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The role of digitalization as enabler of Intellectual Capital Disclosure towards a sustainable and resilient ecosystem

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Abstract. The purpose of this paper is to analyse the link between Intellectual Capital (IC), digitalization, sustainable development and resilience to develop the governance and the management of the Social-Ecological Systems (SESs). The digital reporting era has changed the ways in which companies relate to their stakeholders and disclose about IC. Recent studies show how it is relevant to continue to investigate how the digital era affects the IC Disclosure (ICD), as well as its contribution to reveal new approaches and opportunities for sustainable development in a resilient ecosystem. The lack of an established academic background on this specific subject represents our main research motivation and highlights opportunities for theoretical and practical contributions. This is an exploratory paper; it is intended to contribute to the existing lacking literature about the support provided by Smart Technologies and Digitalization to ICD development, in the light of the development of resilient and sustainable ecosystems. Our study clarified the relationship between Smart Technologies, Digitalization and ICD, on one side, and explored the potential of technology to improve ICD through a preliminary systematization based on literature. These led to the development of a preliminary framework on pros and cons of digitalization on ICD, from the perspective of internal and external stakeholders. Our framework reinforces the theory that digitalization and smart technologies can blur the borders between organizations and ecosystems and, then, act as catalysts of the fourth stage of IC management.

Keywords: Digitalization, Intellectual Capital Disclosure, Sustainability, Resilient Ecosystems.

1 Introduction

The purpose of this paper is to analyse the link between IC, digitalization, sustainable development and resilience, in order to develop the governance and the management of the Social-Ecological Systems (SESs).

In particular, if we consider the information system process, composed of data collection and storage, data modelling and analysis, and communication, we decided to analyse the last phase of this process, focusing on Intellectual Capital Disclosure (ICD).

Since the late 90's, a number of influential articles and reports have considered the impact on corporate disclosure of developments in Information and Communication Technology (ICT). They have highlighted how this development has changed the ways that companies relate to their shareholders, clients, suppliers and institutions (Beattie and Pratt, 2003; Elliott, 1992, 1994; Wallman, 1995, 1997). Furthermore, academics,

consultants, practitioners and regulators have considered the mandatory corporate disclosure through financial statements no longer able to provide useful and complete information to companies' stakeholders.

A growing number of recent studies considers annual reports as backward-looking and lacking information about the future prospects of a company, which one could expect in an IC report (Dumay, 2016).

Many authors (e.g. Striukova et al., 2008; Dumay and Tull, 2007) encourage the use of specific corporate reporting channels which companies could exploit to disclose better IC information – especially in view of the emerging innovations in ICT. ICT of the so-called “digital reporting era” has changed the ways in which companies relate to their stakeholders (Ghani et al., 2009; Hoffman and Mora Rodríguez, 2013).

Edvinsson (2013) makes a similar argument; he states that it is necessary to go beyond the mere IC reporting: although much of the information disclosed is not price-sensitive, it is relevant because the disclosure itself is important to investors and stakeholders, who expect to be informed by companies. Subsequently, Dumay (2016) argues that companies should be more concerned with disclosing information in a timely manner rather than just reporting information, since disclosure and reporting are two fundamentally different concepts. Reporting is “the revelation of information that was previously secret or unknown”, while disclosure is “a detailed periodic account of a company's activities, financial condition, and prospects that is made available to shareholders and investors” (p. 178).

At the same time, in the last few years, there is a renewed interest in disclosing as much information as possible about IC to the different stakeholders and for doing this a new approach is required. However, organisations appear reluctant to voluntarily disclose their valuable IC, because they are not aware of how to gather data and report them (Schaper et al., 2017), and they do it only if required by their regulatory context (Dumay and Tull, 2007). As stated by many authors, “using technology can facilitate such a shift” (La Torre et al., 2018; Dumay, 2016).

First of all, using the Internet allows a company to provide on-line a large volume of information which users can access on demand, in the function of their particular area of interest. In particular, the majority of companies in all sectors use new media to voluntarily disclose information to the various groups of external users. Through their corporate servers, companies are providing large quantities of information, both financial and non-financial, which users can easily access (Lardo et al., 2017). According to Bonsón and Escobar (2006), the variables affecting the spread of companies' voluntary disclosure by the Internet are: having been audited by one of the Big Four accountancy firms; the company's activity being in the financial sector; company size.

Furthermore, in the last century, modern business entities operating under conditions of high competition and feeling the consequences of globalization processes are paying more and more attention to increase the attractiveness of their products or services, exposing outside the companies their values, culture and also non-financial information related to their activity. At the same time, greater requirements have been imposed on accounting information systems through the increased transparency of the financial markets and these are motivating companies to voluntarily enrich both the quantity and quality of information provided by their corporate servers. In addition, there are other

reasons for this trend, associated with the need to offer an image of modernity, that are driving companies to provide information via the Internet as a way of establishing their own identity in the face of all the other economic agents in the current technological environment, also considering the growing request for sustainability at social and environmental levels.

In the light of the emerging changes in technology and communication, recent studies reveal the impact these new avenues of disclosure have had on organisations in order to provide timely and relevant IC information and open up new possibilities for future research (Cuozzo et al., 2017; Lardo et al., 2017). They show how it seems to be relevant to continue to investigate how the digital era affects the ICD, as well as its contribution to reveal new approaches and opportunities for disclosing IC strategies and outcomes.

The lack of an established academic background on this specific subject represents our main research motivation and highlights opportunities for theoretical and practical contributions. Furthermore, a growing number of current studies are investigating the link between sustainable development and smart technologies (Gazzola et al., 2019) and, in particular, how digitalization and smart technologies foster the creation of a sustainable environment (Lardo et al., 2020) according to the three dimensions of Triple Bottom Line (Kiel et al., 2017; Lamboglia et al., 2017; de Sousa Jabbour et al., 2018; Braccini et al., 2019). Therefore, we also aim at analysing the link between IC, digitalization, sustainable development and resilience, in order to develop the governance and the management of the Social-Ecological Systems (SESs).

Starting from previous considerations, we identified a need for an analysis of the potential role of digitalization in driving ICD. This theoretical gap inspired the following research questions: How could digitalization become an avenue for ICD and enhance it? What enablers and obstacles arise from digitalization and are the most prominent in driving ICD? How does the relationship between digitalization and IC contribute to resilience and sustainable success?

Our study has an exploratory purpose, with the trifold objective of: (1) clarifying the relationship between Smart Technologies, Digitalization and ICD; (2) exploring the potential of technology to improve ICD through a preliminary systematization based on literature and (3) analysing how the link between IC and digitalization foster the creation of a resilient and sustainable ecosystem.

These research questions led our research process towards the development of a preliminary framework on pros and cons of digitalization on ICD, considering internal and external stakeholders. In doing so, we aim to provide a better understanding of the use of digital channels and tools in ICD processes and their effects on information flows from and to the organizations. Our framework reinforces the theory that digitalization and smart technologies can blur the borders between organizations and ecosystems and, then, act as catalysts of the fourth stage of IC management. This understanding is important because, although organizations invest large amounts of money in digitalization, a better awareness of enablers and obstacles can add to the effectiveness of such investments and avoid pitfalls.

The paper is structured as follows. After this introduction, the following section explains the methodology used, while section 3 is devoted to give a literature insight about

the relationship between IC, sustainability and resilient ecosystems. Section 4 proposes a review of the literature on the enablers and obstacles arising from digitalization and smart technologies for external and internal stakeholders. Section 5 presents and describes our framework. Finally, the last section presents and discusses our theoretical and practical contributions, together with the limitations of our research and opportunities for future studies.

2 Methodological approach

This is an exploratory paper and it is intended to contribute to the existing lacking literature about the support provided by Smart Technologies and Digitalization to ICD development, by highlighting the main enablers and obstacles arising from these phenomena. In fact, in our opinion, these important variables are not completely clearly defined. In other words, with our exploration of this topic, we aim at a better understanding of it, as well as a systematization to be used in subsequent studies (Saunders et al., 2009).

While IC studies are extensive, literature on digital era effects on ICD, as well as its contribution to reveal new approaches and opportunities for disclosing IC strategies and outcomes, is quite scant. The rationale of our research in this relatively novel area of study, then, is to provide a reflective analysis on the existing knowledge and academic background.

More in detail, our study had an exploratory purpose, with the trifold objective of: (1) clarifying the relationship between Smart Technologies, Digitalization and ICD, (2) exploring the potential of technology to improve ICD through a preliminary systematization based on literature, and (3) analysing how the link between IC and digitalization foster the creation of a resilient and sustainable ecosystem.

Consistently with our exploratory objective, the first phase of our research process consisted of an analysis of the literature.

The literature review process was based on the following strategy. For the identification of the relevant literature, papers were selected following the protocol suggested by Kitchenham (2004), in order to conduct a comprehensive research. The selection procedure was undertaken on the most influential international 'business, management and accounting' journals. Well-known search engines have been used (e.g., ISI, Web of Science, Scopus, Google Scholar), yet, unpublished manuscripts and working papers have not been included. During the selection process, titles, keywords and abstract were considered by checking for the presence of the following text-string: 'digital', 'smart technolog', 'intellectual capital', 'disclosure', 'resilien', 'sustainab' in order to reduce subjective interpretation bias.

It should be noted that our literature analysis covers only articles published in journals, and does not extend to a systematic search of books or book chapters. Despite this discretionary choice, we consider the delimitation is arguable on the basis of the quality of review processes typical of journals and on the basis of accessibility of the papers.

To ensure that the papers incorporated the target concepts and to achieve the research goals, the authors examined the full text of the articles (second phase). During this phase, a very core one of the research process, as first the analysis was at a broad level, aiming at exploring our main topics and, specifically, their relationships. While, subsequently, our analysis was tightened and oriented more precisely towards the same main subjects, but taking into account the alternative stakeholders' perspectives (i.e., external vs. internal users of ICD). However, both steps of our literature review were aimed at identified obstacles and enabling factors of ICD due to digitalization.

As a result of this second phase, we developed the following research questions.

How could digitalization become an avenue for ICD and enhance it?

What enablers and obstacles arise from digitalization and are the most prominent in driving ICD?

How does the relationship between digitalization and intellectual capital contribute to resilience and sustainable success?

According to our purpose to systematize the evidence provided by the academic literature, as the third phase of our research process, we proposed a framework which incorporates both enablers and obstacles arising from digitalization in ICD, as identified during the second phase. The framework developed also considers how the enablers and obstacles identified (i.e. our first dimension of analysis) overlap alternatively with external or internal users of digital tools for ICD (i.e. our second dimension of analysis). Finally, we discussed how the relationship between digitalization and IC is supposed to contribute to long term value creation and sustainability and, hence, matches the literature on resilience and sustainable success.

3 IC, sustainability, smart technologies and resilience

A growing number of current studies are investigating the link between sustainable development and smart technologies (Gazzola et al., 2019) and, in particular, how digitalization and smart technologies foster the creation of a sustainable environment (Lardo et al., 2020) according to the three dimensions of Triple Bottom Line (Kiel et al., 2017; Lamboglia et al., 2017; de Sousa Jabbour et al., 2018; Braccini et al., 2019). Some research works propose interpretative frameworks that link smart technologies, and in particular Industry 4.0, and sustainable issues (Wu, 2018; Stock et al., 2016; Stock et al., 2018).

The relationship between sustainability and smart technologies is based on the possibility of easily upgrading existing production processes and information systems that support decision-making to achieve sustainable outputs, that could be: ensuring cost-efficiency and environmental sustainability; providing a more suitable work environment, safety at work, increasing knowledge and decision-making ability through a large availability of data; improving the efficient allocation of resources and also a sustainable design of processes along the value creation network to ensure an efficient allocation, use and re-use of resources; and finally, collecting data during the product life

cycle to ensure its reuse or remanufacturing or regarding smart products that include some additional services that are able to better satisfy clients.

Another link under investigation is the one between sustainable development, digitalization and IC enhancement. In this perspective, Dumay and Garanina (2013) and Secundo et al. (2017, p. 246) argue that the evolution of IC research is now facing a fourth stage, which studies the dynamics of IC and its disclosure at much broader levels, such as ecosystems, communities and countries. This broader perspective requires spreading IC knowledge outside the organization. In this context, the “disclosure” on IC and the use of the new technologies play a fundamental role, allowing to create the necessary bridge between internal and external orientation. Digitalization and smart technologies have affected internal communication as well as the external one, and they can blur the borders between organizations and ecosystems, acting as facilitator/catalyst of the IC research fourth stage. Internet and enterprise social networks, for example, are considered capable of supporting two-way communication and this facilitates interaction between management and interested parties, thereby enhancing corporate governance structures (Berraies, 2019). In this perspective, many authors (Hauer et al., 2018; Lies, 2012) suggest that corporate communication is part of the corporate governance and deals with the all communication activities of internal and external coordination, as well as interest pronouncement for stakeholders; therefore, communication must be very aligned to the organisational identity and must provide as much information to stakeholders as possible.

To understand the importance of improving ICD through digitalization and smart technologies in the current economic realities, it is necessary to realize the fact that the 21st century society is a mass data community for which information is the most valuable asset and fundamental determinant for action (Kuś and Pypłacz, 2019). Having information extends access to other resources and allows companies and their stakeholders to take action to improve the current state.

Indeed, the IC embodies that sphere of “intangible” resources not quantified in the budget documents (de Villiers and Sharma, 2017; Bhasin et al., 2011; Bhasin, 2011; Meritum, 2002) but decisive for the creation of long term value (Zhou and Fink, 2003), which is necessary for sustainability (Jardon et al., 2019; Xu and Wang, 2018), in support of economic development and people’s well-being and in line with the Sustainable Development Goals established by the 2030 agenda of the United Nations.

In this context, sustainable development has been analyzed also in relationship with the concept of resilience.

Resilience was originally introduced by Holling (1973) as a concept to help understand the capacity of ecosystems with alternative attractors to persist in the original state subject to perturbations. In general, according to one of the most cited definitions, resilience has been considered as “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004:4).

In social–ecological systems (SESs), specified resilience arises in response to the question “resilience of what, to what?” (Carpenter et al., 2001). Social–ecological resilience is about people and nature as interdependent systems. SES resilience that contributes to Earth System resilience is needed for the environment and its quality.

In this scenario, the notion of resilience has been considered as a point of focus to deal with the governance and the management of the SESs. In particular, the concept of resilience seems to represent the starting point to describe the recent developments in ecosystem theory and research. These developments include, for example, the identification of an “adaptive cycle” in the dynamics ecosystems, and a shift of focus from “mechanical” to “adaptive” equilibrium. However, resilience can also be viewed as a key part of the institutionalization of an ecological movement that has been referred to as “resilience thinking” (Holling, 1995; Folke et al., 2010). Resilience thinking relies on the concept of an ecological attractor, because it has come to fruition in activities relating to SESs.

Resilience thinking focuses on three aspects of SES: persistence, adaptability and transformability. The first one refers to the fact that resilience is a tendency of a SES to change and also to adapt to remain within critical thresholds. Adaptability represents the capacity of a SES to adjust itself to the changes of the external drivers and internal processes. Transformability is the capability to create new development trajectories.

Case studies of SESs suggest that transformations consist of three phases: being prepared for or even preparing the social–ecological systems for change, navigating the transition by making use of a crisis as a window of opportunity for change, and building resilience of the new social–ecological regime (Olsson et al., 2004, Chapin et al., 2010). Such transformations are never scale-independent, but draw on social–ecological sources of resilience across scales (Gunderson and Holling, 2002).

The most recent studies (Secundo et al., 2020) consider also the relationship between IC, digitalization, sustainable development and resilience.

In particular, these research studies focus on the strategic role of IC for achieving sustainable development goals as indicated by the 2030 agenda of the United Nations. Among these goals, the goal number 9 named “Build resilient infrastructure to promote inclusive and sustainable industrialization and foster innovation” tries to focus the attention on the relationship between IC and new technologies in order to find the effective solution to resolve issues such ecosystem resilience (Suciu and Năsulea, 2019).

This means that the relationship between IC and digitalization could represent an important potential source of competitive advantage for creating value, because it is important to achieve not only sustainable development, but in a “resilience thinking” perspective, that permits to determine the governance and management of the SES.

However, to achieve these results it is also crucial to go through internal and external integration with other different actors presented in the ecosystem, by the development of an open and comprehensive process involving all stakeholders (Kiel et al., 2017; Lardo et al., 2020).

4 Enablers and obstacles arising from digitalization for external and internal stakeholders

In this section, we present the literature about the enablers and obstacles regarding ICD and digitalization from the two perspectives under investigation: external and internal stakeholders.

This investigation permits us to analyze the first aspects that characterize the integration between internal and external stakeholders in a social-ecological ecosystem.

4.1 The external stakeholders' perspective

ICD is almost always considered an information mechanism mainly for the outside and beyond the annual report (Dumay, 2016, Pisano et al., 2017; Schaper et al., 2017). ICD literature is mainly concerned with value creation from a financial perspective, and focuses on an external financial value creation and on the discussion of the external benefits for organizations (Cuozzo et al., 2017), because market value is considered as an expression of a firm's IC (Firer and Mitchell Williams, 2003; Chen et al., 2005). Therefore, it is not surprising to find the majority of ICD studies focussing on "publicly listed companies" (Cuozzo et al., 2017).

Recent studies (Lardo et al., 2017; Mouritsen et al., 2001) argue that firms try to achieve results by ICD in order to increase their popularity and, consequently, to create new value. These research are based on evidence that ICD, and its components, can improve the financial performance of companies and the value of its employees (Lardo et al., 2017; Mouritsen et al., 2001). The identification of intangible assets and the communication of their value seem to be viewed as a key competitive driver (Eustace, 2000). These studies are usually based on "Grand theory", that disclosing IC leads to greater profitability (Dumay, 2012; Llewelyn, 2003). This theory states that ICD is important for investors because it improves their decision making and it disciplines management and boards with positive economic rewards (Zarowin and Lev, 1999; Andriessen, 2004).

Also Dumay's theoretical study (2016) reveals how authors need to abandon reporting and instead concentrate on "disclosure", that represents how an organisation discloses what "was previously secret or unknown", so that all stakeholders understand how an organisation takes into consideration ethical, social and environmental aspects. ICD is important to investors and other stakeholders because they expect these types of disclosures from a company. "Any current or potential investor with access to the internet can see from the company's website that it builds, for example, sustainability into its business model. Periodic reporting, which comes in the form of a printed report or its PDF equivalent, internet-based disclosures are dynamic and followed" (Dumay, 2016). Despite the importance taken by ICD for external users, the impact of smart technologies and digitalization on ICD with regards to the effects on external users has not yet been well investigated. Few articles explore corporate ICD in light of changes in technology and have analyzed these innovative communication channels as drivers for IC value or the importance of involuntary disclosures (Dumay and Guthrie, 2017).

In general, experts perceive digitalization to play a significant role in the development of disclosure to the outside (Hauer et al., 2018). Hauer et al. (2018) reveal how, by new technologies, the disclosure gets digitalized and more flexible, data is available in real-time and can be used faster, easier and more efficient, processes are expected to get standardized, involving time-saving.

Currently most researchers tend to highlight the enabling factors of technologies, highlighting how these produce a positive effect on the ICD as a mechanism mainly for the outside.

These researches mainly focus on social media and social networks as new crucial technologies for the IC growth (Falkowski, 2014). In recent years, it seems that firms have embraced the social networks to optimize interpersonal collaborations and transversal knowledge flows with their stakeholders (Riemer, 2016). "Through these collaborative tools, companies benefit from the knowledge deposits and skills of their members and from the synergy created by interactive networks both formal and informal" (Berraies, 2019). Social media are considered a tool for disclosing IC information in a relevant and timely manner. From a strategic management perspective, there are economic opportunities to be gained from managing social media platforms appropriately and that knowledge derived from social media needs to be used effectively by companies, so that followers can be transformed into consumers.

ICD can benefit from using social media in a variety of ways ranging from fruitful communications, helpful suggestions within online communities to posting videos or documents. Social Networks allow capturing knowledge from employees and disseminating it to the other members of the social network communities who can reuse it to add value, improving firms' product and process innovation (Falkowski, 2014). Social Networks are considered "collaborative tools" to foster knowledge sharing, boost interactions between organizational and the stakeholders and promote innovation (Turban et al., 2011). Also other studies (Dalmaso et al., 2018; Berraies and Chaher, 2014) found that the use of Social Networks develop a radical innovation in the companies, by promoting the flow of knowledge and the creation of new relationships. Berraies and Chaher (2014) also stressed that interactions between internal and external actors promote strategic knowledge, particularly: the development of new information and communication technologies, new methods, new suppliers of raw materials and the response to the market or competitive needs. Furthermore, the interactions with customers allow designing new products that respond to their latent needs.

Starting from all these considerations, recent studies (Lardo et al., 2017) highlight how companies are needed to hire social media experts that are able to develop, coordinate and manage digital communication strategies.

Literature is also focused on the economic and financial effects that these technologies produce. Since over two decades ago, companies have begun to consider the relationship between intangible assets, such as human and relational capital, and market value. Several research (Dumay, 2008; Gerpott et al., 2008; Petty and Guthrie, 2000; Stewart, 1997; Sullivan, 2000; Williams, 2001) have considered the disclosure of intangible assets and IC as an integral part of a company's value creation process from a market perspective.

This link now appears to be strengthened by the use of social media. In general, literature reveals that social media networks can create strong relationships among and with external stakeholders, and this establishes connections that can be transformed into economic returns for the company (Lardo et al., 2017; Boylan and Boylan, 2017). In this way, the social media revolution seems to contribute to developing the value of the company, and has led to a full range of new distribution channels on various digital platforms, increasing the value of the relationships between companies and their stakeholders (Boyle and Haynes, 2004; Hamil and Chadwick, 2010).

Lardo et al. (2017), for example, explain how emerging changes in technology and communication platforms provide relevant and timely ICD, enabling companies to communicate with a wide array of stakeholders. Social media can be used as a tool to disclose voluntary and involuntary information about IC, which are particularly useful to investors. This research argues that expanding communication through social media can directly contribute to the development of IC and impact on market capitalization and company's value. Social media could involuntarily reveal previously unknown information about intellectual assets that are value-relevant, reduce the uncertainty that stems from information asymmetry between managers and investors, but can also have a direct impact on a company's revenue. In summary, the paper reveals empirically that technology creates popularity and new ways to impact company value, provides new sources of revenue and new lines of expenditure and makes information disclosure and communication with stakeholders easier.

However, other studies suggest that social media is not becoming popular among financial market professionals yet (Cwynar et al., 2019). They tend to retrieve the information provided there just occasionally for several reasons. First, social media content is often untreated, redundant, and less credible. Second, a time lag effect is observed and, then, social media are expected to play an increasingly important role in the future, for investment decisions purposes.

4.2 The internal stakeholders' perspective

If we focus on the perspectives of the internal stakeholders, we can see some different enablers and obstacles arising from digitalization and smart technologies.

The interactivity characterizing ICD through digital tools highlights the potential active role of ICD users in the communication process. They are able to select the information according to their specific purposes, but they also act as providers of precious additional data for firms. In doing so, internal stakeholders contribute to the strategy (re)formulation process. This becomes possible because of the bidirectional nature of digital channels (Holland, 2005, pp. 249, 264) and their ability to generate Big Data. According to recent literature, Big Data, digital revolution, and social media are drastically changing decision making processes (Brown et al., 2011). In fact, processing large volumes or wide varieties of data allows firms to derive business value from them, when strong internal capabilities to bridge up ICT and data with decision making is available (Ransbotham et al., 2015). This ability transforms Big Data into Business Analytics (BA, Davenport, 2007, Holsapple et al., 2014), which enables better forecasting and smarter decisions in areas that were previously dominated by intuition rather than data

and rigour (McAfee et al., 2012). Growing evidence suggests that leading BA users achieve higher returns compared to their competitors (Brynjolfsson et al., 2011). Other Authors (Mello et al., 2014, Warren et al., 2015, Raffoni et al., 2018) focus on BA based on Big Data and underline how this could enrich management control systems, particularly in terms of performance evaluation, goal communication and strategy formulation. Malmi and Brown (2008) emphasize the need to adapt management control systems to the digital revolution of the business environment. Using controlled experiments, companies can test hypotheses and analyse results to make more data-driven investment and operation decisions. In sum, recent studies highlight that the new digital context is changing communication for internal purposes too, and especially management accounting (Bhimani and Willcocks, 2014; Warren et al., 2015, Agostino and Sidorova, 2017, Arnaboldi et al., 2017).

5 A systematization of enablers and obstacles arising from digitalization in ICD

The analysis of the literature provided in the previous sections has highlighted that only few articles explore corporate ICD in the light of changes in technology and, more in detail, how these innovative communication channels become drivers for IC value (Dumay and Guthrie, 2017). Generally speaking, experts perceive digitalization to play a significant role in making digitalized disclosure more flexible and faster, easier to be found and cheaper (Hauer et al., 2018). Furthermore, most researchers tend to highlight the enabling power of technologies for external users, while we also mentioned the importance for internal purposes too.

On the bases of these considerations, in the following sections we propose a systematization and a description of enablers and obstacles arising from digitalization in ICD.

5.1 Enablers arising from digitalization in ICD

Digital channels and tools differentiate from traditional ones by a number of characteristics, which overlaps the critical success factors for an effective ICD process. We refer to the following features, which constitute enabling factors in our conceptual framework:

- interactivity, i.e. the possibility for users to play an active role in the communication process, as well as the opportunity for firms to capture from the interaction precious additional information for management purposes. This becomes possible because of the bidirectional nature of digital channels. This also meets Holland emphasis on the dynamic elements of interaction and learning as fundamental characteristics of disclosure (2005);
- dynamicity, in fact, while traditional annual reports provide backward-looking information and static reports, digital platforms and solutions can disclose updated information and also receive instant feedback from stakeholders, making the communication more dynamic. La Torre et al. (2018) highlight the importance to go beyond static and periodic reporting towards a more dynamic and relevant disclosure for stakeholders;

- personalization, because the same set of information can be created in order to meet a plurality of information needs. Thanks to digital tools' features users can navigate and retrieve customized disclosure, indeed. Therefore, this turn out to be calibrated for different audiences;
- effectiveness and flexibility, because digitalization enables innovative communication tools and firms can then set up the most proper frame to open wide windows into their IC and can follow flexible and customized communications strategies. Electronic forms of reporting allow reporting users to select information they are more interested in (de Villiers et al., 2014, p. 1046). Furthermore, visualization, which includes various techniques for creating images, diagrams, and animations favoured by digital tools, can deeply add to the intelligibility of information. These factors impact on the perceived usefulness and ease of use of digital tools, which are suggested to be important drivers of technology acceptance models (King and He, 2006);
- timeliness of digital channels and easy access to an open arena, since digital channels offer instant, one-to-many communication that bypass traditional media and allow firms to broadcast their intended messages to a large network of stakeholders. To sum up, data is available in real-time and can be used faster, easier and more efficiently;
- efficiency, because processes are expected to become standardized within IC disclosure and this generates time-saving. Furthermore, if data are available in real-time and can be used faster, easier and more efficiently, this reduces the uncertainty that stems from information asymmetry between managers and external investors and stakeholders. Finally, digitalization can reduce overlapping and double activities, for instance data enter activities avoided thanks to synchronization;
- measurability, i.e. the ability to promptly measure users' responsiveness and interactivity to IC communication;
- mobility/availability, which makes information highly accessible from a multitude of users and from a large number of devices. Information becomes available when, where and how everyone prefers;
- networked communication, which enables improvements of the relationships with the plethora of stakeholders in the ecosystem;
- visibility, that companies can leverage to create and strengthen the corporate image and reputation. Digital channels and tools are particularly suitable for creating an agile, flexible and modern picture of the business and, in doing so, to advance the corporate image. This leads to an integration between accounting and marketing activities.

5.2 Obstacles arising from digitalization in ICD

Organisations embracing digitalization face also important challenges and risks which turn out in potential obstacles to ICD digitalization. We aim to contribute to the literature by identifying the followings:

- lack of digital human talent and skills to organize, analyse and exploit data (McAfee and Brynjolfsson, 2012, Bi and Cochran, 2014, Kennedy et al., 2015, Ransbotham et al., 2015). From this perspective, training is essential in getting people to accept innovation and to implement it. They need competences about technology devices and applications and on integration between different devices in work settings. Training can

be formal and controlled by the organization or informal, e.g. based on personal experience exchange. This can be facilitated by social network like LinkedIn and Twitter;

- resistance to change and adaptation in human resources (Hong and Kim, 2002, Chen et al., 2009), because all organisational changes' may cause uncertainty, due to necessary restructuring and the way such changes are communicated and internalized by employees. Not all of them are aware of the benefits of technology and some may distrust technological tools;

- cultural barriers, which influences the adaptation to digitalization. If there is a culture of use, this would encourage others to use innovative digital channels and tools. Hence, a cultural change is needed before such tools catch on with IC information users. Low individual computer experience and innovativeness can represent obstacles to the use of digital tools (King and He, 2006), since they restrict people perceptions of technology and their flexibility towards technological changes;

- low level of standardization of information and communication flows, which makes digitalization more complex. Standardization is particularly hard when information refers to IC elements, given their undefined nature by definition; as a consequence, digitalization becomes even more challenging. To be converted into a digital format, information has to be objective, simple and clear;

- lack of digital assets, i.e. technological resources constraints, when infrastructures (optic fiber, devices, hardware, software, digital networks, etc.) are not adequate;

- legal aspects, which refer to the fair and secure use of data in digitalization, from the law and regulation point of view. Protection, privacy and security of sensitive data during their collection, storage and transfer can be relevant issues and require specific protocols, measures, and investments (Larrán and Giner, 2002), to avoid security failure, information leakage, hackers attacks, etc. Furthermore, gaps in the regulatory framework still exist and sometimes laws are not sufficiently clear and adequate;

- difficult balance between disclosable and undisclosed information, in order to preserve strategic information secrecy and avoid to jeopardise key sources of competitive advantage, like distinctive knowledge, competences and resources;

- involuntary disclosure, as a dark side of digital channels and tools, when negative aspects are made public and dangerously impact on stakeholders and investors' perceptions about the firm integrity and values. This aspect is connected to the reputation risk and it is strengthened by the open participation typical of social media, for example, where external participants' conversations are outside companies' control (Ramassa and Di Fabio, 2016). As a consequence, adequate monitoring tools are necessary to promptly detect reactions of participants and the impact on the reputation strategy

- risk of manipulation and opportunistic behaviours, due to Internet bots or paid analysts who convey messages and signals and/or spread fake or misleading information (Cwynar et al., 2019).

5.3 A framework for enablers and obstacles from the internal and external stakeholders' perspectives

An awareness of enablers and obstacles to ICD digitalization can help to improve this process, avoiding pitfalls. The enablers included in our framework reinforce the theory

that digitalization and smart technologies can blur the borders between organizations and ecosystems and, then, act as catalysts of the fourth stage of IC management. On the other hand, some important obstacles also arise.

The following figure summarizes how enablers and obstacles identified in our framework (i.e. our first dimension of analysis) overlap alternatively with external or internal users of digital tools for ICD (i.e. our second dimension of analysis). In the figure, the overlaps are highlighted by the grey areas, relative to both dimensions.

1 st dimension: Enablers vs. Obstacles to ICD digitalization	2 nd dimension: External vs Internal stakeholders		
	Enablers	External users	Internal users
	interactivity		
	dynamicity		
	personalization		
	effectiveness and flexibility		
	timeliness and easy access		
	efficiency		
	measurability		
	mobility/availability		
networked communication			
visibility			
Obstacles	External users	Internal users	
lack of digital human talent			
resistance to change			
cultural barriers			
low level of standardization			
lack of digital assets			
legal aspects			
disclosable and undisclosable			
involuntary disclosure			
manipulation and opportunistic behaviour			

Figure 1- Enablers and obstacles to ICD digitalization for external and internal users

More in detail, if we focus on the impact on external stakeholders, more overlaps with enablers emerge. As a consequence, we believe that digitalization mainly facilitates IC disclosure and, hence, it also allows a wider spread/dissemination of valuable knowledge outside company boundaries, in favour of the entire community of stakeholders who co-exist in the ecosystem. In doing so, digitalization and smart technology contribute to IC exploitation. This phenomenon emerges as an additional magnificent consequence of the usage of digitalization and smart technologies for IC disclosure

purposes. While less overlaps concern external stakeholders and obstacles. However, cultural barriers on the use of digital technologies still exist, as well as a common scepticism about privacy protection issues. Furthermore, concerns that information spread by social media can be manipulated, fake or misleading represents an obstacle to a larger and routine usage of this source of information by external stakeholders.

If we focus, instead, on internal users, more obstacles appear to be relevant. Some of them mainly refer to organizational aspects, like the lack of digital talent reported by numerous studies, as well as the existence of cultural barriers against digitalization and staff resistance to change. Other obstacles concern insufficient digital assets, like investments in digital infrastructures and standardization along the information system process. Finally, the balance between voluntary and involuntary disclosure can be very challenging. However, thanks to the instant feedback from stakeholders and the Big Data they provide just by making use of digital channels and tools, companies have access to precious inputs to renew their IC generation process, indeed. Digital and smart solutions enable organisations to gather information through the interconnection between IC disclosure providers and users. This information can be used by companies to create and strengthen their IC elements. Furthermore, it can be used for strategic decisions and corporate marketing activities. In sum, a virtuous circle originates: digital media can become strategic external sources for IC identification and, in turn, positively contribute to new IC creation.

This virtuous cycle can also foster the transformation towards SESs and, more precisely, prepares transition; first, identifying opportunities for change and, after, building resilience of the new social–ecological regime (Olsson et al., 2004; Chapin et al., 2010). By this, IC plays an important role in achieving sustainable development goals, as suggested by the goal number 9 of the 2030 agenda of the United Nations (Build resilient infrastructure to promote inclusive and sustainable industrialization and foster innovation). The enablers of ICD digitalization support new technologies in order to find the effective solution to resolve issues such as ecosystem resilience (Suciu and Nășulea, 2019). This means that the relationship between IC and digitalization could represent an important potential source of competitive advantage for creating value, important to achieve not only sustainable development, but also a “resilience thinking” perspective. Furthermore, a higher awareness of the obstacles of ICD digitalization also contribute to their overcoming and this goes also in favour of a leaner SES transformation.

6 Concluding remarks

A first aim of this research was to analyse the link between IC, digitalization, sustainable development and resilience, and, more specifically, to clarify the relationship between Smart Technologies, Digitalization and ICD.

To achieve our aims, we adopted an exploratory methodology; the first phase of our research consisted in a literature review process about IC, digitalization and the relationships with sustainable development and resilience in the SESs’ perspective. Then, the review process was oriented taking into account specifically the users of ICD, that

are the stakeholders (i.e., external vs. internal users of ICD), in order to systematise and highlight the enablers and obstacles to ICD digitalization.

The main result of our research is the proposal of a preliminary framework providing a systematization of enablers and obstacles to ICD digitalization for external and internal stakeholders. Our framework highlights enablers generated by digitalization of ICD, which lead to a wider dissemination of valuable knowledge inside and outside a company's boundaries, in favour of the entire community of stakeholders, internal and external. This meets their expectations and needs for flexible, interactive, multidirectional and timely approaches, technologies, and infrastructures to acquire, process and disclose data and information.

The results confirm different information needs of external stakeholders compared to internal. While external stakeholders require reliable and timely information about companies' IC in order to guide their behaviour, internal stakeholders need to share and process large volumes and a wide variety of data in order to contribute to the strategy (re)formulation process.

This study makes theoretical and practical contributions. For researchers, it contributes to the extant literature that seeks to better understand the relationship between ICD and digitalization, by adding further theoretical insights to the existing studies regarding ICD. It provides a systematization of them, with specific regard to the relationship between digital and smart technologies, on one side, and ICD, on the other.

Practical implications of the study are essentially related to the clarification of which are the main obstacles faced by companies, underlining the key and critical aspects to overcome. In particular, our results suggest that additional investments are necessary to enhance the digital talent of human capital and to break down cultural barriers against digitalization that still exist. While digital technologies are rapidly becoming a commodity, success largely depends on the organisation's digital capabilities and skills. In this light, training and education represent critical success factors to be embedded in the firm's strategy.

Additional efforts should also reinforce digital assets in the form of digital infrastructures. On the basis of the obstacles to ICD digitalization still existing, we recommend using a mixed structure of communication tools and channels. Such a mix allows organizations to take advantage of digitalization strengths, but, at the same time, it does not neglect a need for integration with traditional reporting.

Furthermore, the integration of the technologies used for the internal and external disclosures could reduce the obstacles for the two categories of stakeholders (external and internal) and also enrich the factors enabling ICD.

The implementation of these practical contributions could determine several benefits for companies, e.g. each stakeholder can access on demand a large volume of information in their particular area of interest, and companies could improve corporate image, competitive advantage and their market value. Therefore, we can state that digitalization and smart technologies can blur the borders between organizations and ecosystems and, then, act as catalysts of the fourth stage of IC exploitation and management, in order to find the effective solution to resolve issues such as ecosystem resilience (Suciu and Năsulea, 2019).

In line with this perspective, our study can also contribute to achieving sustainable development and a resilient ecosystem, considering the different actors presented in the ecosystem, by the development of an open and comprehensive process involving all stakeholders (Kiel et al., 2017; Lardo et al., 2020). Indeed, our framework can represent a useful approach to integrate internal and external stakeholders' perspectives and to foster a wider dissemination of valuable knowledge inside and outside a company's boundaries, in favour of the entire community.

Our study represents a first attempt to link the ICD and smart technology research with the new studies regarding sustainable development and resilience.

Finally, this research presents a main limitation: it is only a preliminary analysis of our topic. A future step could be an enrichment of our framework in the light of the three main aspects the resilient thinking is focused on: persistence, adaptability and transformability.

References

- Agostino, D. and Sidorova, Y. (2017), "How social media reshapes action on distant customers: some empirical evidence", *Accounting, Auditing and Accountability Journal*, Vol. 30 No. 4, pp. 777-794.
- Andriessen, D. (2004), "IC valuation and measurement: classifying the state of the art", *Journal of Intellectual Capital*, Vol. 5 No. 2, pp. 230-242.
- Arnaboldi, M., Busco, C. and Cuganesan, S. (2017), "Accounting, accountability, social media and big data: revolution or byproduct?", *Accounting, Auditing and Accountability Journal*, Vol. 30 No. 4, pp. 762-776.
- Bhasin, M.L., Shaikh, D. and Hanif, J.M. (2011), "Intellectual capital disclosures in the annual reports: a comparative study of the Indian and Australian IT-corporations", *International Journal of Managerial and Financial Accounting*, Vol. 3 No. 4, pp. 1-24.
- Bhasin, M. (2011), "Disclosure of intellectual capital in the annual reports by the IT companies: an exploratory study of India", *International Journal of Managerial and Financial Accounting*, Vol. 3 No. 3, pp. 255-278.
- Berraies, S. (2019), "The effect of enterprise social networks use on exploitative and exploratory innovations: Mediating effect of sub-dimensions of intellectual capital", *Journal of Intellectual Capital*, Vol. 20 No. 3, pp. 426-452.
- Berraies, S. and Chaher, M. (2014), "Knowledge creation process and firms' innovation performance: mediating effect of organizational learning", *International Journal of Human Resource Studies*, Vol. 4 No. 1, pp. 204-222.
- Bhimani, A. and Willcocks, L. (2014), "Digitisation, 'Big Data' and the Transformation of Accounting Information", *Accounting and Business Research*, Vol. 44 No. 4, pp. 469-490.
- Bi, Z. and Cochran, D. (2014), "Big Data analytics with applications", *Journal of Management Analytics*, Vol. 1 No. 4, pp. 249-265.

- Boylan, D.H. and Boylan, C. (2017), "Technology in Accounting: Social Media as Effective Platform for Financial Disclosures", *The International Journal of Digital Accounting Research*, Vol. 17, pp. 93-109.
- Braccini, A.M., and Margherita, E.G. (2019), "Exploring organizational sustainability of industry 4.0 under the triple bottom line: the case of a manufacturing company", *Sustainability*, Vol. 11 No. 1, pp. 36-53.
- Brynjolfsson, E., Hitt, L. and Kim, H. (2011), "Strength in Numbers: How does Data-driven Decision making Affect Firm Performance", 9th Annual Industrial Organization Conference, April 22.
- Brown B., Chui M. and Manyika, J. (2011), "Are you ready for the era of "Big Data"?", *McKinsey Quarterly*, October, 24-35.
- Carpenter, S.R., B.H. Walker, J.M. Anderies, and N. Abel. 2001. From metaphor to measurement: resilience of what to what? *Ecosystems* 4:765-781.
- Chen, M.C., Cheng, S.J. and Hwang, Y. (2005), "An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance", *Journal of Intellectual Capital*, Vol. 6 No. 2, pp. 159-176.
- Chen, H.H., Chen, S.C. and Tsai, L.H. (2009), "A study of successful ERP - from the organization fit perspective", *Journal of Systemics, Cybernetics and Informatics*, Vol. 7 No. 4, pp. 8-16.
- Cuozzo, B., Dumay, J., Palmaccio, M. and Lombardi, R. (2017). Intellectual capital disclosure: a structured literature review. *Journal of Intellectual Capital*, 18(1), 9-28.
- Cwynar, A., Cwynar, W., Pater, R. and Filipek, K. (2019), "Social Media as an Information Source in Finance: Evidence from the Community of Financial Market Professionals in Poland", *The International Journal of Digital Accounting Research*, Vol. 19, pp. 29-58.
- Dalmasso, C., Gand, S. and Garcias, F. (2018), "Stimuler l'innovation radicale par l'usage d'un réseau social d'entreprise: une expérimentation dans l'industrie pétrolière", *Revue Française de Gestion*, Vol. 272 No. 3, pp. 103-120.
- Davenport, T. and Harris, J.G. (2007), *Competing on Analytics*. Harvard Business Press, Boston.
- de Sousa Jabboura A.B.L., Chiappetta Jabboura C.J., Foropona C., and Filhob M.G. (2018), "When titans meet – Can industry 4.0 revolutionise the environmentally-sustainable manufacturing wave? The role of critical success factors", *Technological Forecasting & Social Change*, Vol. 132, pp. 18-25.
- de Villiers, C., Rinaldi, L. and Unerman, J. (2014), "Integrated reporting: insights, gaps and an agenda for future research", *Accounting, Auditing & Accountability Journal*, Vol. 27 No. 7, pp. 1042-1067.
- de Villiers, C. and Sharma, U. (2017), "A critical reflection on the future of financial, intellectual capital, sustainability and integrated reporting", *Critical Perspectives on Accounting*, p. 101999.
- Dumay, J. (2016), "A critical reflection on the future of intellectual capital: from reporting to disclosure", *Journal of Intellectual Capital*, Vol. 17 No. 1, pp. 168-184.
- Dumay, J.C. (2012), "Grand theories as barriers to using IC concepts", *Journal of Intellectual Capital*, Vol. 13 No. 1, pp. 4-15.

- Dumay, J. (2008), "Narrative disclosure of intellectual capital: a 'structural' analysis", *Management Research News*, Vol. 31 No. 7, pp. 518-537.
- Dumay, J. and Guthrie, J. (2017), "Involuntary disclosure of intellectual capital: is it relevant?", *Journal of Intellectual Capital*, Vol. 18 No. 1, pp. 30-45.
- Dumay, J. and Tull, J.A. (2007), "Intellectual capital disclosure and price-sensitive Australian stock exchange announcements", *Journal of Intellectual Capital*, Vol. 8 No. 2, pp. 236-255.
- Dumay, J. and Cai, L. (2015), "Using content analysis as a research methodology for investigating intellectual capital disclosure: a critique", *Journal of Intellectual Capital*, Vol. 16 No. 1, pp. 121-155.
- Dumay, J. (2016), "A critical reflection on the future of intellectual capital: from reporting to disclosure", *Journal of Intellectual Capital*, Vol. 17 No. 1, pp. 168-184.
- Edvinsson, L. (2013), "IC 21: reflections from 21 years of IC practice and theory", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 163-172.
- Falkowski, M. (2014), "Social media's role in intellectual capital's growth", *Review of Business and Economics Studies*, Vol. 2 No. 2, pp. 66-74.
- Firer, S. and Mitchell Williams, S. (2003), "Intellectual capital and traditional measures of corporate performance", *Journal of Intellectual Capital*, Vol. 4 No. 3, pp. 348-360.
- Folke, C., S. Carpenter, B. Walker, M. Scheffer, T. Chapin, and J. Rockstrom. 2010. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecol. Soc.*15(4):20–28.
- Gazzola, P., Del Campo, A. G., and Onyango, V. (2019), "Going green vs going smart for sustainable development: Quo vadis?", *Journal of Cleaner Production*, Vol. 214, pp. 881-891.
- Guthrie, J. and Petty, R. (2000), "Intellectual capital: Australian annual reporting practices", *Journal of intellectual capital*, Vol. 1 No. 3, pp.241-254.
- Hauer, G., Harte, P. and Kacemi, J. (2018), "An Exploration of the Impact of Industry 4.0 Approach on Corporate Communication in the German Manufacturing Industry", *International Journal of Supply Chain Management*, Vol. 7 No. 4, pp. 125-131.
- Holland, J. (2005), "A grounded theory of corporate disclosure", *Accounting and Business Research*, Vol. 35 No. 3, pp. 249-267.
- Hong, K.K. and King, Y.G. (2002), "The critical success factors for ERP implementations: an organizational fit perspective", *Information & management*, Vol. 40, pp. 25-40.
- Holsapple, C., Lee-Post, A. and Pakath, R. (2014), "A unified foundation for business analytics", *Decision Support Systems*, Vol. 64, pp. 130-141.
- Jardon, C.M. and Martinez-Cobas, X. (2019), "Leadership and organizational culture in the sustainability of subsistence small businesses: an intellectual capital based view", *Sustainability*, Vol. 11 No. 12, p. 3491.
- Kennedy, H., Moss, G., Birchall, C. and Moshonas, S. (2015), "Balancing the potential and problems of digital methods through action research: methodological reflections", *Information, Communication & Society*, Vol. 18 No. 2, pp. 172-186.
- King, W. R. and He, J. (2006), "A meta-analysis of the technology acceptance model", *Information & management*, Vol. 43, pp. 740-755.

- La Torre, M., Valentinetti, D., Dumay, J. and Rea, M. A. (2018), "Improving corporate disclosure through XBRL", *Journal of Intellectual Capital*, Vol. 19 No. 2, pp. 338-366.
- Lamboglia R., Mancini D., and Piedepalumbo P. (2017), New Business Model for Value co-creation in Smarter Universities, in Marchi L., Lombardi R. (Eds), *Il Governo Aziendale tra Tradizione e Innovazione*, Franco Angeli, pp. 68-83.
- Lardo, A., Dumay, J., Trequattrini, R. and Russo, G. (2017), "Social media networks as drivers for intellectual capital disclosure: Evidence from professional football clubs", *Journal of Intellectual Capital*, Vol. 18 No. 1, pp. 63-80.
- Lardo, A., Mancini, D., Paoloni, N., Russo, G. (2020), "The perspective of capability providers in creating a sustainable I4.0 environment", *Management Decision*, Vol. 58, No. 8, pp. 1759-1777.
- Larrán, M. and Giner, B. (2002), "The Use of the Internet for Corporate Reporting by Spanish Companies", *The International Journal of Digital Accounting Research*, Vol. 2, No. 1, pp. 53-82.
- Llewelyn, S. (2003), "What counts as theory in qualitative management and accounting research? Introducing five levels of theorizing", *Accounting, Auditing & Accountability Journal*, Vol. 16, No. 4, pp. 662-708.
- Lies J. (2012), Internal communication as power management in change process: Study on the possibilities and the reality of change communications, *Public Relations Review*, Vol 38, pp. 255-261.
- Kiel, D., Müller, J. M., Arnold, C., and Voigt, K. I. (2017), "Sustainable industrial value creation: Benefits and challenges of industry 4.0", *International Journal of Innovation Management*, Vol. 21 No. 8, pp. 1-21.
- Kitchenham, B. (2004). Procedures for Undertaking Systematic Reviews, Joint Technical Report, Keele University (TR/SE-0401) and National ICT Australia, Ltd (0400011T.1).
- Kuś, A., & Pyłacz, P. (2019). The Importance of Information Management in the Context of Industry 4.0: Evidence from the Kuyavian-Pomeranian Forbes Diamonds. *Social Sciences*, 8(6), 169.
- Malmi, T. and Brown, T.A. (2008), "Management Control Systems as a package – Opportunities, challenges and research directions", *Management Accounting Research*, Vol. 19 No. 4, pp. 287-300.
- McAfee, A., Brynjolfsson, E., Davenport, T.H., Patil, D. and Barton, D. (2012), "Big Data. The Management Revolution", *Harvard Business Review*, Vol. 90 No. 10, pp. 61-67.
- Mello, R., Leite, L.R. and Martins, R.A. (2014), "Is Big Data the Next Big Thing in Performance Measurement Systems", *Proceedings of the Industrial and Systems Engineering Research Conference*, Montreal, Canada, May 3.
- Meritum, P. (2002), *Guidelines for Managing and Reporting on Intangibles*, Fundacion Airtel-Vodafone, Pennsylvania.
- Morris, R.D. (1987), "Signalling, agency theory and accounting policy choice", *Accounting and Business Research*, Vol. 18, pp. 47-56.
- Mouritsen, J., Larsen, H.T. and Bukh, P. (2001), "Intellectual capital and the 'capable firm': narrating, visualising and numbering for managing knowledge", *Accounting, Organizations and Society*, Vol. 26 No. 7, pp. 735-762.

- Petty, R. and Guthrie, J. (2000), "Intellectual capital literature review: measurement, reporting and management", *Journal of Intellectual Capital*, Vol. 1 No. 2, pp. 155-176.
- Pisano, S., Lepore, L., Lamboglia, R. (2017). Corporate disclosure of human capital via LinkedIn and ownership structure. *Journal of Intellectual Capital*, Vol. 18 No. 1, pp. 102-127.
- Ramassa, P. and Di Fabio, C. (2016), "Social media for investor relations: a literature review and future directions", *The International Journal of Digital Accounting Research*, Vol. 16, pp. 117-135.
- Raffoni, A., Bartolin, M., Visani, F. and Silvi, R. (2018), "Business Performance Analytics: Exploring the Potential of Performance Management Systems", *Production Planning and Control*, Vol. 29 No. 1, pp. 51-67.
- Ransbotham, S., Kiron, D. and Kirk Prentice, P. (2015), "The Talent Dividend, The 2015 Data & Analytics Report", MIT Sloan Management Review & SAS. Accessed 13 November 2020 at <http://sloanreview.mit.edu/projects/analytics-talent-dividend/>.
- Riemer, K. and Scifleet, P. (2012), "Enterprise social networking in knowledge-intensive work practices: a case study in a professional service firm", *Proceedings of the 23rd Australasian Conference on Information Systems*, Geelong, Victoria, December 3-5.
- Rodriguez, R., Svensson, G. and Mehl, E. J. (2020), "Digitalization process of complex B2B sales process - Enablers and obstacles", *Technology in Society*, Vol. 62, pp. 1-12.
- Schaper, S., Nielsen, C. and Roslender, R. (2017), "Moving from irrelevant intellectual capital (IC) reporting to value-relevant IC disclosures: key learning points from the Danish experience", *Journal of Intellectual Capital*, Vol. 18 No. 1, pp. 82-101.
- Secundo, G., Del Vecchio, P., Dumay, J. and Passiante, G. (2017), "Intellectual capital in the age of Big Data: Establishing a research agenda", *Journal of Intellectual Capital*, Vol. 18 No. 2, pp. 242-261.
- Secundo, G., Ndou, V., Del Vecchio, P., & De Pascale, G. (2020). Sustainable development, intellectual capital and technology policies: A structured literature review and future research agenda. *Technological Forecasting and Social Change*, 153, 119917.
- Saunders, M., Lewis, P. and Thornhill, A. (2009). *Research methods for business students*, Pearson Education Limited.
- Stewart, T.A. (1991), "Brainpower: how intellectual capital is becoming America's most valuable asset", *Fortune*, Vol. 3, pp. 44-60.
- Striukova, L., Unerman, J. and Guthrie, J. (2008), "Corporate reporting of intellectual capital: evidence from UK companies", *The British Accounting Review*, Vol. 40 No. 4, pp. 297-313.
- Turban, E., Bolloju, N., & Liang, T. P. (2011). Enterprise social networking: Opportunities, adoption, and risk mitigation. *Journal of Organizational Computing and Electronic Commerce*, 21(3), 202-220.
- Warren, J.D., Moffitt, K.C. and Byrnes, P. (2015), "How Big Data will change accounting". *Accounting Horizons*, Vol. 29 No. 2, pp. 397-407.
- Whiting, R. H., & Miller, J. C. (2008). Voluntary disclosure of intellectual capital in New Zealand annual reports and the "hidden value". *Journal of Human Resource Costing & Accounting*.

Williams, S.M. (2001), "Is intellectual capital performance and disclosure practices related?", *Journal of Intellectual Capital*, Vol. 2 No. 3, pp. 192-203.

Wu, J., Guo, S., Huang, H., Liu, W. and Xiang, Y. (2018), "Information and communications technologies for sustainable development goals: State-of-the-art, needs and perspectives", *IEEE Communications, Surveys & Tutorials*, Vol. 20 No. 3, pp. 2389-2406.

Xu, J. and Wang, B. (2018), "Intellectual capital, financial performance and companies' sustainable growth: evidence from the Korean manufacturing industry", *Sustainability*, Vol. 10 No. 12, p. 4651.

Zarowin, P. and Lev, B. (1999), "The boundaries of financial reporting and how to extend them", *Journal of Accounting Research*, Vol. 37 No. 2, pp. 353-385.

Zhou, A.Z. and Fink, D. (2003), "The intellectual capital web: a systematic linking of intellectual capital and knowledge management", *Journal of Intellectual Capital*, Vol. 4 No. 1, p. 3.