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An Empirical Framework for Assessment of the Effects of Digital Technologies on Sustainability Accounting and Reporting in the European Union

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Abstract: Sustainability accounting and reporting is an emerging area of accounting that is receiving increasing attention as a result of sustainability requirements. In this paper, we examine the effects of implementing digital technology on sustainability accounting and reporting. This research consists of an empirical study at the level of 21 European Union countries using data provided by Eurostat. Transversal research emphasizes the impact of digital technologies (cloud computing, Big Data, the Internet of things, and artificial intelligence) on sustainability accounting and reporting. In this paper, we highlight the relationships between variables using artificial neural network analysis and cluster analysis. The study findings indicate that digital technologies significantly influence the sustainability accounting and reporting and sustainability-oriented culture of the countries included in the empirical study. A cluster analysis reveals a group of countries at the top of the sustainability reporting rankings as a result of advances in digital technologies. This study demonstrates that the digital transformation produced by Industry 4.0 contributes to the potential improvement of sustainability accounting and reporting, with significant links between sustainability and digitization.

Keywords: digital technologies; cloud computing; Big Data; Internet of Things; artificial intelligence; sustainability accounting; sustainability reporting

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1. Introduction

Sustainability and digitization have attracted special attention recently, as the main drivers of economic and social transformation. Sustainability represents the policy of an organization, country, or supranational body (such as the European Union or the United Nations) that involves a radical transformation of the economy and all human activities on with the goal of a sustainable society [1–8]. Therefore, using different approaches, organizations increasingly incorporate social and environmental variables [3] into financial and managerial accounting. Sustainability accounting and reporting (SAR) has received increasing attention in accounting research [6–10] based on the requirements of regulations that will be introduced in the future [11]. George et al. [12] showed that digital sustainability represents an organization's actions that promote sustainability objectives by implementing digital technologies.

Whereas financial accounting is an old research field and is relatively rigid, owing to international standards and national regulations, SAR is a relatively new field emerging from managerial accounting that considers the environmental and social dimensions of sustainability instead of only the financial dimension [13]. SAR has two essential branches [3]: environmental accounting, which incorporates indicators regarding energy, water, waste, emissions, and carbon footprint, and social accounting, which incorporates indicators regarding other issues of stakeholder interest, apart from financial and environmental concerns [14]. Industry 4.0 has generated a digital transformation of the economy, creating a digital environment through the developed and implemented technologies, enabling the collection and processing of a massive amount of data with speed never experienced in the past [15]. Digitization of operations through new technologies can provide more and faster data for accounting information systems, both regarding traditional financial indicators and other social and environmental sustainability indicators [16]. The fourth industrial revolution brought with it new digital technologies, such as cloud computing (CC), Big Data (BD), the Internet of things (IoT), and artificial intelligence (AI). New digital technologies have generated an environment that facilitates the achievement of sustainability goals.

The relationship between digital technologies and sustainability has been studied in the literature [17,18], with few researchers addressing the role of digital technologies in SAR [3,4,19]. For example, Burritt and Christ [4] highlighted the potential of digital technologies in environmental accounting, whereas Tiwari and Khan [19] showed that there is little empirical evidence of new digital technology adoption, owing to the novelty of their use in accounting. Further investigation is needed to support the role of accounting in implementing sustainability.

In this paper, we address the identified need to establish the relationships between digital technologies and sustainability accounting and reporting by presenting an exploratory investigation across 21 European Union countries. In this study, we investigate the relationships between the degree of new digital technology implementation (CC, BD, IoT, and AI) and the index of sustainability reporting calculated for each country by KPMG [20]. The research strategy involved formulating two research questions according to the research goal: RQ1: To what extent does the degree of new digital technology implementation influence the sustainability reporting index at the level of the selected European Union countries? RQ2: Can the European Union countries selected included in the study be grouped into homogeneous clusters according to the degree of new digital technology implementation and sustainability reporting performance? We addressed these research questions through different research methods. To answer RQ1, we used artificial neural network analysis, whereas to answer RQ2, we used cluster analysis.

The structure of the paper is as follows. In Section 2, we present a literature review on the role of digital technologies in SAR. In Section 3, we set out the research design, variables, and methods used, and in Section 4, we present the research findings. Finally, the last two sections, we present the discussion, theoretical and practical implications, conclusions, limitations, and directions for further research.

2. Literature Review

2.1. Sustainability Accounting and Reporting

Sustainability a current paradigm of the business environment in the 21st century [21], with managers' decisions sweeping between social and environmental concerns and obtaining the best possible economic performances [22]. In the 1970s, the first wave of organizational sustainability manifested through social reports disclosed by organizations in developed countries [23]. Toward the end of the 1980s, increasing environmental problems emerged in the economy, with environmental reporting becoming increasingly popular among companies [24]. Since the 1990s, owing to increased attention on social and environmental issues, SAR, especially sustainability reporting, has become a frequently encountered research topic in the managerial and accounting literature [9,10,13,14,19,21,23]. The pursuit of objectives not related to maximizing profits or the share value determines a need to monitor and measure the indicators illustrating social and environmental drivers [21]. Measuring social and environmental impact makes traditional financial reporting no longer suitable for reporting organizations in the 21st century [25–29].

Tiwari and Khan [19] (p. 1) define SAR as a "framework for defining and implementing techniques for measuring and reporting the current state of variables in public reports by a company". SAR is based on a framework derived from the triple bottom line model (with economic, social, and environmental drivers). Because financial and managerial accounting mainly provide financial information describing the economic vector, SAR requires operational information to report social and environmental problems. The pragmatic approach of SAR places emphasis on the search for improved management accounting methods and processes to increase sustainability performance [30,31].

Several authors [3,23,24,32–35] claim that external sustainability reporting is more concerned with cosmeticizing reality to present a good image and increase the organization's reputation. As a result, SAR did not have a spectacular evolution because organizations were more concerned with the exposure of a sustainable organizational image and not sustainable development based on clear and correct records of social and environmental measures [34].

Two critical factors appear in the analysis of the sustainability reporting process: the level of formalization of reporting procedures and the level of integration in managerial accounting and operational management of sustainability practices [3]. Sustainability practices must be integrated into current activities and correlated with the accounting information system that provides data for sustainability reporting. In addition, sustainability practices must be instilled in all organizational processes [27,30,36].

Although sustainability accounting and sustainability reporting are two distinct concepts, together, they can be combined in a tool to ensure the recording and disclosure of the company's sustainable developments [37,38]. A sustainability report completes the accounting process by disclosing information on the organization's sustainability [39]. The concept of sustainability accounting involves the treatment of corporate business transactions (considering economic, environmental, and social factors). Sustainability reporting involves disclosing results through sustainability reports [40] and providing information to stakeholders through financial and non-financial reporting [41].

In the sustainability literature, there is unanimous agreement regarding the importance of sustainability reporting, but a gap can also be noted regarding the existence of accounting standards to regulate sustainability accounting [42–44]. As a result of a multitude of complex and confusing terminologies and the lack of an easy-to-implement standard recognized by most organizations, SAR is approached in multiple ways within organizations in a non-homogeneous manner [45].

Burritt and Christ [4] highlighted the need for a more efficient technology that provides the quality raw material for an accounting and managerial information system in the context of sustainability orientation. In addition, implementing digital technologies has made it possible to collect and quickly process the data needed for SAR. Therefore, digital technologies are of crucial importance for an alignment of SAR with the sustainable development of organizations [3].

The aim of this research was to highlight the impact of new digital technology implementation on sustainability reporting through the introduced paradigm shift. The originality of the present study emerges from addressing the research gap with respect to the relationship between digital transformation and sustainability accounting and reporting. The following first research hypothesis was formulated based on the identified gap and the first research question (RQ1):

Hypothesis H1. *The degree of new digital technology implementation significantly influences the sustainability reporting index at the level of the European Union countries included in the study.*

2.2. Relationships between Digital Transformation and Sustainability Accounting and Reporting

Optimal decisions toward sustainable development require correct, relevant, objective, and fast information that SAR can provide with innovations generated by implemented new digital technologies [46–48]. New digital technologies have transformed accounting in general and SAR in particular. New digital technologies upgraded the IT solutions and have already become standard tools in accounting. These digital technologies either optimize existing IT solutions (BD and AI) or introduce new features such as accessibility and interactivity (CC) or the possibility of real-time data collection and transmission (IoT). In addition to the large amount of data collected and processed in real time, the characteristics of accessibility and transparency have significantly contributed to the development of sustainability reporting [49]. IoT and CC facilitate the collection of accounting data shared through CC and processed by software solutions that integrate BD and AI. AI uses robotic process automation and machine learning to generate accounting information relevant to the three drivers of sustainability (economic, social, and environmental). AI technology supports sustainable strategy development and strategic decisions [50], allowing accountants to focus on activities with high added value [51]. Reducing operating costs and the time it takes to obtain the information required for sustainability reporting increases the efficiency and effectiveness of sustainability reporting activities.

CC offers storage capabilities, real-time transmission of data and information, and customized accessibility as a technological resource based on the Internet [49,52,53]. As a result, CC is useful in both internal sustainability accounting and external sustainability reporting activities. With the help of CC, sustainability accounting achieves the storage and management of a large volume of data, sharing these data with internal and external stakeholders, significantly contributing to the improvement of sustainability reporting [54,55]. The disadvantages of CC are the need for a strong Internet connection, the lack of standardization, and high costs of ensuring information security and data privacy [55–57]. Nevertheless, CC plays a vital role in optimizing accounting and management information systems by improving the collection, management, processing, and transmission of data and information [58,59]. One of the most widely used organizational resource management systems using CC technology is enterprise resource planning (ERP). Integrating other technologies (BD, Ai, and IoT) to enhance ERP can provide financial and non-financial information that addresses social and environmental drivers. CC enables organizations to manage large amounts of data (BD) without the need for expensive server investments and to manage organizational sustainability information in an integrated manner. Internal uses (accountants, managers, and other employees), as well as external uses (customers and other stakeholders), make CC a digital technology that will have a significant impact on SAR [60].

AI enables a deep analysis of accounting data with predictive implications and enables it to make strategic decisions with respect to organizational sustainability [49]. Therefore, implementing sustainable policies by analyzing a large amount of data (AI is usually associated with BD) can be based on the results of IT solutions that integrate AI and BD.

BD is an essential technology for accounting and management information systems. The large amount of data provided by BD is necessary for AI decision making [61]. Additionally, the large amount of data is essential in improving sustainability reporting, providing stakeholders with the necessary information. Warren et al. [62] showed that video, audio, images, and text files provided by Big Data could be a valuable supplement for accounting records, especially in reflecting social and environmental drivers. CC and BD allow stakeholders to explore sustainability information in real time, contributing to the efficiency of sustainability reporting.

IoT is a technology that relies on sensors embedded in various assets that collect, manage, process, and transmit data, thereby communicating with other IoT devices. Data generated by the IoT, transmitted via CC technology, and supported by BD technology, owing to their large quantity and volume, are essential for accounting information systems [63–65]. Various tools, including AI solutions, process data transmitted by the IoT in the cloud [65,66]. The implementation and improvement of the IoT are facilitated by the development other technologies such as BD and CC [64]. The implementation of IoT technology is hampered by challenges such as implementation costs, standardization, ensuring privacy, and interoperability [65,67].

IoT can dramatically change data collection for accounting information systems [49]. Brous et al. [67] suggested that IoT will positively impact information systems, increasing the ability to monitor organizational processes [68] and the amount of information available for sustainability reporting. The impact of IoT technology on SAR is significant, owing to the automation of the sustainability data collection process.

Guse and Mangiuc [69] showed that digital transformation can determine a reorganization of social contact between individuals and organizations, requiring a continuous process of development of the technical skills of all organizational stakeholders. The digital transformation of how the economy and society work will generate a repositioning of organizations in terms of social and environmental sustainability [55,70].

In the context of increasing demands for sustainability, digital transformation outlines a new vision for SAR, collecting, sharing, owning, using, and organizing information resources to ensure sustainable development [55,71]. Most SAR operations can be translated into a controlled and accessible digital environment from any location, and countries that promote digital transformation at the strategic level will experience a sustained pace of economic growth and sustainable development. The second research hypothesis was formulated based on this assumption and the second research question (RQ2), as follows:

Hypothesis H2. *The European Union countries with a high degree of digitization included in the study also have a strong culture of sustainability reporting.*

3. Materials and Methods

The research design involves an empirical study, starting with a literature review and formulating research hypotheses. In the empirical study, we used data from Eurostat [72–75] and the KPMG Sustainability Reporting Index report [20]. The last stages involve processing the data and testing the validity of the hypotheses, as well as presenting the results, discussion, and conclusions (Figure 1).

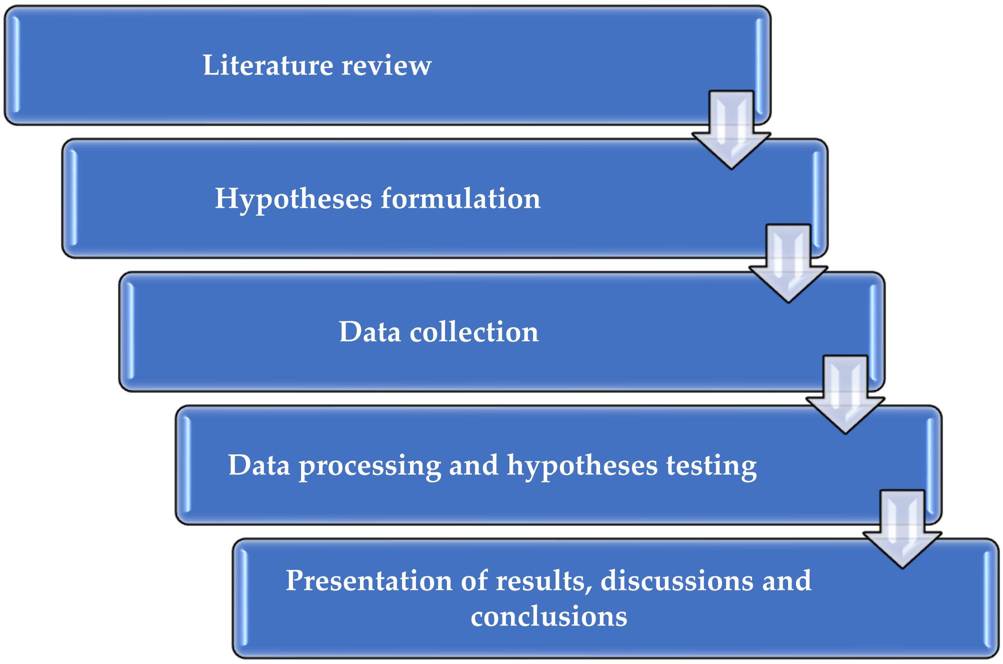

Figure 1. Research process. Source: own construction.

The research variables are the digital technologies (CC, BD, AI, and IoT) that significantly impact sustainability reporting and the sustainability reporting index. The year used for the dataset is 2020. For CC, the used data series represents the percentage of enterprises that use cloud computing services at the level of each European Union country included in the research [72]. BD presents the percentage of enterprises that analyze Big Data internally obtained from any source [73]. AI includes the percentage of businesses that use an artificial intelligence system [74]. The data series for IoT shows the percentage of enterprises using IoT [75]. The KPMG Sustainability Reporting Index report [20] provides the sustainability reporting index as a percentage of enterprise reporting, with the top 100 companies by revenue in each investigated country included in the sample.

Table 1 presents the variables, datasets, measures, and references for data sources.

Table 1. Research variables.

Variable	Dataset	Measure	Reference
CC	Buy cloud computing services used over the Internet	Percentage of enterprises	[72]
BD	Analyze big data internally from any data source	Percentage of enterprises	[73]
AI	Enterprises that use one AI system	Percentage of enterprises	[74]
IoT	Enterprises that use IoT	Percentage of enterprises	[75]
SRI	Sustainability reporting index	Percentage of enterprises reporting	[20]

Source: developed by the authors based on [20,72–75].

Table 2 presents the descriptive statistics of the selected data series for the research variables.

Table 2. Descriptive statistics.

Variable	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
CC	20	16	75	38.95	17.899	0.713	−0.739
BD	20	3	26	12.50	6.977	0.382	−1.155
AI	20	3	20	6.25	3.654	3.049	11.150
IoT	20	7	44	22.35	10.106	0.729	−0.242
SRI	20	23	98	77.35	17.349	−1.549	4.048

Source: developed by the authors using SPSS.

In the investigation, we tested Hypothesis H1 using a multilayer perceptron (MLP) from via artificial neural network analysis. The multilayer approach in MLP allows for the identification of relationships between variables in an input layer and variables in an output layer [76]. Artificial neural network analysis has been used by other authors [77–79] to evaluate the influence of independent variables on dependent variables and predict the evolution of these relationships. For hypothesis H2, we used cluster analysis, similar to the approaches adopted by other researchers [80,81]. In this research, we tested several methods of cluster analysis. The optimal approach was identified as the average linkage method, which avoids massive or compact clusters for the collected data [82].

4. Results

For the empirical investigation, we used the analysis of artificial neural networks to determine the influence of the degree of new digital technology implementation on the sustainability reporting index at the level of the European Union countries included in the study. The multilayer perceptron model includes a layer with the input variables (CC, BD, AI, and IoT) and a layer with the sustainability reporting index (SRI) as the output variable. The data series contain the values of the included variables recorded in the year 2020 for the selected European Union countries. The activation functions of the hidden layer (interposed between the input layer and the output layer) and the output layer are of sigmoid type. The hidden layer is the level of sustainability in the countries included in the research. The rescaling method used for the input layer variables was data standardization. Figure 2 illustrates the relationships between the variables.

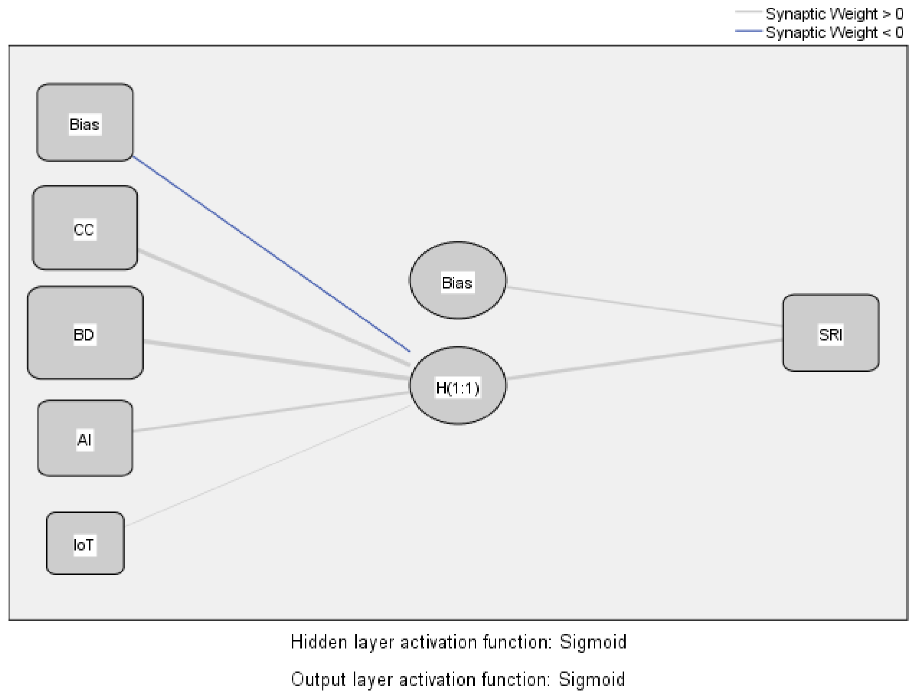

Figure 2. MLP model illustrating the influences of digital technologies on the sustainability reporting index. Source: own construction using SPSS v.20.

Table 3 contains the predictive values for the input and hidden-layer variables and their influences.

Table 3. Predictors of the MLP model.

Predictor		Predicted			
		Hidden Layer 1	Output Layer		
		H(1:1)	SRI	Importance	Normalized Importance
Input Layer	(Bias)	−0.256			
	CC	1.629		0.328	72.2%
	BD	2.530		0.455	100.0%
	AI	1.057		0.210	46.2%
	IoT	0.055		0.008	1.7%
Hidden Layer 1	(Bias)		0.494		
	H (1:1)		1.360		

Source: own construction using SPSS v.20.

Figure 2 and Table 3 reveal significant positive relationships between digital technologies (percentage of enterprises using digital technologies) and the sustainability reporting index (percentage of enterprises reporting). BD and CC exert the strongest positive influences on the hidden layer, significantly influencing the sustainability reporting index placed in the output layer. The biases acting on the hidden layer and the output layer are low compared to the influences of the main variables of the model. Investigation of hypothesis H1 led to its confirmation as valid. The degree of new digital technology implementation significantly influences the sustainability reporting index at the level of the European Union countries included in the study.

We used cluster analysis to group the European Union countries included in the study into homogeneous clusters according to the degree of new digital technology (CC, BD, AI, and IoT) implementation (percentage of enterprises using digital technologies) and the index of sustainability reporting (percentage of enterprises reporting). Table 4 shows the agglomeration schedule used in the cluster analysis.

Table 4. Agglomeration schedule.

Stage	Cluster Combined		Coefficients	Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	14	17	18.000	0	0	2
2	11	14	46.000	0	1	3
3	11	15	78.833	2	0	4
4	10	11	176.600	0	3	6
5	6	7	238.000	0	0	14
6	10	16	243.133	4	0	8
7	8	20	259.000	0	0	10
8	5	10	295.333	0	6	13
9	2	13	297.000	0	0	13
10	1	8	342.667	0	7	11
11	1	12	362.000	10	0	12
12	1	19	467.000	11	0	15
13	2	5	484.889	9	8	17
14	3	6	530.667	0	5	17
15	1	4	541.533	12	0	16
16	1	18	624.000	15	0	19
17	2	3	716.924	13	14	18
18	2	9	1126.744	17	0	19
19	1	2	1571.032	16	18	0

Source: own construction using SPSS v.20.

Figure 3 shows a dendrogram containing two homogeneous clusters. The only country that does not fall into one of the two clusters is Cyprus, which registers the lowest level of SRI (23%) among the countries included in the research—far from the next-ranked country, i.e., Greece (59%). Furthermore, the level of digital transformation in Cyprus is low (CC, 35%; BD, 3%; AI, 3%; and IoT, 20%).

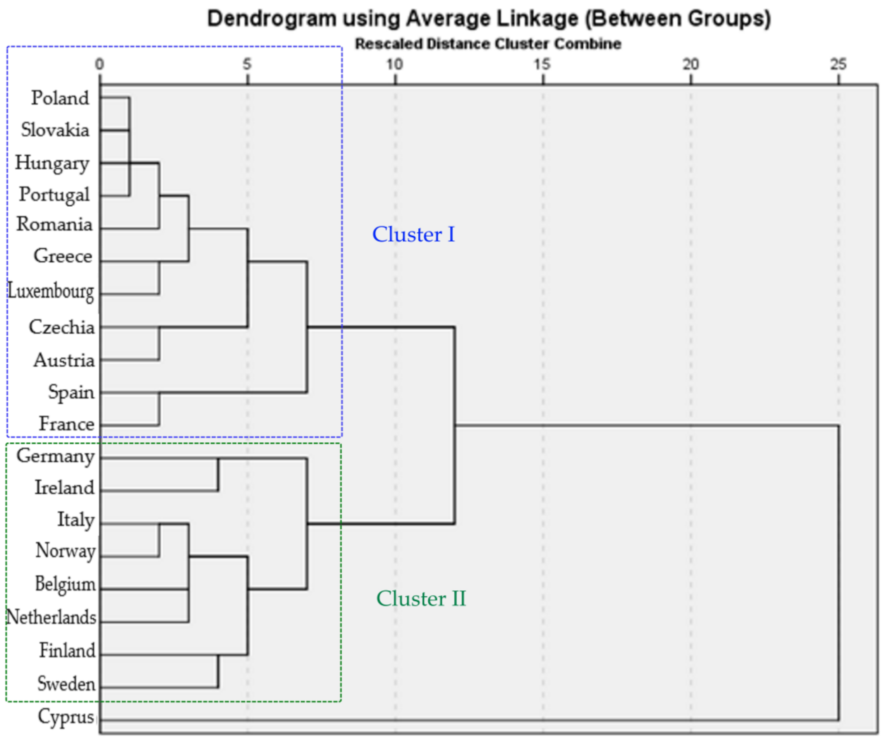

Figure 3. Dendrogram. Source: own construction using SPSS.

Table 5 includes countries in Cluster I with lower digitization rates (percentage of enterprises using digital technologies) and a lower level of SRI (percentage of enterprises reporting). The only two exceptions in this cluster are France and Spain, with very high SRI values but relatively modest values of the degree of new digital technology implementation compared to the countries in Cluster II.

Table 5. Cluster I.

Country	**CC (Percentage of Enterprises)**	**BD (Percentage of Enterprises)**	**AI (Percentage of Enterprises)**	**IoT (Percentage of Enterprises)**	**SRI (Percentage of Enterprises Reporting)**
Poland	24	8	4	17	77
Slovakia	26	5	6	17	76
Hungary	25	6	3	14	83
Portugal	29	10	8	13	72
Romania	16	4	5	7	66
Greece	17	12	5	22	59
Luxembourg	29	17	5	22	65
Czechia	29	9	6	44	66
Austria	38	7	4	32	74
Spain	26	6	7	16	98
France	27	20	5	10	97
Mean values of Cluster I	26.00	9.45	5.27	19.45	75.73
Mean values at UE level (20 countries)	38.95	12.50	6.25	22.35	77.35

Source: own construction using SPSS.

Cluster II includes countries with a high percentage of enterprises reporting and a high percentage of enterprises using digital technologies (Table 6).

Table 6. Cluster II.

Country	**CC (Percentage of Enterprises)**	**BD (Percentage of Enterprises)**	**AI (Percentage of Enterprises)**	**IoT (Percentage of Enterprises)**	**SRI (Percentage of Enterprises Reporting)**
Germany	33	17	6	36	92
Ireland	51	22	20	34	88
Italy	59	7	7	23	86
Norway	64	17	5	16	77
Belgium	53	22	5	27	72
Netherlands	53	26	4	17	88
Finland	75	19	10	40	90
Sweden	70	13	7	20	98
Mean values of Cluster II	57.25	17.88	8.00	26.63	86.38
Mean values at UE level (20 countries)	38.95	12.50	6.25	22.35	77.35

Source: own construction using SPSS.

The countries included in Cluster II are the Scandinavian countries (Sweden, Finland, and Norway) and two Benelux countries (Belgium and the Netherlands), joined by Germany, Italy, and Ireland. These countries are part of Western Europe and are developed countries with a strong culture of sustainability and a high level of digitization.

According to the cluster analysis, Hypothesis H2 is valid. The European Union countries included in this study can be grouped into homogeneous clusters depending on the degree of new digital technology implementation (percentage of enterprises using digital technologies) and the sustainability reporting index (percentage of enterprises reporting).

The analysis demonstrates that the European Union countries included in this study with a high degree of digitization also have a strong culture of sustainability reporting.

5. Discussions

Organizational sustainability concerns all activities that improve environmental, social, and economic drivers to determine an organization's sustainable development and to increase the contribution of the organization to the sustainability of society [48].

Although financial accounting is the result of a long evolution, acting as a mirror of the financial operations of organizations, SAR reflects the other drivers of sustainability (social and environmental) in the process of development [83]; digital technologies are vital for SAR advancements [3]. Based on the information provided, SAR can support the achievement of sustainable development objectives [84–86]. Sustainability accounting considers economic, environmental, and social factors to ensure sustainable development [44,87,88].

The data collected for sustainability accounting can have, first of all, external purposes related to the reporting of operations. Besides financial information, non-financial information presents indicators of an organization's sustainable development to external stakeholders [89]. The second purpose of sustainability accounting is internal, supporting decisions about the organization's strategic objective of sustainable development [80]. SAR allows organizations to assess their impact on the environment [89] and stakeholders other than shareholders or managers [90]. Burritt and Christ [4] showed that digital technologies can operationalize sustainability accounting and reporting tools and make them effective. In the present research, the investigation of hypothesis H1 led to the conclusion that the degree of new digital technology implementation (percentage of enterprises using digital technologies) significantly influences the sustainability reporting index (percentage of enterprises reporting) at the level of the European Union countries included in this study. Industry 4.0 can upgrade management accounting and extend it to better track and report social and environmental activities.

This aim of this study was to explore the relationships between the degree of new digital technology implementation (CC, BD, IoT, and AI) and the sustainability reporting index, responding to calls to emphasize the importance of digital technologies in sustainability reporting. Furthermore, we grouped countries into homogeneous clusters to provide countries with lower sustainability reporting with means and good practices to increase their sustainability reporting index. The analysis showed that European Union countries with a high degree of digitization also have a strong culture of sustainability reporting and digital transformation that offers them additional support to improve sustainability.

Schaltegger et al. [46] showed that measurement systems and accounting are essential for sustainability because only correct and transparent information from stakeholders can generate actions in favor of sustainability to reduce unwanted impacts on the environment and social aspects. However, because existing conventional accounting systems are overburdened, SAR must appeal to innovative approaches to accounting and reporting that involve improved efficiency and effectiveness of accounting and management information systems [48].

5.1. Empirical and Managerial Implications

The aim of this study was to enrich the research on SAR and investigate the contribution of digital transformation to the achievement of sustainability reporting at the level of 21 European Union countries. Recent studies have investigated the relationships between SAR and digital technologies [3,19], highlighting the importance of digitization to improving sustainability. However, there is a lack of empirical studies in the literature on the relationships and influences of digital transformation on sustainability reporting. This study provides insight into how the degree of new digital technology implementation (CC, BD, IoT, and AI) relates to the sustainability reporting index calculated by KPMG for each European Union country included in the study. Whereas digitization is implemented in manufacturing operations, providing financial and operational information on economic drivers, digital technology has limited use in providing real-time data to SAR. Countries with a high degree of digitization benefit from additional support to increase the sustainability reporting index.

Analysis of the digital transformation impact on sustainability reporting using artificial neural networks analysis provides an adequate assessment of the influences and predictors of the multilayer perceptron model. Cluster analysis delivered valuable results, grouping countries into homogeneous clusters and identifying countries with successful strategies in implementing digital technologies and reporting sustainability. These strategies can be adopted by countries that are less developed in these areas.

5.2. Theoretical Implications

Although the body of knowledge on sustainability accounting systems is vast [21,91,92], researchers emphasize the need to develop accounting and management information systems to systematically pursue the integration of sustainability into business strategy [93].

Digital transformation is an enabler of sustainability by increasing the efficiency and effectiveness of the physical production process through optimal and flexible use of digital data collected and processed through new digital technologies [16]. In addition, digital technologies provide the necessary information for organizational accounting and management information systems, allowing them to develop sustainably. Digital technologies have the potential to record the indicators of all economic, social, and environmental drivers. Moreover, by coupling digital technologies with sustainability principles, more information can be obtained faster and with higher quality. Because accounting information systems generate the information required for sustainability reporting, innovations are needed to overcome the deficiencies of conventional accounting approaches to responsibility drivers [46]. The purpose of innovations that could make sustainability accounting more effective is to develop and improve accounting methods and processes to better contribute to the organization's sustainable development [47,48]. Innovation is a critical organizational process for survival in a competitive and globalized market, through which it can mitigate the impact on the environment and social problems.

5.3. Limitations and Further Research

Give the exploratory nature of this study, a limitation of the research consists of the synthetic analysis at the macroeconomic level of the relationships between the degree of new digital technology implementation and the sustainability reporting index. Future research can consider other variables to provide a more analytical character to the research (e.g., variables regarding sustainability reporting for each driver and variables regarding other digital technologies). The geographical limitation (to only the 21 countries of the European Union for which KPMG calculates the sustainability reporting index) can be overcome by extending the research to other countries outside of Europe. This research can provide clues regarding the particularities of approaching the relationship between SAR and digital transformation in other models of society. A future research path could be a longitudinal approach analyzing the dynamic evolution of the researched phenomena over time, considering the static cross-sectional approach of this research. How sustainability reporting can help implement a strategic vision of sustainable development should be further investigated in other contexts. A future research direction could involve the development of guidelines for integration of new digital technologies within existing information systems, ensuring an improvement in accounting and sustainability reporting activities.

6. Conclusions

In this paper, we presented an exploratory study on the digitization of sustainability reporting at the level of 21 European Union countries. Organizations are increasingly aware of the need to carry out sustainable operations and show stakeholders that they are engaged in a sustainable development strategy. Sustainability accounting tools have become increasingly efficient and effective through digital technologies, providing the data needed for efficient and effective sustainability reporting. CC and BD paired with IoT sensors can also enhance sustainability reporting. Empirical studies show that most organizations consider SAR and digital transformation to be two separate phenomena. The aim of this paper was to cover this gap and demonstrate a close relationship between the two phenomena, ensuring symbiotic, integrative development in the future. Combining SAR and digitization is necessary for organizations to remain competitive.

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Conflicts of Interest: The authors declare no conflict of interest.

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