral or technical dimensions for instance (Pawłowski, 2008).

2.1.1 Sustainable Businesses

Companies are increasingly forced to reconsider their business model innovation in order to support sustainable development goals (SDGs) (Hajiheydari, Shouraki, Vares & Mohammadian, 2022). In fact, businesses today are supposed to respond appropriately to social and environmental issues as well as their shareholders' economic expectations (Geissdoerfer, Vladimirova & Evans, 2018). It has been shown that, while developing business models, organizations must consider every stakeholder and, more broadly, society in general (Short, Rana, Bocken, & Evans, 2013; Stubbs & Cocklin, 2008). In this perspective, sustainability is having an increasingly important role in business model innovations (BMIs), with the development of sustainable business models (SBMs) (Zott & Amit, 2010). This has resulted in the latest definition that considers sustainable BMs as a modification of the conventional BM, with specific traits and purposes added to it (Rantala, Ukko, Saunila & Havukainen, 2018). In fact, two ways exist for a sustainable BM: they either embrace sustainability concepts, principles, or goals or include sustainability into their value creation and delivery, value proposition, and/or value capture mechanisms. Currently, sustainable BMs are more and more viewed as a source of competitive advantage (Nidumolu, Prahalad & Rangaswami, 2009). As a result, some researchers state that sustainable BM can, in some situations, overcome traditional BM, just like sustainable competitive advantage has supplanted competitive advantage (Grant, 2010). Furthermore, in order to systematically steer a firm toward sustainability, an innovative BM must integrate societal value into products and services. As a result, sustainability is a driving force behind BMI's efforts to achieve sustainable development (Schaltegger, Lüdeke-Freund & Hansen, 2012). Generally, corporations must reinvent their business models for sustainability and reconfigure current corporate ecosystems to support societal efforts.

Overall, sustainability transition challenges correspond, for businesses, to the necessity to switch to completely new and more sustainable value propositions and business models (Schaltegger, Hansen, & Lüdeke-Freund, 2016). As a result, academics focus more on sustainable business models allowing the creation of ecological and social value, in addition to exclusively economic gains (Lüdeke-Freund, 2020). Moreover, not only a value to the corporation should be provided by these types of business models, but also to its shareholders and society as a whole (Hahn, Preuss, Pinkse & Figge, 2014).

2.2 DIGITALIZATION

Industries are increasingly faced with a core concept today, which is business digitalization. Its holistic nature hardens its definition, as well as the reach of a consensus on it (Guandalini, 2022). In addition, the review of the literature reveals that studies on digitalization are largely dispersed, and there is a necessity to distinguish between digital technologies itself and digitalization (Parida, Sjödin & Reim, 2019). Besides, we note that different terms related to digitalization are used in the literature, such as digitization or digital transformation. Despite their similar and linked interpretations, the concepts are quite distinct and not interchangeable. Thus, many authors have attempted to explain the difference between them (El Hilali, El Manouar & Idrissi, 2020). Therefore, this section is dedicated to provide an overview of the main terms related to digitalization, in order to determine a definition.

To start with, several authors have stated that digitalization represents the increased adoption or use of digital technologies, involving their networking and interconnectivity. This draws attention to digitalization as a *"mean to an end, not an end in itself",* used by governments, sectors, or organizations (Parida, Sjödin & Reim, 2019; Van der Velden, 2018). In other words, digitalization highlights how various areas of business, government, and social life are being reorganized around digital technologies (Brennen & Kreiss, 2016) and how society needs to

adapt to this progression (Acciarini, Borelli, Capo, Cappa & Sarrocco, 2021). Moreover, based on the selected articles in our systematic literature review, we assert that digital technologies and methods are mainly summarized in concepts, such as bigdata, industry 4.0, artificial intelligence, blockchain, the Internet of Things, etc.

Noting that, a popular definition outlines that digitalization seeks to change a business model and create new revenue and value-creation opportunities while adopting digital technologies (Gartner, 2019[1]). This leads us to conclude that digitalization plays a crucial role as an enabling factor of business model innovations as it provides opportunities to affect it in various aspects (Acciarini, Borelli, Capo, Cappa & Sarrocco, 2021). For instance, digitalization helps on one hand optimize or transform an existing business model, and on the other hand, it helps develop a new one (Rachinger, Rauter, Müller, Vorraber & Schirgi, 2018). From a similar perspective, the concept of digitalization is studied, at the organizational level, as the use of emerging digital technologies enhancing new market offerings and business models, as well as reaching significant business improvements (Brennen & Kreiss, 2016; Gregori & Holzmann, 2020). Consequently, there is no doubt that the main objective of creating digital businesses entails major transformation (Lichtenthaler, 2021). It reshapes the way people interact and so the way organizations, institutions, and societies function (Brenner & Hartl, 2021).

Nevertheless, it is essential to note that digitalization varies from digitization and digital transformation. In fact, digitization represents the process of transforming writings, images, or sounds into digital content. It is associated with automation, noting that converting physical data into digital formats enables to automate workflows and business processes and hence,

[1] Gartner (2019). *Employ Digital Technology to Enable a Circular Economy*.

enhances efficiency (Brenner & Hartl, 2021). In other words, digitization covers the automation of operations and jobs like the transformation of physical information into digital information.

As for digital transformation, it is viewed, by both academic scholars and practitioners, as the next step of digitalization (El Hilali, El Manouar, & Idrissi, 2020). In fact, unlike digitalization, digital transformation refers to the process conducted by digital technologies that provokes distributions in organizations, with massive effects on value creation, strategy, and structure mechanisms (Vial, 2021). It is an organizational change stimulated and shaped by digital technologies (Hanelt, Bohnsack, Marz & Antunes Marante, 2021). Moreover, digital transformations are also defined as an evolutionary process in which digital technologies and digital capabilities add value by enhancing customer experiences, operational processes, and business models.

In short and from what has been previously exposed, it is clear that digital transformation doesn't refer to a unique initiative that is carried out to improve certain functions, but instead it is a process driving core organizational changes, leading to the creation of additional improvement opportunities (Feroz, Zo & Chiravuri, 2021). Furthermore, this phenomenon is not a process focused only on organizations, but also brings industrial and societal changes (Vial, 2021).

Taking everything into account, we may identify the difference between digitalization and digital transformation. However, in this research, we adopt the general term digitalization to deal with all sorts of digital transformation (Brenner & Hartl, 2021).

3. METHOD FOR THE LITERATURE REVIEW

In order to examine the link between digitalization and sustainable development in firms, we carried out a systematic literature review (Tranfield, Denyer, & Smart, 2003). This is a useful approach that is typically used to explore new emerging subjects, eliminate uncertainties and provide a synthesis of past studies. Moreover, it is an approach that aims to identify and provide avenues of research and hence expand the domain (Jones, 2004). Systematic literature reviews have recently been conducted in the social and management sciences (Da Silva, Kovaleski, Pagani, Silva & Corsi, 2020).

The following table (Table 1) depicts the research protocol applied in this systematic review.

Table 1. The research protocol

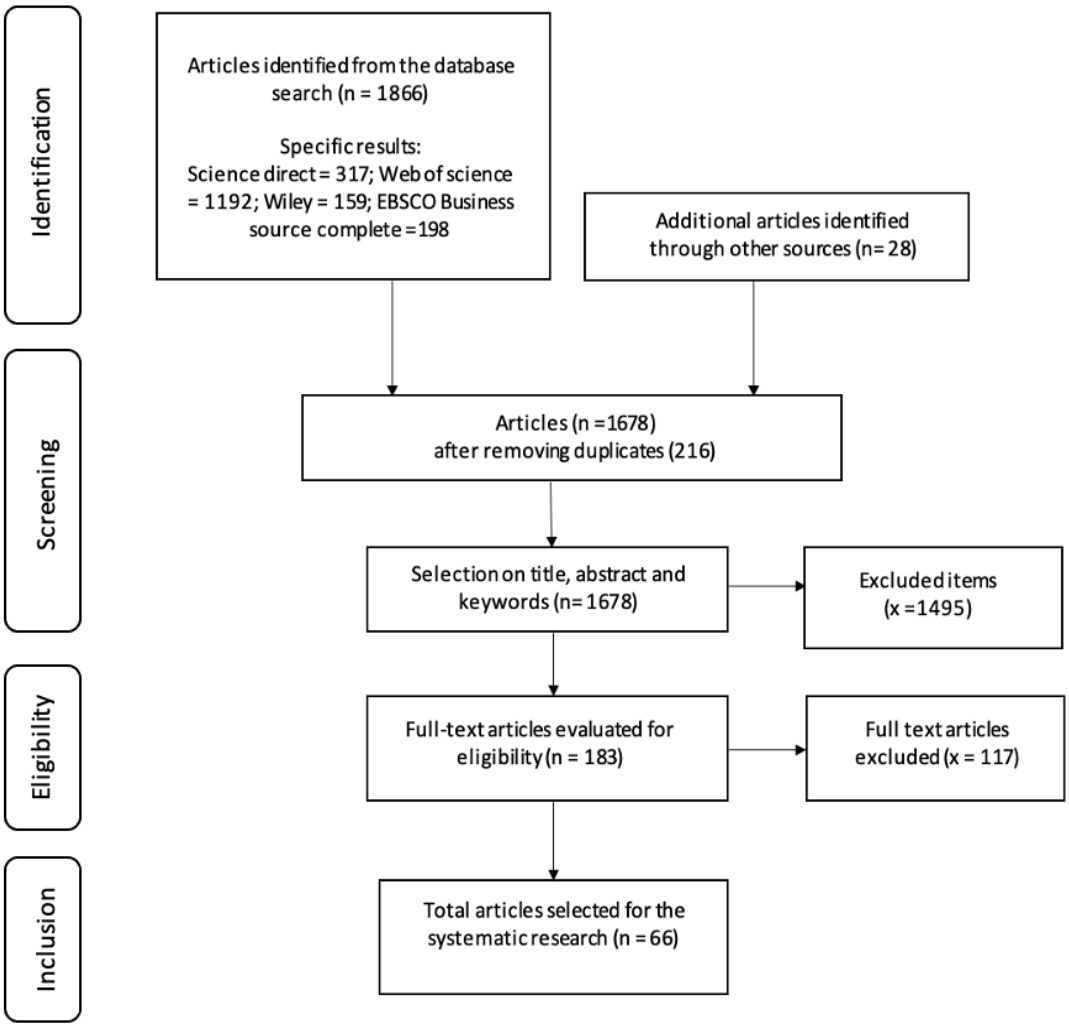
RESEARCH PROTOCOL	DESCRIPTION
Databases	Searches were conducted in four databases, namely Wiley, Web of Science, ScienceDirect, and EBSCO Business source complete.
Timeframe	Up to and including September 2022.
Search fields	Title, abstract, and keywords in the first place. Full text in the second place.
Research equation	"digita*" AND (sustainab* OR corporate social responsib*)
Inclusion/exclusion criteria	-Only peer-reviewed literature was considered. Searches were limited to journal articles. -Only publications in English and French were considered.

	-Only articles in the disciplines of management sciences and social and economic sciences were selected. -Articles that refer to the link between sustainable development and digitalization with a purely technical approach or which are based on contexts or interpretations other than those sought were excluded.

Source: author's elaboration

Within this regard, we used the PRISMA (preferred reporting items for systematic reviews and meta-analysis) approach to effectuate this systematic review. This method entails the use of an evidence-based checklist. As to ensure transparency and clarity, this method is proposed as a flow chart in four phases, which are: identification, screening, eligibility and inclusion (Moher, Shamseer, Clarke, Ghersi, Liberati, Petticrew, ... & Stewart, 2015). In this sense, the PRISMA flow diagram below (Figure 1) exposes the four phases.

Figure 1. PRISMA flow diagram completed



Source: author's elaboration

3.1 IDENTIFICATION PHASE

Because this systematic review is interdisciplinary and encompasses both digitalization and sustainable development, searches were undertaken across four databases to ensure that all relevant articles were identified. The databases are Wiley, Web of Science, ScienceDirect, and EBSCO Business source complete. Moreover, we chose the databases based on past systematic studies on this subject (such as Isensee, Teuteberg, Griese & Topi, 2020). The Web of Science database was chosen for its coverage of journals with high-impact factors. EBSCO Business

Source Complete was chosen because it is one of the most extensive sources of business research often cited in literature reviews. The ScienceDirect and Wiley Online Library databases were selected for their wide scope, enabling not only a general search across a variety of fields but also an advanced search in a specific one.

Regarding the keywords, the analysis of various articles helped us to identify a list of terms to be included in the search and could be used to study the concepts of digitalization and sustainable development. In this way, our search equation is: "digita*" AND (sustainab* OR corporate social responsib*).

After defining the search equation, we adopted the same approach for each database. We proceeded to search in the title, abstract, or keywords of the publications. This step allowed us to narrow down the search results to publications that addressed both the concept of digitalization and sustainable development. As a result, we identified 1866 eligible articles for the selection phase. It is also important to mention that we completed this identification phase by adding 28 additional articles, identified from other sources. In fact, articles not included in the databases but cited by many selected articles were included, to avoid ignoring any important reference for our research. Taking into account that the identification phase occurred between July and September 2022, we note that one article (Holzmann & Gregori, 2023) published after that time period and that we believe is relevant to this study, was added.

3.2 SCREENING PHASE

We removed duplicates (216 articles), reviewed all articles that came up after screening, and read their titles and abstracts so that we could identify work that may potentially be in accordance with our research guidelines. This was done on the basis of inclusion and exclusion criteria that we determined. Thus, only articles in the disciplines of management sciences

(management, marketing, finance, etc.) and social and economic sciences were selected. Furthermore, there was a restriction concerning the type of publications. In fact, we have limited the works to peer-reviewed journal articles. Book chapters, books, seminar and conference papers, company reports, editorial notes, and doctoral theses were not considered. This is the standard approach for systematic reviews because it ensures quality control that validates the knowledge provided (Light, Richard, Light & Pillemer, 1984). We refrained from limiting the timeframe for our search, covering the entire available period up to and including September 2022. In addition, only works in French and English were considered. However, no article in French was retained. In this regard, the Zotero software was used to export references, and identify and delete duplicates, thus 1495 articles were excluded and 183 articles were selected for full-text evaluation.

3.3 ELIGIBILITY PHASE

This third step consisted in analyzing the eligibility of the works according to the inclusion and exclusion criteria. To accomplish this, we read the remaining 183 articles one by one, in full text. In this phase, 117 articles were excluded. Specifically, 25 articles were deleted because of the unavailability of the full text. For the rest, 92 articles were deemed out of scope. Indeed, some works are based on contexts or interpretations other than those pursued, such as *"financial sustainability"* (Faroqi, 2015) or *"sustainability of digital artifacts"* (Bradley, 2007) or *"sustainability of competitive advantages"* (Knudsen, Lien, Timmermans, Belik & Pandey, 2021). On top of that, the selected articles should mention and discuss digitalization and sustainable development jointly, in a central rather than a marginal way. Therefore, in order to be included, an article must clearly evoke the idea of digitalization and sustainable development.

3.4 INCLUSION PHASE

In sum, this approach allowed us to select and analyze 66 articles eligible for content analysis in order to synthesize knowledge in this field of research, answer our research question, and identify gaps and future directions. The sample size is reasonable given the small number of publications due to the field's maturity and dispersed character (Kraus, Breier & Dasí-Rodríguez, 2020), yet it also makes it easier for a more complete review of each article (Kraus, Palme, Kailer, & Kallinger & Spitzer, 2018).

On the same note, we follow a systematic approach to article analysis. Using a detailed spreadsheet, we were able to categorize the articles according to the name of the journal, title, author, year of publication, and methodology. In addition, we identified for each article its scope, objective, and main results and contributions. This allows us to conduct a more detailed review of the literature.

4. DESCRIPTIVE ANALYSIS OF SELECTED ARTICLES

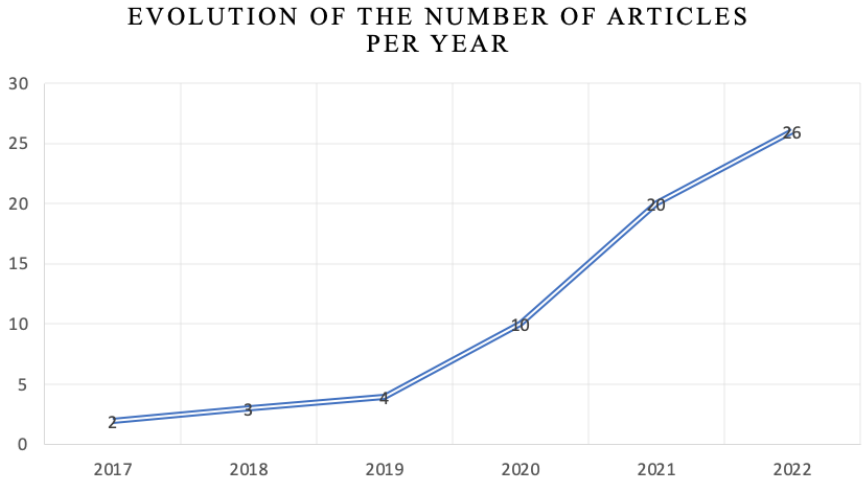
In this section, we present a brief descriptive analysis of the 66 papers chosen for the systematic review. This analysis was constructed around five components, namely the progression of the articles over time, the distribution of the articles by journal, the classification of the articles by methodology, a word cloud, and the authors' positioning concerning the type of link between the concepts of digitalization and sustainable development.

4.1 DISTRIBUTION OF ARTICLES OVER TIME

The search was not restricted to a particular time frame. Nevertheless, the chosen search equation allowed us to identify 65 articles from 2017 to 2022. As previously mentioned, only one article published in 2023 was added to our sample. Hence, we will not take it into account when describing the distribution of articles over time, otherwise, it will bias our analysis. In this

regard, two articles were published in 2017 and three in 2018. Likewise, as exposed in Figure 2, we notice an increasing evolution in the number of articles published between 2019 and 2022. As a matter of fact, 90% of the selected articles, i.e., 60 articles were published in the last four years. This allows us to confirm the growing interest that researchers have today in the themes of digitalization and sustainable development.

Figure 2. Evolution of the number of articles per year



Source: author's elaboration

4.2 CLASSIFICATION OF ARTICLES BY JOURNAL

There are 37 journals in various domains interested in the link between digitalization and sustainable development, which confirms the topic's relevance. The rising academic attention in the field is emphasized even more by highlighting the variety of journals where such studies have been published. Table 2 shows that Business Strategy and the Environment and Sustainability are the journals with the most publications; with seven articles published in each. They are followed by Journal of Cleaner Production and Technological Forecasting and Social Change with five articles each and Journal of Business Research with four articles.

Table 2. Number of articles per journal

JOURNAL	NUMBER OF ARTICLES
Business Strategy and the Environment	7
Sustainability	7
Journal of Cleaner Production	5
Technological Forecasting and Social Change	5
Journal of Business Research	4
International Journal of Information Management	3
Journal of Information Management	2
Procedia CIRP	2
Serbian Journal of Management	2
Technology in Society	2
Africa Journal of Management	1
Benchmarking: An International Journal	1
Cleaner Logistics and Supply Chain	1
Corporate Social Responsibility and Environmental Management	1
Economic research	1
Engineering Economics	1
Entrepreneurship and Sustainability Issues	1
Entrepreneurship Theory and Practice	1
Foresight	1
Futures	1
ID&A Interaction design & architecture (s)	1
IEEE Transactions on Engineering Management	1
Information Systems Frontiers	1
Intereconomics	1
International Journal of Innovation Science	1
Journal of Competitiveness	1
Journal of Strategy and Management	1
Logforum	1
Macroeconomic Review	1
Management Systems in Production Engineering	1
Managerial Challenges of the Contemporary Society	1
Operations Management Research	1
Procedia manufacturing	1
Smart and Sustainable Built Environment	1
Sustainability science	1
The International Journal of Logistics Management	1
The TQM Journal	1

Source: author's elaboration

Table 3 shows that of the 37 journals, only 11 journals are listed in the FNEGE 2022 classification. Five journals are ranked 2 and the remaining are ranked 3. Furthermore, only 2 journals belong to the domain of business strategy, which represents 8 articles selected in total. Based on these provided informations, we deduce that more studies are needed.

Table 3. FNEGE Classification of the journals

JOURNAL	NUMBER OF ARTICLES	FNEGE CLASSIFICATION 2022	DOMAIN
Journal of Cleaner Production	5	2	LOG
Technological Forecasting and Social Change	5	2	INNOV
Journal of Business Research	4	2	MKG
IEEE Transactions on Engineering Management	1	2	MIS
Journal of Strategy and Management	1	2	STRAT
Business Strategy and the Environment	7	3	STRAT
International Journal of Information Management	3	3	MIS
Corporate Social Responsibility and Environmental Management	1	3	GEN MAN
Futures	1	3	INNOV
Information Systems Frontiers	1	3	MIS
The International Journal of Logistics Management	1	3	LOG

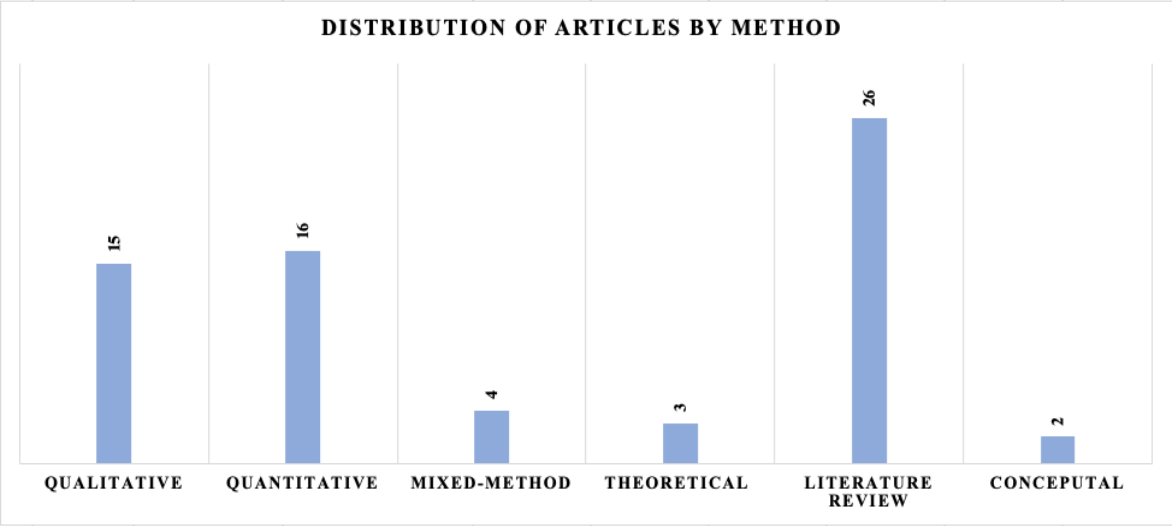
Source: author's elaboration

4.3 CLASSIFICATION OF ARTICLES BY METHOD

In terms of the research design, Figure 3 allows us to detail the different methods adopted by our sample. In this sense, we note that 39% of the selected articles represent literature reviews and 53% of them are empirical articles. This shows that there is a willingness by researchers to not only understand the link between digitalization and sustainable development at the theoretical level but also strive to deliver pragmatic research at the empirical level. Besides, only 3% of the articles correspond to conceptual articles. This proves the theoretical gaps in the definition of the link between digitalization and sustainable development.

More specifically and concerning the empirical articles, 15 articles adopt a qualitative method, 16 articles have a quantitative approach and 4 articles adopt a mixed method. In the 15 papers employing a qualitative method, multiple case studies are the dominant research approaches, stating that there is only one comparative study.

Figure 3. Distribution of articles by method



Source: author's elaboration

4.4 WORD CLOUD

In order to carry out a more in-depth analysis of the selected references, and after having proceeded to a complete reading of the 66 articles, we used the NVivo software, by importing the research library from Zotero. A set of queries was carried out and allowed us to bring out the cloud of 50 of the most quoted words in the articles as well as the main approached themes. The word cloud (Figure 4) obtained allows us to observe that the most frequent words are: digitalization, technologies, data, innovators, digital, sustainability, future, transformation, change, strategy, etc.

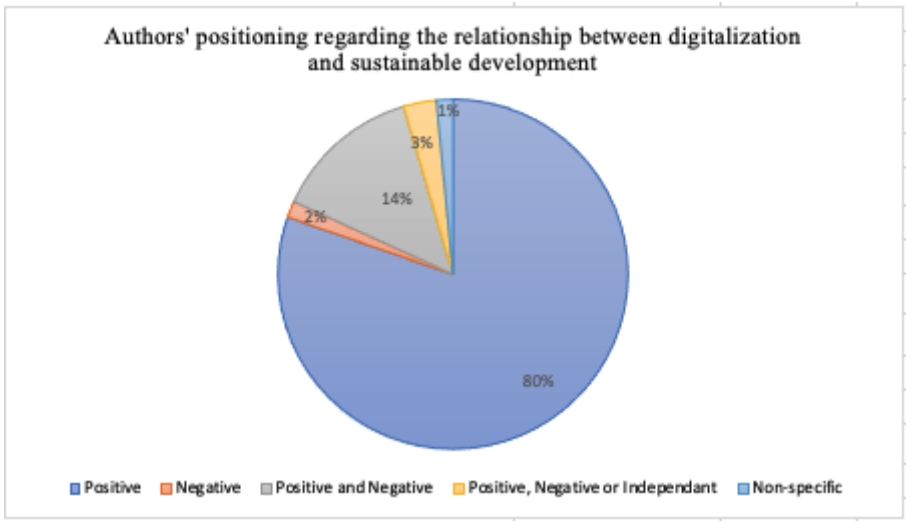
Figure 4. word cloud of the articles

Source: author's elaboration

4.5 AUTHORS' POSITIONING

The in-depth examination of the selected papers enabled us to highlight the authors' positioning regarding the relationship between digitalization and sustainable development. Nevertheless, it appears that a positive perception bias exists. This is demonstrated in figure 5 below.

Figure 5. Authors' positioning regarding the relationship between digitalization and sustainable development



Source: author's elaboration

In short, 80% of the articles consider the relationship between the two concepts as positive. Some authors refer to digitalization as an enabler of sustainable development (Feroz, Zo & Chiravuri, 2021), or sustainable development as a driver of digitalization (Denicolai, Zucchella & Magnani, 2021), while other authors consider the relationship between the two concepts as a mutually beneficial relationship (Evangelista & Hallikas, 2022). Conversely, only 2% of the articles focus on the negative impact of digitalization on sustainable development and therefore point out that digitalization represents a risk for sustainable development (Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade, 2022). Moreover, 14% of the papers defend the existence of both types of relationship, i.e., both a positive and a negative relationship (Bohnsack, Bidmon & Pinkse, 2022; Gupta, Motlagh & Rhyner, 2020). In this respect, the authors explain the importance of reducing and minimizing the negative impact of digitalization on sustainable development, against capitalizing on and maximizing its positive impact. Besides, only 3% of the articles take into consideration not only the negative and positive relationship but also discuss the possibility of independence between digitalization and sustainable development (Brenner & Hartl, 2021). Thus, there is no link between the two concepts. Finally, we note that only one of the selected papers does not explain clearly its perception of this relationship. The authors focus, instead, on the negative impact of the duality of digitalization and sustainability as two strategies on a firm's performance (Ardito, Raby, Albino & Bertoldi, 2021).

5. RESULTS

Two imperatives among others drive existing policy and managerial agendas today, which are digitalization and sustainable development (Brenner & Hartl, 2021). Many authors shed light on the theoretical gap relating both of these concepts as well as their relationship and have called for further research (Gomez-Trujillo & Gonzalez-Perez, 2021). In fact, many more

efforts are required to narrow this knowledge gap (El Hilali, El Manouar & Idrissi, 2020). That's why, through this section, we carry out the analysis of the articles selected, in order to understand the nature of the relationship between digitalization and sustainable development at a firm level. This study unveils four main types of relationships that will be explained below.

5.1 POSITIVE RELATIONSHIP BETWEEN DIGITALIZATION AND SUSTAINABLE DEVELOPMENT

A majority of scholars claim in the literature that a favorable perception appears to exist in managerial decision-making regarding digitalization and sustainability (Brenner & Hartl, 2021). A positive relationship between the two concepts is strongly supported. Therefore, it is regarded differently by various authors, as we will discuss further.

5.1.1 Positive impact of digitalization on sustainability challenges

First of all, by looking into the literature, we notice that digitalization is regarded mostly as a key enabler of sustainability. It is a driver and a precursor to sustainable development (Gomez-Trujillo & Gonzalez-Perez, 2021). Isensee, Teuteberg, Griese & Topi (2020) propose the term digitalization for sustainability, to describe this outlook. In this sense, digital technologies development is appropriate for solving sustainability's grand challenges (Popkova, De Bernardi, Tyurina & Sergi, 2022), such as resources scarcity, poverty, and inequality (Rosário & Dias, 2022; Maffezzoli, Ardolino, Bacchetti, Perona & Renga, 2022). This assumption was argued and adopted by various scholars. Hence, there is clearly an optimistic mindset toward the benefits that digitalization brings to sustainable development (Guandalini, 2022). More specifically, Gregori & Holzmann (2020) state that digital technologies permit the creation of value propositions combining economic, social, and environmental value. Similarly, Ghobakhloo (2020), presuming that industry 4.0 is an industrial digitalization, asserts that it

affects sustainable development in a favorable way and that technologies lead, as a result, to the attainment of sustainable development goals (SDG).

Authors shed light on the role of digitalization to solve environmental and social problems. In other words, they consider that digitalization has a beneficial impact on the environmental dimension of sustainable development (Niehoff & Beier, 2018). Voza, Szewieczek & Grabara (2022) affirm for example that it plays a crucial role in reducing carbon emissions and addressing the causes and impacts of climate change (Ågerfalk, Axelsson & Bergquist, 2022). They argue that while digitalization isn't explicitly addressed in any of the 17 Goals listed, it represents a method required to attain nearly all of them. Along the same line, Castro, Fernandez & Colsa (2021) state that digitalization is one of the most prominent transformations for sustainable development in addressing the SDGs. It is a tool for assisting environmental protection activities and achieving overarching sustainability objectives. Companies are currently launching new products based on digital technologies that are being used to improve environmental sustainability (Feroz, Zo & Chiravuri, 2021). For instance, they are changing the way environmental sustainability problems are measured and managed. Moreover, Akbari & Hopkins (2022), sharing the same point of view as well, believe that the adoption of I4.0 technologies, i.e., digital technologies, has significant potential to support digitalization, leading to sustainability gains. Actually, Gupta, Motlagh & Rhyner (2020) divided digital technologies into three categories based on their relevance at the SDG indicator level. The first category includes data-driven technologies, such as mobile internet technology, blockchain, and IoT. The analytics-driven technologies, such as big data, cloud computing, and AI, are the second kind. Finally, the third category includes design-driven technologies like virtual/augmented reality, adaptive manufacturing, and 3D printing. On top of that, mission-driven firms believe that the innovative application of digital technologies will alleviate some

of our time's most difficult problems, namely climate change (George & SCHILLEBEECKX, 2021).

Besides, scholars point out the positive effects of digitalization on not only environmental and social sustainability but also economic sustainability (Gregori & Holzmann, 2020). In fact, deploying disruptive technologies has a number of advantages, notably productivity increases and resource usage (Dwivedi & Paul, 2022). It contributes to cost reduction and increased efficiency, particularly resource efficiency (Antikainen, Uusitalo & Kivikytö-Reponen, 2018; Brenner & Hartl, 2021). Thus, firms in globally competitive marketplaces are increasingly keen to embrace and sustain digitized processes, such as digital supply chains (Dwivedi & Paul, 2022). In addition, Evangelista & Hallikas (2022) judge that digital technologies that promote sustainability practices, improve performance levels. Besides, digitalization has the potential to accelerate the transformation towards a more sustainable circular economy (Antikainen, Uusitalo & Kivikytö-Reponen, 2018). It contributes to closing the material loops by giving precise information on product availability, condition, and location. In short, digitalization also enables more efficient business processes, minimizes waste, enhances product longevity, and lowers transaction costs (Antikainen, Uusitalo & Kivikytö-Reponen, 2018; Demartini, Evans & Tonelli, 2019).

5.1.2 Digitalization and sustainable business models

Authors direct their attention to the importance of digitalization in the development of a sustainable business model (SBM). In fact, from the beginning of this digital era, the multiplicity of business models and the necessity to build sustainable ones have grown more than ever (Hajiheydari, Shouraki, Vares & Mohammadian, 2022).

In this context, business models are viewed as a critical component in allowing sustainable industry through digitalization (Parida, Sjödin & Reim, 2019). Some authors focus on the role of AI, as a digital technology, in the development of SBMs (Di Vaio, Palladino, Hassan & Escobar, 2020). Moreover, sustainable business models supported by digital technologies seek to increase environmental and social value (Bähr & Fliaster, 2022). Besides, technologies play a significant role in the circular economy transformation (Oyinlola, Schröder, Whitehead, Kolade, Wakunuma, Sharifi, ... & Abolfathi, 2022). Likewise, using various digital technologies such as AI and big data might disrupt linear traditional business models since they allow mass personalization, permitting organizations to select sustainable inputs to meet clients' needs (Chauhan, Parida & Dhir, 2022). It is also worth noting that according to Acciarini, Borelli, Capo, Cappa & Sarrocco (2021), innovative and sustainable business models generate advantages not only for firms but also for customers and society. In fact, sustainable business model elements have new configurations due to digital technologies: *"a blended value proposition, integrative value creation, and multidimensional value capture"* (Gregori & Holzmann, 2020). Therefore, organizations should consider the opportunities that digital transformation provides to firms concerning sustainable development (El Hilali, El Manouar & Idrissi, 2020).

In a different mindset, some authors assess that another scenario is emerging. In this sense, Denicolai, Zucchella & Magnani (2021) consider sustainability as a 'meta-driver' enabling growth paths, specifically in SMEs, like digitalization.

In addition to what we have outlined before, other authors regard digitalization as an integral aspect of sustainable development due to their mutual interaction (Evangelista & Hallikas, 2022). In fact, the authors state that economic sustainability is usually the outcome of digitalization, allowing the implementation of sustainable digital-related initiatives. Moreover,

Acciarini, C., Borelli, Capo, Cappa & Sarrocco (2021) affirm that the two phenomenons are interconnected, and hence digitalization supports sustainability and vice versa.

Given the above, according to the majority of researchers, digital technologies are considered a viable resource for achieving sustainable objectives (Nambisan, Wright & Feldman, 2019) and critical tools for alleviating and counteracting today's most pressing environmental and social issues (Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade, 2022). In light of this, we conclude that the ability to exploit digital technologies is a crucial determinant of success in achieving sustainable development (Hajiheydari, Shouraki, Vares & Mohammadian, 2022). In this vein, we notice that a new term has been developed in the literature to describe how digitalization contributes positively to sustainable development, which is digital sustainability. This latter is defined as the application of digital technologies for new business models, enabling the creation of environmental and social value (George, Merrill & Schillebeeckx, 2021; Gregori & Holzmann, 2020). Similarly, digital sustainability represents the organizational practices striving to achieve sustainable development objectives via the use of technologies that create, utilize, transfer or receive digital data (George, Merrill & Schillebeeckx, 2021). The main objective of these organizational activities is to create sustainable socio-ecological value as part of an economic value proposition. In other words, it refers to an organization's broad vision regarding the way it reaches increased sustainability using digital technologies (Wut, Lee, Ip & Lee, 2021).

5.2 NEGATIVE RELATIONSHIP BETWEEN DIGITALIZATION AND SUSTAINABLE DEVELOPMENT

On the contrary, Guandalini (2022) criticizes the definition of digital sustainability, stating that a positive relationship between sustainability and digitalization is not certain. While the opportunities offered by digitalization to sustainability are being pointed out by many researchers, it is imperative to be aware that digitalization can be a disruptive force if

unplanned, unmanaged, or underrated and can have a negative impact on sustainability and its development (Ghobakhloo, 2020). In addition, Di Vaio, Palladino, Hassan & Escobar (2020) use the example of IA, as a digital technology and state that it might also have negative impacts, since some of its features, if not managed, inhibit the fulfillment of various goals.

In this sense, some authors devote their research to criticize digital technologies for having negative effects on the environment (Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade, 2022). These outcomes include for example high energy use, greenhouse gas emissions, and harmful destruction of IS/IT systems (Murugesan, 2008). Besides, the management of e-waste during recycling has been recognized as unfriendly to the environment.

Furthermore, the influence of digitalization on the societal level is being criticized as well. In fact, it is redefining the labor-technology interaction, raising worries about the future of employment, practices, and the ethical adoption of digital technologies (Orbik & Zozuľaková, 2019). Accordingly, Corporate Digital Responsibility (CDR) is emerging as the new direction shift, integrating ethical issues at the organizational, individual, and societal levels to ensure responsible transformations for a digitalized workforce.

To sum up, Castro, Fernandez & Colsa (2021) believe that digitalization raises numerous unknown problems and its capacity to support sustainable development is still debatable. In fact, there are significant uncertainties regarding the relationship between digital technologies and corporate sustainability (Jones, Wynn, Hillier & Comfort, 2017). Digitalization may lead to unexpected unsustainable environmental or social consequences (Van der Velden, 2018), like natural ecosystems destruction, higher carbon dioxide emissions (Acciarini, Borelli, Capo, Cappa & Sarrocco, 2021) or workforce replacement (Lichtenthaler, 2021). These consequences, positive or negative, depend not only on how digitalization is shaped (Niehoff, 2022), but also on its form (Bohnsack, Bidmon, & Pinkse, 2022). In fact, the authors claim that

a sustainable value can't be created by all forms of digitalization. Some of them increase consumption and disparities while aggravating growth trends and pushing the planet's boundaries even further. Therefore, Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade (2022) highlight the urgent need for a more complete and balanced point of view on the opportunities of technology-based solutions, where the negative impact is exposed. As a result, a stronger focus on responsible digitalization must be the appropriate path to achieve a sustainable transition.

5.3 Positive and negative relationship between digitalization and sustainable development

Although it is commonly acknowledged that technology is a crucial and integral component of the solution, industry, and society at large perceive it as part of the issue at the same time (Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade, 2022). It is considered a double-edged sword for sustainable development (Bohnsack, Bidmon & Pinkse, 2022). In fact, while digitalization helps companies attain their financial goals, for instance, it also has a negative effect on the environment and aggravates social differences (Gupta, Motlagh & Rhyner, 2020).

Moreover, studies are increasingly emphasizing the significance of responsible digitalization in order to avoid considerable amounts of electronic waste (Dwivedi, Hughes, Kar, Baabdullah, Grover, Abbas, ... & Wade, 2022). Responsible digitalization is described as a business's ability to embrace digital technologies while maintaining the achievement of sustainable development goals (Cardinali & De Giovanni, 2022). In other words, authors argue that it is critical to reduce and minimize digitalization's negative influence on sustainable development while exploiting and optimizing its beneficial impact. Indeed, it is necessary to counter the negative impact caused by digitalization in order to achieve a positive net impact (Lichtenthaler, 2021), which

can be accomplished by merging sustainable development with digitalization (Gupta, Motlagh & Rhyner, 2020).

Within this regard, Tiron-Tudor, Kolisnyk & Savrina (2021) postulate that although digitalization is seen as an effective instrument for supporting sustainability, it contributes to firms' development only if its process is sustainable. In this sense, the operationalization of digital technologies should be shaped in a sustainable and beneficial way from not only technical but also social perspectives (Gupta, Motlagh & Rhyner, 2020). Therefore, the truth is that technology is an essential element to achieve sustainable development goals, yet, its deployment necessitates realistic decisions as we move from present behaviors to a more environmentally friendly society.

5.4 INDEPENDENT RELATIONSHIP BETWEEN DIGITALIZATION AND SUSTAINABLE DEVELOPMENT

Despite what has been said, some authors state that the two concepts are unrelated. In fact, regardless of the divergence of sustainability efforts, in several organizations, they are unlinked to digitalization activities initiated by the same organization (Castro, Fernandez & Colsa, 2021). George, Merrill & Schillebeeckx (2021) find this independence of digitalization and sustainability striking, especially given that both concepts require significant change and transformation in firms. Moreover, firms' sustainable development reports, which use non-digital measures exclusively, highlight the small interdependencies of managing digitalization and sustainability (Lichtenthaler, 2021). Projects and initiatives are implemented in isolation without taking into account the possible positive and negative interrelations (George, Merrill & Schillebeeckx, 2021; Stuermer, Abu-Tayeh & Myrach, 2017). Denicolai, Zucchella & Magnani (2021), taking the example of international SMEs, state that these companies find it challenging to follow both pathways jointly. In fact, due to a lack of resources, these businesses attain

international performance by focusing on either digitalization or sustainability, rather than both at the same time.

In the same vein and to describe the relationship between digitalization and sustainability, Brenner & Hartl (2021), cite the existence of a possible independent relationship between the two concepts. They find that the concepts are considered as two distinct trends with distinct issues that should be addressed separately. In addition, we note that, in the literature, a framework was developed based on the concept of "*digiainability",* integrating digitalization and sustainability as two development dimensions, which aims to resolve this controversial relationship (Lichtenthaler, 2021). Noting that digitainability is a recent concept proposed by Gupta, Motlagh & Rhyner (2020) and defined as *"the cross-fertilization between the processes of digitalization and sustainable development"*. As part of this framework, Lichtenthaler (2021) exposes that digitalization and sustainability are separate elements, which can be completely independent as well. Furthermore, firms have the option to focus on either sustainability or digitalization, as they can focus on both or neither.

6. DISCUSSION AND CONCLUSION

Besides the individual importance of digitalization and sustainable development, that will most certainly keep expanding, their relationship will very surely become more significant as well, as it needs in-depth understanding. In fact, we notice, through this systematic literature review, that the transition to a more sustainable environment, as well as the role of digital technologies in this regard, is far from certain and involves complicated interdependencies. Therefore, different types of relationships between sustainable development and digitalization are highlighted as results of our study: positive, negative, positive and negative, independent.

Yet, because of its strictly theoretical character, this systematic literature review has many limitations, which help us to propose a guideline for future research. First of all, this review

aims to explore and to understand the nature of the relationship between digitalization and sustainable development based on academic articles. However, an in-depth study on how various actors within firms perceive this relationship is lacking. Consequently, an empirical study that emphasizes the perception of these actors may be relevant and could add an important value to the existing literature.

Further, it must be noted that a general conclusion, stating that digitalization is considered as an opportunity for sustainability (Feroz, Zo & Chiravuri, 2021; El Hilali, El Manouar & Idrissi, 2020), is adopted by the majority of researchers. We observe that almost all articles reflect a positive perception regarding the relationship between digitalization and sustainable development and that the independent relationship between the two concepts is little studied. This allows us to assert that future studies are needed to further understand this independent relationship.

Moreover, we believe that there is a need for more comparative studies to supplement current empirical research, offering a better comprehension of the relationship and potential synergy between digitalization and sustainable development. In addition, because digital and sustainable transformations might occur at distinct speeds, longitudinal studies are required in order to analyze the dynamics of the convergence between them in the firms.

Furthermore, the articles used in the analysis were exclusively from peer-reviewed journals. While this ensures quality control of the sources, however, it could be beneficial to enrich the analysis by adding the grey literature as well, like blog articles and reports.

Additionally, the way the studied relationship is framed by firms and which factors influence it, need further discussion. According to the literature, attitudes towards the interaction between the two growth paths, sustainable development, and digitalization, can vary depending for

example on the technology used (Bohnsack, Bidmon & Pinkse, 2022), the maturity level of digitalization (Ghobakhloo, 2020), the network of stakeholders (Acciarini, Borelli, Capo, Cappa & Sarrocco, 2021), the company's size (Denicolai, Zucchella & Magnani, 2021), etc.

Finally, we note that future academic studies on the way businesses as a whole, involving stakeholders and functions, may make use of synergies in digitalization processes to meet sustainable development goals, should be taken into consideration. This will provide a significant chance to address the lack of studies focused on strategy and management.

It is worth noting that this article contains a few inputs. First of all, it enhances our understanding and summarizes, briefly, existing studies defining the concepts of digitalization and sustainable development independently. Second, it enriches the literature by examining and presenting a detailed overview of the intersection of these notions, highlighting various terms in the literature that combine them. On one hand, scholars working on this crucial topic will benefit from this systematic analysis. On the other hand, this contribution is also valuable to managers who are dealing with both sustainability and digital transformations and are attempting to capitalize on the interconnections that exist between them. Finally, the debate and delivery of clear and practical research avenues and ideas is our third contribution.

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