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Analysis of ICT Energy Efficiency Disclosure to Improve Business Management Practices and Its Contribution to the SDGs

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Abstract: Purpose: The new global approach to sustainability within the context of the SDGs is driving a digital transition. However, new technologies bring challenges related to the energy efficiency of their infrastructures. The aim of this exploratory work is to identify the companies with best practices in various aspects of the management, disclosure and verification of the energy efficiency of emerging technologies. Design/methodology/approach: Using a mixed qualitative and quantitative approach, the Non-Financial Information Statements of Spanish IBEX 35 companies are assessed. Findings: The results show that companies disclose non-financial information in relation to the materiality of energy efficiency and the actions implemented to improve it, but regulatory development is still required to ensure greater comparability of such information. Originality: To the best of our knowledge, this is the first study to analyse information on ICT energy sustainability in the context of Law 11/2008 in Spain, which also includes an analysis of information on the double materiality of risks and the policies and actions implemented by companies to manage them. Practical implications: Improving the information disclosed will increase its usefulness for the internal decision-making of companies, to improve ICT energy efficiency and SDG. Social implications: Improving the information disclosed will increase its usefulness for external decision-making by the different stakeholders, as regulators and other disclosing companies may take these selected companies as an example in each sector of activity.

Keywords: financial reporting; ICT; sustainability; energy efficiency; non-financial reporting

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1. Introduction

The use of information and communication technologies (ICT) by companies improves production and management processes (Zhou et al., 2022), as well as relations with stakeholders (Woźniak & Wereda, 2018). In the "third industrial revolution", the end of work is predicted (Rifkin, 1995). Thus, ICTs are increasingly present, both in business and personal activity, to the point of making them almost indispensable (Silverstone & Haddon, 1996; Abdul-Wakeel Karakara & Osabuohien, 2022).

However, the mass use of ICTs leads to an increase in the volume of data; this makes management more difficult and is becoming an increasingly complex task for companies (Caviglione et al., 2017). The key element to handling the massive volume of data will be the current fourth industrial revolution (Observatorio Nacional 5G, 2021). It promises to change the processes and means of production of companies through "artificial intelligence"

(AI), "Big Data", "the Cloud" or "blockchain", moving from the Internet of Information to the "Internet of Things" (IoT) (Joyanes, 2017; European Commission, 2018, 2021).

In the field of the preparation and verification of financial and non-financial information, advances in ICTs are moving towards the automation of tasks of little added value for organisations, thus reducing repetitive tasks and human error and providing greater quality to the documentation generated by the auditor in his/her working papers (Montoya Hernandez & Valencia Duque, 2020; Pérez, 2021). As times are moving in this direction, IT and auditing are complementing each other to improve the processes and management of all audit firms (Sian, 2022). Until recently, continued development and innovation in this area was the preserve of the Big Four, but the emergence of COVID-19 highlighted the need for a greater technological response (Farcane et al., 2023).

The "Communication on Progress 2022" report on sustainability identifies digitalisation, materiality, comparability and verification among the five key issues (Global Compact, 2023). But carbon footprint refers to the total greenhouse gases emitted by an individual, organisation, event or product (Belkhir & Elmeligi, 2018; BBVA, 2020), and the effects of ICT hardware itself on energy and climate are also coming under increasing scrutiny (Williams, 2011; European Parliament, 2021). In other words, the economy must be made "green" (European Parliament, 2007). Furthermore, according to the 2030 Agenda, organisations are expected to play an essential role in achieving the SDGs (Rosati & Faria, 2019). Thus, new challenges emerge from these ICTs, such as the need for the infrastructure that comes with this new era of digital economy to be sustainable, fair and transparent (Pastor, 2020).

Despite technological advances and their effect on the development of business activities, institutional theory emphasises the importance of social and cultural environments rather than technological dimensions (Benito et al., 2023). Following this framework, incorporating sustainable practices can serve as a strategy for addressing external pressures (Crane et al., 2008) and complying with legal requirements. Therefore, the aim of this paper is to identify their effects from the point of view of energy efficiency in the context of business sustainability and identify the companies that better manage and disclose it in diverse aspects. As secondary objectives, we aim to verify how many companies have cited the SDGs in their disclosures and how many have used the GRIs as a reference to elaborate their disclosures. Thus, identifying the companies that best manage and disseminate not only provides validity to institutional theory, but these actions serve as an example to other companies and other sectors. Indeed, various interest groups have recently called on the public sector to act in line with socially accountable criteria (Crane et al., 2008).

In this respect, as industrial development, and more specifically the use of more advanced technologies, has historically played a fundamental role in the environment, we analyse the information, paying special attention to the energy efficiency of ICTs. To this end, we review how IBEX 35 companies report on the materiality and risk associated with these technologies, as well as the policies adopted to mitigate this risk.

Following this introduction, Section 2 presents a literature review of academic and professional publications to put emerging technologies into context, and the impact they have, not only on corporate governance in general and the specific reporting process and auditing of accounts but also on corporate sustainability, with particular emphasis on energy efficiency. In addition, Law 11/2018 (2018) is reviewed in relation to the presentation of the Non-Financial Information Statement (NFIS) in Spain. Section 3 is devoted to the empirical study in which the qualitative and quantitative research methodology content analysis of the NFIS of IBEX 35 companies is used. The final section is devoted to the conclusions.

2. Background

2.1. ICT Opportunities and Challenges for Energy Sustainability

The Brundtland Report (United Nations, 1987) defined sustainability as the need to manage today's resources without compromising the needs of the future. Subsequently, the 2030 Agenda of 17 Sustainable Development Goals (SDGs) was adopted by the United Nations, which commits countries regardless of their level of development, and is defined as an objective "to establish a plan of action for people, planet and prosperity, which also intends to strengthen universal peace and access to justice" (United Nations, 2015). In addition, the European Commission is currently promoting the double transition to a green and digital economy (European Commission, 2020).

Among the SDGs, one of the targets of SDG 7 is to ensure access to affordable, reliable, sustainable and modern energy for all and double the global rate of improvement in energy efficiency by 2030 (United Nations, 2015). Furthermore, ICT is an essential element in addressing the challenge of lower energy consumption (Lu, 2018). In this regard, Directive 2019/944 defines energy efficiency as "the ratio between the output of a performance, service, good or energy and the expenditure of energy" and establishes the relationship between ICT and energy consumption (EU, 2019).

In general, information and communication technologies (ICTs) involve three main elements: hardware (computers, peripherals, etc.), software (computer programs) and communication networks (the Internet) (Vishwakarma et al., 2022). In addition, this framework generates other concepts such as IT security and the set of emerging technologies such as AI (artificial intelligence), Big Data, IoT (Internet of Things), and blockchain (Kim & Oh, 2022). Thus, the combination of these four ICTs may be the key to sustainable and digital development (Burmaoglu et al., 2019; Observatorio Nacional 5G, 2021). At the business level, the use of emerging technologies can help organisations better manage their resources for profit (Condom-Vilà, 2020). In particular, ICTs have enabled the evolution of the accounting information system and improved the collection, analysis and presentation of financial information, helping companies' decision-making (Bodnar & Hopwood, 2001).

However, while digitisation contributes to decarbonisation, the large amount of energy required to support the emerging technologies industry by manufacturing electronic devices, such as PCs, servers, cooling equipment, etc., as well as their use through telecommunication networks, means that they are not energy sustainable (Zeadally et al., 2012; Greenpeace, 2017; Kaur & Chana, 2015; Shi et al., 2022). The 24/7 consumption of servers, including their cooling systems, and the consumption of fossil materials for the manufacture of their components, makes it necessary to evaluate the efficiency of their consumption and is, therefore, a challenge for all organisations with data centres (Laurent et al., 2020). Another challenge faced is the high energy consumption of telecommunications networks, as the consumption of the 5G network accounts for 10% of global electricity and will increase due to future demands derived from AI, the Internet of Things and the so-called Industry 4.0 (Aretxabala, 2020). Consequently, companies must also take this into account in their strategic planning, consumption and the impact of their business activity on the environment. Thus, from the OUT–IN approach of dual materiality, technology has positive aspects for the improvement of data management and decision-making in companies, which will improve the profitability and financial position of these companies. But from an IN–OUT approach, the use of technology has negative aspects, such as the energy consumption of computers running 24/7, which negatively impacts the environment.

2.2. From the Non-Financial Information Statement (NFIS) to the Sustainability Information

The application of the Non-Financial Reporting Directive 2014/95 (EU, 2014) required certain companies to submit a Non-Financial Information Statement (NFIS) that discloses information on environmental, social and corporate governance areas.

The Spanish Law 11/2018 (2018) went a step further and required the entity to report on its commitments to the SDGs. To this end, the Law highlights the use of the GRI (Global Reporting Initiative) key indicator standard. In any case, since the entry into force of Law 11/2018 (2018), the GRI must also include information on human rights and the fight against corruption and bribery, including due diligence procedures to identify and assess risks (ICAC, 2021). In this respect, the GRI is divided into blocks: universal, sectoral and thematic. Furthermore, within the block of universal standards, GRI 3 explains how companies can determine the material issues and the process followed (Fundación ANDI, 2021). To assist in this process, the discussion on the role of blockchain in non-financial reporting is still sparse (Pizzi et al., 2022). But Distributed Ledger Technologies (DLT) will provide a boost by processing and packaging sustainability reports in a streamlined way by creating agile, transparent and automated data collection processes (Cerchiaro et al., 2021). In the United States and Canada, blockchain has proven well positioned to help accountants and auditors prepare and review sustainability information by providing reliable tracking and custodial support for sustainability information that many companies prepare, such as greenhouse gas emissions, conflict minerals disclosure, product sourcing, and others (Bakarich et al., 2020).

In Spain, the NFIS must currently be verified in a limited way (ICJCE, 2019). In this regard, the impact of ICT is especially reflected in the revised ISA 315 (ICAC, 2021) and ISA 330 (ICAC, 2013) to assess the risk not only associated with hardware and/or software components but also with processes.

Now, the CSRD establishes a phased entry into the application of the ESRS. Companies already obliged by the NFRD should apply them in January 2024, and other large companies the year after (2025), and list SMEs in 2026, and non-EU companies with branches/subsidiaries in the EU should apply them in 2028 (Giner et al., 2024).

Following the adoption of the Corporate Sustainability Reporting Directive (CSRD) (EU, 2022), limited assurance on sustainability reporting will be required in all other countries from 2024 onwards, either by the company's statutory auditor or, at the choice of the Member State, by another auditor or by an independent assurance service provider, whereby Member States will have to establish equivalent requirements for the independent assurance service provider in terms of quality, independence and oversight. However, in the medium term, reasonable assurance, similar to that of financial reporting, will be sought and technological developments will open up great possibilities for the increased quality of these assurance reports, which is a major challenge for the auditing profession (Duran et al., 2021).

2.3. Materiality of the Company's Sustainability Issues

Both financial and sustainability information reported by companies needs to be clear and proportionate, and not only communicate the good but also account for the risks faced in a fair, reliable and credible way. It seems necessary, therefore, to incorporate sustainability risk for the purposes of organisational risk analysis. The concept of materiality arises both from the conceptual accounting framework of the Spanish General Accounting Plan and from the International Accounting Standard IAS 1, which defines the principle of materiality, explaining how certain facts or data can be excluded from financial statements because they are not significant. More specifically, in relation to the Statement of Non-Financial Information, materiality refers to those aspects and indicators that are important for the

company and stakeholders. Thus, the company must perform an analysis of the degree of significance of the information to be reported, and report the criteria used to determine materiality (Ortiz & Marín, 2022).

In 2021, the EFRAG (European Financial Reporting Advisory Group) published a set of guidelines to define and explain the differences between financial materiality and impact materiality in the context of sustainability. Impact materiality refers to those sustainability-related aspects that affect people, the economy, the environment and human rights through the entity's activity. Financial materiality refers to those sustainability-related aspects that are financially significant for the entity and may affect it beyond what is reported in the financial statements (EFRAG, 2021). Several years ago, the PWC already announced that auditing could consist of verifying the new management models of companies' sustainable development strategy and that technological solutions will undoubtedly play a key role in corporate sustainability by reducing, for example, energy consumption (PWC, 2014).

Thus, the progress of ICTs produces important synergies in the accessibility, efficiency and verification of data by connecting the different business processes (Garrigues, 2014). However, it is important to analyse the impact of ICTs on production processes where equipment and human resources are combined, and also assess how they affect sustainability.

2.4. Institutional Theory and Literature Review

In relation to theories that may affect the accountability and disclosure of non-financial information, institutional theory advocates that organisations are influenced and shaped by the broader institutional environment, which is affected by social and environmental pressures (Meyer & Rowan, 1977; Powell & Di Maggio, 1991). According to Meyer and Rowan (1977), organisations evolve to become more similar to each other. This may affect the level of disclosure of information on the SDGs reported by companies in this sector, not only because of the mandatory nature of the law but also because of the criteria to be used by the companies, which with the European Sustainability Reporting Standards will allow for greater comparability of the information provided by each company.

From this perspective, organisational design is seen as a process determined by internal and external factors that make organisations in a particular field and their form of action converge over time (DiMaggio & Powell, 1983; Powell & Di Maggio, 1991). This, in relation to the disclosure of information and despite the fact that it is mandatory, will make companies in the sector tend to report the same information as all companies opt for the same forms of action.

Although research began in the 1970s, the disclosure of non-financial information has increased exponentially over the past 10 years (Grueso-Gala & Zornoza, 2022).

Spain is an interesting case for study because it is one of the European countries that is the most strongly committed to the presentation of non-financial information, and the reports published by Spanish companies achieve high scores in sustainability indexes (Sierra-Garcia et al., 2018). They pointed out that companies that provide non-financial information in their sustainability reports are those that report the most on this topic. Van Zanten and Van Tulder (2018) analysed the results of a survey of 81 European and North American companies finding that multinational companies are more committed to SDG targets that are feasible within their operations (value chain) than to targets outside their operations, and more committed to SDG targets that "prevent harm" than to those that "do good".

Nevertheless, there is still significant heterogeneity in the way companies publish their NFIS (García-Benau et al., 2022). Moreover, there is still a lack of understanding and guidance on SDG implementation (Sachs et al., 2019; Adams et al., 2020; SDG Impact, 2021). Perhaps this is due to the large number of concepts for which companies believe they are

accountable. Although the literal interpretation of the wording of the SFDR (Sustainable Finance Disclosure Regulation) and the Taxonomy Regulation strongly argues against an artificial disassociation of the concepts of sustainability, CSR and shared values (Balcerzak et al., 2023). Furthermore, there is still much to gain in SDG reporting; for instance, common reporting problems are intangibility, omission of negative impacts, poor standardisation, diversity of criteria and lack of comparability (Diaz-Sarachaga, 2021).

At the country level, Europe is making uneven progress towards the SDG targets, and northern regions, particularly Sweden, stand out positively and Spain ranks 20th out of 27 countries in terms of SDG compliance (Anselmi et al., 2024). The EU knows that it is necessary to balance between strict regulations and softer directives and it is critically important to engage in a multi-stakeholder model involving communications with national authorities and the ultimate addressees of the sustainability-related disclosures (Rubáček & MacGregor, 2023). Given this, research should try to elaborate a common framework for assessing disclosure quality and determine an optimal level of disclosure (Daub, 2007; Minutiello & Tettamanzi, 2022).

Although several studies have analysed how companies report their impact on the SDGs, information on the contribution of specific sectors to the SDGs has not been achieved. Regarding the ICT sector, Ramautar et al. (2023) focused on analysing the 2021 sustainability reports of the 23 largest ICT companies to determine how these companies contribute to the SDGs and found, as Mhlanga et al. (2018), that ICT companies display no consistent approach to determining their priority SDGs. Although in some cases they found that SDG reporting was comprehensive and supported by evidence. Kuhndt et al. (2006) found that ICT companies did not systematically prioritise sustainability aspects, and even more so, transparency was not guaranteed. Beske et al. (2020) pointed out that another approach to improving SDG prioritisation is to conduct a materiality assessment. We conduct such an assessment in this paper for the biggest companies of different sectors in Spain.

3. Methodology

Content analysis involves the elaboration of a classification plan, as well as the definition of standards for coding, measuring and collecting the information analysed (Krippendorff, 1990; Andréu, 2002).

The Sustainable Finance Disclosure Regulation is based on qualitative data. In order to perform a homogenisation of this information, it is necessary to use a "content analysis" methodology. This consists of classifying and/or codifying the various elements of a message into categories in order to make their meaning adequately appear, in addition to analysing the presence and absence of terms or concepts independently of each other (Andréu, 2002). Therefore, following this methodology, the Non-Financial Information Statement of all IBEX 35 companies for the year ended 2021 was analysed. To subsequently determine the rules for coding, the information provided (or not provided by the companies) on the topic being addressed was scored as follows (Andréu, 2002):

- 0: No information
- 1: Only qualitative or quantitative information (not complete information)
- 2: Qualitative and quantitative information.

In summary, first, the common elements to be analysed were determined and then the information that each company contributes to these common elements was coded.

For the analysis, the information published by listed companies was considered, since the status of listed companies, being Public Interest Entities, is associated with the disclosure of non-financial information. More specifically, the Non-Financial Information Statement of all IBEX 35 companies for the year ended 2021 was analysed. Of the 35 companies that make up this stock market index, ARCELOR MITTAL, SA had not published its NFIS at

the time of the analysis (July 2022) as it is based in Luxembourg, so the final sample was made up of 34 documents.

For each of the companies, the influence of ICTs was determined, as well as their energy efficiency. It was analysed whether these issues are reflected in the materiality and risk analysis of the companies, as well as the impact these risks may have for the Statutory Audit. In the event that the results obtained are mentioned in the IV Comparative Report on IBEX 35 NFIS (EY, 2021), the figure with respect to previous years was reported in order to be able to measure the evolution.

4. Empirical Study

4.1. Description of the Reports Analysed and Rankings on Various Aspects of Management and Disclosure About Energy Efficiency of ICT of Companies

The companies that made up the final sample of the analysis (34 companies) are shown in Table 1. In order to describe them, firstly, the Spanish National Classification of Economic Activities CNAE-93 is used, resulting in seven sectors. They correspond to: (a) consumer goods (five companies); (b) basic industrial and construction materials (seven); (c) oil and energy (eight); (d) consumer services (two); (e) financial services (six); (f) real estate services (two), and (g) technology and telecommunications (four companies).

Table 1. Ranking of companies according to the characteristics of the non-financial information statements analysed and materiality type disclosed.

No.	Company	Sector	NFI VERIF.	Risks Matrix. Materiality Type		Risks Matrix
				Double	Classic	No
1	Acciona	(b) Basic ind. and constr. mat.	KPMG	1		
2	Aena	(d) Consumer services	DELOITTE	1		
3	Banco Sabadell	(e) Financial services	KPMG	1		
4	Banco Santander	(e) Financial services	PWC	1		
5	Fluidra	(b) Basic ind. and constr. mat.	EY	1		
6	Grifols	(a) Consumer goods	KPMG	1		
7	Indra	(g) Technology and telecommunications	DELOITTE	1		
8	Mapfre	(e) Financial services	KPMG	1		
9	Red Eléctrica	(c) Oil and energy	KPMG	1		
10	Repsol	(c) Oil and energy	PWC	1		
11	Solaría	(c) Oil and energy	EY	1		
12	Telefónica	(g) Technology and telecommunications	PWC	1		
13	Acerinox	(b) Basic ind. and constr. mat.	KPMG		1	
14	ACS	(b) Basic ind. and constr. mat.	KPMG		1	
15	Amadeus	(g) Technology and telecommunications	EY		1	
16	Bankinter	(e) Financial services	PWC		1	
17	BBVA	(e) Financial services	KPMG		1	
18	Cellnex	(g) Technology and telecommunications	DELOITTE		1	
19	Cie Automotive	(b) Basic ind. and constr. mat.	PWC		1	
20	Colonial	(f) Real estate services	PWC		1	
21	Enagás	(c) Oil and energy	EY		1	
22	Endesa	(c) Oil and energy	KPMG		1	
23	Ferrovial	(b) Basic ind. and constr. mat.	EY		1	
24	Iberdrola	(c) Oil and energy	KPMG		1	
25	Inditex	(a) Consumer goods	DELOITTE		1	

Table 1. *Cont.*

No.	Company	Sector	NFI VERIF.	Risks Matrix. Materiality Type		Risks Matrix
				Double	Classic	No
26	Meliá	(d) Consumer services	DELOITTE		1	
27	Merlín Properties	(f) Real estate services	PWC		1	
28	Pharmamar	(a) Consumer goods	PWC		1	
29	Rovi	(a) Consumer goods	KPMG		1	
30	Siemens Gamesa	(b) Basic ind. and constr. mat.	EY		1	
31	Almirall	(a) Consumer goods	KPMG			1
32	CaixaBank	(e) Financial services	PWC			1
33	IAG	(c) Oil and energy	KPMG			1
34	Naturgy	(c) Oil and energy	KPMG			1
			Total	12	18	4
			Total %	35.29%	52.94%	11.76%

Source: Own elaboration.

Law 11/2018 (2018) requires that non-financial information be verified by an independent service provider, which brings transparency and security to the report. In the 2021 financial year, 100% of the companies stated that the non-financial information had been verified by an independent service provider.

In 2021 (Table 1), as was the case in 2020 (EY, 2021), all the verification firms belonged to the Big Four list and, in addition, presented an unqualified report. For the evaluation of this information, the external verifiers stated that they had used the NIEA 3000 (or ISAE 3000) standard. Also, as in 2020 (EY, 2021), 100% of the companies had prepared their reports in accordance with the GRI reporting standard, although some of them also mentioned using other frameworks more specialised in the sector in which they operated. In addition, 100% of companies linked their strategies and objectives to the SDGs.

The identification of the most relevant issues is key to the preparation of the NFIS. Therefore, it is essential that the company conducts a study of the material issues, assessing their importance. One hundred per cent of the companies had explained which issues they considered material for the company, both in 2021 and 2020 (EY, 2021), but 11.76% did not include the materiality matrix in their report, although they mentioned having done so. With the materiality assessment, companies not only reported on how external factors affected them (OUT–IN approach) but also how they impacted the environment (IN–OUT approach), increasing transparency and the ability to define a strategy to mitigate the risks associated with the most relevant aspects. This is why 35,29% of companies (which in this ranking in Table 1 appear in alphabetical order) present the matrix under the concept of dual materiality in 2021, compared to 9% in the previous year, which shows a positive trend in this regard (a 25 point increase).

4.2. Analysis of Information to Assess Risk and Improvement Actions

Materiality assessment is the diagnosis of the most relevant aspects of the company's strategy, as well as the evaluation of the real or potential impact of the organisation's contributions to sustainable development (Ortiz & Marín, 2022). In this section, the items under analysis are energy efficiency, along with the level of relevance that each company gives to these concepts after the result of their analysis.

Globally, the use and production of energy have serious consequences on the climate (European Environment Agency, 2017). The Non-Financial Reporting and Diversity Act 11/2018 requires companies to address certain topics in relation to the environment, particularly pollution and climate change, the circular economy, and the sustainable use of

resources and biodiversity protection. In this case, 100% of the companies in the sample included energy efficiency as a material aspect (Table 2), either directly (38% of the companies), or indirectly, through the material aspect of "climate change" (62%). By sector, in g) technologies and telecommunications, two of the four companies included energy efficiency as a material aspect, with Cellnex and Indra being the ones that valued the importance of this aspect through climate change in general.

Table 2. Ranking of companies according to the energy efficiency materiality relevance assessment.

			Energy Efficiency		Level of Relevance		
No.	**Company**	**Sector**	**Direct**	**Indirect**	**High**	**Medium**	**Low**
1	Acerinox	(b) Basic ind. and constr. mat.	1		1		
2	Colonial	(f) Real estate services	1		1		
3	Enagás	(c) Oil and energy	1		1		
4	Iberdrola	(c) Oil and energy	1		1		
5	Repsol	(c) Oil and energy	1		1		
6	Telefónica	(g) Tech. and telecom.	1		1		
7	Amadeus	(g) Tech. and telecom.	1			1	
8	Inditex	(a) Consumer goods	1			1	
9	Mapfre	(e) Financial services	1			1	
10	Meliá	(d) Consumer services	1			1	
11	Almirall	(a) Consumer goods	1				1
12	Grifols	(a) Consumer goods	1				1
13	CaixaBank	(e) Financial services	1				
14	Acciona	(b) Basic ind. and constr. mat.		1	1		
15	ACS	(b) Basic ind. and constr. mat.		1	1		
16	Aena	(d) Consumer services		1	1		
17	Banco Santander	(e) Financial services		1	1		
18	BBVA	(e) Financial services		1	1		
19	Cellnex	(g) Tech. and telecom.		1	1		
20	Endesa	(c) Oil and energy		1	1		
21	Ferrovial	(b) Basic ind. and constr. mat.		1	1		
22	Fluidra	(b) Basic ind. and constr. mat.		1	1		
23	Merlin Propert.	(f) Real estate services		1	1		
24	Naturgy	(c) Oil and energy		1	1		
25	Pharmamar	(a) Consumer goods		1	1		
26	Red Eléctrica	(c) Oil and energy		1	1		
27	Siemens Gamesa	(c) Oil and energy		1	1		
28	Solaria	(c) Oil and energy		1	1		
29	Banco Sabadell	(e) Financial services		1		1	
30	Bankinter	(e) Financial services		1		1	
31	Cie Automotive	(b) Basic ind. and constr. mat.		1		1	
32	Indra	(g) Tech. and telecom.		1		1	
33	Rovi	(a) Consumer goods		1		1	
34	IAG	(c) Oil and energy		1			
	Total		13	21	21	9	2
	% Total		38%	62%	62%	26%	6%

Source: Own elaboration.

If we look at the level of importance attached to it (see Table 2), 62% of the companies consider climate change, and therefore energy efficiency, to be a highly significant issue; 26% give it medium importance, and only 6% believe it has a low impact. Similarly, within the technology and telecommunications sector, two companies, in this case, Cellnex and Telefónica, directly consider energy efficiency to be material and of high impact, whilst the other two, Amadeus and Indra, set their level of relevance at medium.

After analysing energy efficiency more generally in terms of materiality and risk, we looked in more detail at what measures companies are employing to improve energy efficiency and which of these are related to the use of emerging technologies (Rotolo et al., 2015). The extent and detail of information provided by companies in their NFIS are highly heterogeneous, but all of them report on energy efficiency policies (see Table 3), compared to 91% in 2020 (EY, 2021), so there is also a positive development in this aspect. In addition, the reports detail the companies' policies for mitigating this risk, but only 59% include energy efficiency in their risk analysis. One hundred per cent of the companies describe measures to improve energy efficiency, regardless of whether it is considered material, even if they did not include it in the risk analysis. This is because the NFIS is required by regulation to mention it.

Table 3. Ranking of companies according to the risk analysis and energy efficiency improvement actions.

		Risk Analysis		Types of Improvement Actions									Types of External Verification			
Cod	**Company**	**Yes**	**No**	**Energy Efficiency Policies**	**1. Renewable Energy**	**2. Air Conditioning/Lighting**	**3. Smart Nets/Software**	**4. Renovation of Infrastructure and Equipment**	**5. Self-Consumption/Photovoltaics**	**6. Other**	**They Relate Their Efficiency to ICT Use**	**Include Information on Data Centre Consumption**	**1. ISO 14001**	**2. ISO 50001**	**3. Energy Audit**	**4. Other**
1	Telefónica	1		1	1	1	1	1	1		1	1	1	1		
2	Meliá	1		1	1	1	1				1		1	1		
3	Grifols	1		1	1	1	1						1		1	
4	Naturgy	1		1	1	1		1	1				1	1		
5	Indra	1		1	1	1					1	1	1	1		1
6	Merlin Properties	1		1	1	1					1	1	1	1		
7	Repsol	1		1	1		1	1			1	1	1			1
8	Almirall	1		1	1		1		1	1	1		1	1		
9	ACS	1		1	1		1		1		1		1			
10	Colonial	1		1	1		1			1	1	1	1	1		
11	Enagás	1		1	1		1				1		1	1		
12	Cie Automotive	1		1	1				1		1		1			
13	Bankinter	1		1	1						1		1			
14	IAG	1		1	1						1		1			

Table 3. *Cont.*

		Risk Analysis		Types of Improvement Actions									Types of External Verification			
Cod	**Company**	**Yes**	**No**	**Energy Efficiency Policies**	**1. Renewable Energy**	**2. Air Conditioning/Lighting**	**3. Smart Nets/Software**	**4. Renovation of Infrastructure and Equipment**	**5. Self-Consumption/Photovoltaics**	**6. Other**	**They Relate Their Efficiency to ICT Use**	**Include Information on Data Centre Consumption**	**1. ISO 14001**	**2. ISO 50001**	**3. Energy Audit**	**4. Other**
15	Iberdrola	1		1		1	1		1		1		1		1	
16	Inditex	1		1		1	1				1	1	1	1		
17	Banco Santander	1		1		1		1	1		1	1	1			1
18	CaixaBank	1		1		1		1					1	1		
19	Aena	1		1		1					1		1	1		
20	Banco Sabadell	1		1						1	1	1	1			
21	Rovi		1	1	1	1	1	1	1				1			
22	Amadeus		1	1	1	1		1			1	1	1	1		1
23	Mapfre		1	1	1	1			1				1	1		
24	Acerinox		1	1	1	1					1		1			
25	BBVA		1	1	1	1							1	1		
26	Pharmamar		1	1	1	1							1			
27	Siemens Gamesa		1	1	1		1	1			1		1			
28	Red Eléctrica		1	1	1		1				1		1			
29	Ferrovial		1	1	1			1			1	1	1	1		
30	Fluidra		1	1	1				1		1		1			1
31	Solaria		1	1	1								1		1	
32	Cellnex		1	1		1	1	1			1	1	1	1		
33	Acciona		1	1			1				1		1	1		
34	Endesa		1	1				1			1	1	1	1		
	Total	20	14	34	25	18	15	11	10	3	26	12	34	18	3	5
	% Total	59%	41%	100%	74%	53%	44%	32%	29%	9%	76%	35%	100%	53%	9%	15%

Source: Own elaboration.

The most common actions regarding energy efficiency are as follows. Firstly, 74% of companies refer to the purchase of renewable energies and 53% establish their action policies through improvements to air conditioning and lighting. Forty-four per cent adopt measures related to ICTs and smart grids as energy distribution systems that combine electronics and emerging technologies such as AI, Big Data or IoT. Among other significant actions, 32% mention the renewal of infrastructures and equipment for more energy-efficient ones. Furthermore, 29% mention the installation of photovoltaic panels for self-consumption.

All these measures are internal actions that are supposed to be implemented by the companies but, within the context of the limited review, the auditors do not check their

veracity. Therefore, it was considered relevant to investigate whether, within the NFIS, companies mention external certifications as a guarantee of the work carried out to improve energy efficiency. One hundred per cent are certified according to the environmental standard ISO 14001 (ISO, 2004). However, this is insufficient to conclude whether the energy consumption of the companies is efficient not only on a general level but also including the data centres directly related to the use of ICTs. Only 53% have implemented an energy management system certified through the ISO 50001 standard, and a much lower percentage (only 9%) of companies indicate that they have carried out an energy audit.

To detect whether companies take into account the risk associated with the use of ICTs in terms of energy consumption, the types of companies that refer to the energy efficiency of their data centres were identified by sector.

In this respect, only two sectors ((g) technology and telecommunications, and (f) real estate services) take it into account in their NFIS and report information on it for all the companies in the sample (Figure 1). However, in the rest of the sectors, this does not occur in the same proportion, which shows intrasector mimetic isomorphism behaviour, which could be explained by institutional theory, i.e., by the institutional context in which each entity operates, which through normative, mimetic and coercive processes, creates its rules of action (DiMaggio & Powell, 1983).

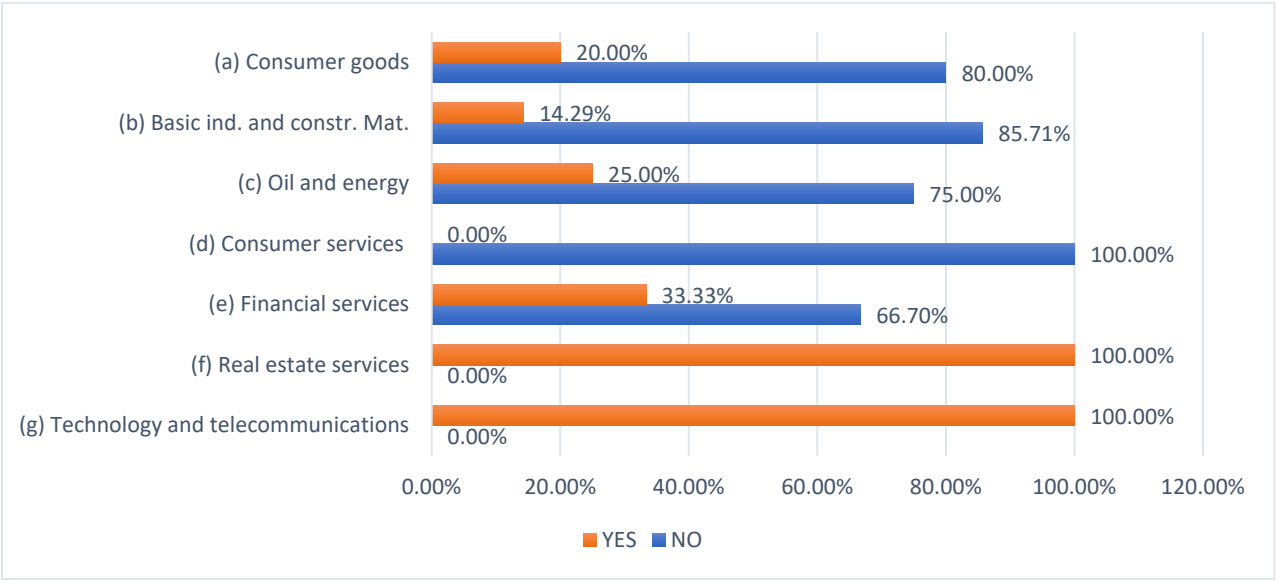

Figure 1. Energy efficiency in data centres. Source: Own elaboration.

Amadeus explains quite extensively that its data centre accounted for 50% of the company's estimated environmental impact until recently, and that improving energy efficiency remains a priority for the company today. Cellnex mentions the need for more sustainable servers with lower consumption on the path to digital transformation proposed in the 2030 Agenda. Indra, however, only refers to LEED Gold certification in the company's data processing centres. Telefónica, like Amadeus, includes extensive information about the measures taken; such as, for example, switching off 2G and 3G networks, improving their environmental impact by 78%, improving energy consumption over data consumption, and including information on their evolution in the period 2015–2021. In addition, within its strategies, it highlights the need to keep energy consumption stable, despite the strong increase in ICT use and, therefore, in data traffic circulating through the networks.

The rest of the sectors do not provide much data. For example, Sabadell mentions the importance of the energy consumption of data processing centres; Endesa, the powerful infrastructure (servers, storage, security) required by ICTs; Ferrovial, the challenge of

electrification and data mobility; Colonial and Banco Santander also include, like Indra, a mention of the "Leed Gold" certification of their data processing centres. This lack of information means that the impacts of those infrastructures that companies say they use cannot be accurately assessed. In addition, if they cannot be evaluated, these impacts cannot be corrected either.

4.3. Discussion

This analysis of the 34 companies' NFIS finds that all have cited the SDGs. It confirms that Law 11/2018 (2018), which is obliged to report on the SDGs going further than Directive 2014/95, had its fruits in Spain by getting companies to cite the SDGs in their non-financial disclosures.

From the analysis of the NFIS of the 34 companies, we found that all have used the GRIs as a reference. In this case, there was considerable homogeneity of references used to elaborate the information (all of them had used the GRI), but the 2014/95 directive allowed many options, which did not guarantee the comparability of the disclosure practices. In this sense, we believe that the CSRD Directive of 2022 and, above all, the approval of the ESRS (European Sustainability Reporting Standards) in 2023, will increase the level of comparability by making it mandatory for all companies to use the same set of standards.

Almost all the companies address the potential of applications of emerging technologies such as AI, Big Data or IoT, but only Amadeus and Telefónica address environmental impacts and concrete measures to minimise them in a transparent and comprehensive manner. We believe that regulators need to develop guidelines and recommendations to drive an environmentally and climate-friendly transition to digitalisation through energy efficiency. Companies must be more energy efficient and this must be achieved not only by applying renewable energy or self-consumption facilities, but also by making data centres and telecommunications networks more efficient in terms of consumption. A clear example is the case of Telefónica, which has already reduced energy consumption considerably by shutting down 2G and 3G networks.

The use and implementation of ICTs in companies allow greater access to the information necessary for decision-making and a reduction in errors, which brings great benefits in terms of increased productivity, resulting in greater value as a differentiating element for companies. Therefore, it is necessary to take advantage of ICTs in financial and non-financial reporting practices to respond, on the one hand, to the need for business transparency and, on the other hand, to communicate information of interest in the environment. Thus, this work is in line with Bierstaker et al. (2001), who state that the audit or verification of accounting information should also become more technological. The benefits of applying emerging technologies will range from reducing the risk of material misstatement, to being able to analyse more data in real-time, or even to broadening the scope and depth not only of financial but also of non-financial information.

ICTs are therefore of great relevance, both in business information and in the verification or auditing function, but they must also be sustainable in order to be integrated into climate change mitigation criteria. This paper puts forward a practical demonstration of how digitalisation provides highly dynamic tools for advancing environmental protection or climate action, although it shows that companies do not sufficiently analyse the risk associated with the use of emerging and sustainable technologies. In this respect, the NFIS can be highly useful in providing insight into the management of companies, particularly the aspects that are important for both organisations and stakeholders, which require an analysis of materiality. Materiality, although it arises from the accounting field, goes a step further thanks to the GRI standards, and due to the interest that this concept has acquired, we have analysed how it is implemented in IBEX 35 companies.

5. Conclusions

The aim of this article has been to identify the companies that better manage and disclose information on the energy efficiency of ICTs, which are useful, both in the management and preparation of financial and non-financial information of companies, as well as its auditing or verification by external entities. We have found that all the companies in the stock market index mention which aspects they consider material, but we believe that they should go further by including the analysis of double materiality, as in 2021, only 34% of the companies analysed did so. In the context of increasing infrastructures and computing devices, data processing through large servers or telecommunication networks considerably increases energy consumption (Van Heddeghem et al., 2014). However, the results of this empirical study on the mainly Spanish-listed companies show that little or no attention is usually paid to the obvious risk that digitisation contributes to increased energy consumption and thus CO_2 emissions. This evidence suggests that it would be necessary to incorporate basic indicators of the environmental impact of the digital transition, such as PUE (Power Usage Effectiveness), which measures the energy devoted specifically to IT equipment, or to report on the life cycle of ICTs.

Regarding the aim of identifying their effects from the point of view of energy efficiency in the context of business sustainability, this study puts forward a practical demonstration of how digitalisation provides highly dynamic tools for advancing environmental protection or climate action. However, it shows that companies do not sufficiently analyse the risk associated with the use of emerging and sustainable technologies. Only two companies address environmental impacts and concrete measures to minimise them in a transparent and comprehensive manner. Although larger companies have a higher business performance regarding the reduction of direct and indirect energy consumption, there is a long way to go, which can be smoothed if all companies commit to this objective by not only seeking to comply with the rules but also being aware of the improvements that it can cause in the management of their entity itself.

The main limitation in carrying out this study was the lack of homogenisation of the information disclosed by the companies. On the one hand, as far as the location of the information is concerned, it is relatively easy to find a piece of information in the annual accounts, as users know where to look for it. On the other hand, in the NFIS, despite the proposals for indicators and national and international standards, it is more complex to find the desired information. Moreover, in terms of the type of indicators, we found diversity in the ways of measuring data and in the ways of presenting them, complicating their comparability.

Therefore, the current regulatory framework on which this work is based does not ensure that users' information needs are met. Companies either do not report on sustainability issues or what they do report is not sufficiently useful. This leads to users of the information not being able to adequately take into account sustainability-related risks that threaten the financial stability of the organisation. In short, we believe that more work needs to be done to increase the transparency of reporting, but in a more consistent way. It is reasonable to believe that the activity of companies, and their audit and regulatory bodies, are is affected by technological changes to a greater or lesser extent and that the processes on which risk assessment and management are based will need to be updated by all parties. These ICT risks are relatively recent and an immediate response to the various threats arising from these technologies is necessary. In any case, we believe that there is still a lack of definition as to what digitalisation entails. The main regulatory bodies should put more emphasis on regulating the use of these technologies, both in business activity and in the audit function, and make clear minimum guidelines to provide security, both to professionals when working with them and to users of the information.

Furthermore, the above-mentioned measures can help to improve the information disclosed, which will increase its usefulness for external decision-making by the different stakeholders, and regulators and other disclosing companies may take these selected companies as an example in each sector of activity.

Future studies will be able to analyse the disclosure behaviour of companies in response to the new regulation. All this, insofar as the regulations to be applied will be modified in 2024 due to the recent approval of the Sustainability Directive (CSRD-Corporate Sustainability Reporting Directive) (EU, 2022), will have to be transposed into Spanish legislation, as well as the ESRS (European Sustainability Reporting Standards) developed by the EFRAG, which will be mandatory for companies subject to the Directive. A future line of research may consider explaining inter- and intra-industry behaviour based on stakeholder, legitimation and institutional theories, among others.

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