



Economia Aziendale Online

# Economia Aziendale Online

Business and Management Sciences  
International Quarterly Review

Understanding and Exploring Digital  
Technologies Effect on Sustainability  
Management Control: An interpretive case study

Daniele Giordino

Luca Maria Manzi

Francesca Culasso

Pavia, March 31, 2024  
Volume 15 – N. 1/2024

DOI: 10.13132/2038-5498/15.1.165-184

[www.ea2000.it](http://www.ea2000.it)

[www.economiaaziendale.it](http://www.economiaaziendale.it)



PaviaUniversityPress

# Understanding and Exploring Digital Technologies Effect on Sustainability Management Control: An interpretive case study

---

Daniele Giordino, PhD

Assistant

Department of Management  
"Valter Cantino". University of  
Turin, Italy, IT.

Luca Maria Manzi

Associate professor

Department of Management  
"Valter Cantino". University of  
Turin, Italy, IT

Francesca Culasso

Full professor

Department of Management  
"Valter Cantino". University of  
Turin, Italy, IT

---

## Corresponding Author:

Daniele Giordino

*daniele.giordino@unito.it*

---

## Cite as:

Giordino, D., Manzi, L. M., &  
Culasso, F. (2024). Understanding  
and Exploring Digital  
Technologies Effect on  
Sustainability Management  
Control: An interpretive case  
study. *Economia Aziendale Online*,  
15(1), 165-184.

---

## Section: *Refereed Paper*

---

**Received:** February 2024

**Published:** 31/03/2024

## ABSTRACT

This paper aims to explore the impact of digitalization on corporations' sustainability management control (SMC), as well as comprehend the effects digitally empowered SMC has in promoting corporations' sustainability performance. This research employs a qualitative case study approach by gathering empirical data from a corporation operating within an environmentally sensitive sector (cement sector), regarded as highly polluting. The foregoing context has been chosen because it is believed to offer material insights in relation to the integration of sustainability logics into a broader corporate framework and SMC. The selected corporation utilises SMC systems and practices, as well as various digital tools and technologies to support its sustainability operations, performance evaluation and innovation processes. Fundamentally, this article provides readers with empirical evidence highlighting the role digital technologies have in facilitating SMC collection, analysis and evaluation processes. Nevertheless, this study finds that the integration of digital technologies in SMC raises new challenges and concerns for managers and corporations. The insights deriving from this body of work should prove useful in underlining the importance of digital technologies' effect on corporations' sustainability performance thus supporting the twin transition notion. From a theoretical perspective, this manuscript expands the literature strand on twin transition and digitally empowered SMC. From a managerial standpoint, this article emphasises the role digital technologies have within SMC and sustainability performance and practices hence promoting its addition within firms operating in environmentally sensitive and controversial sectors.

Questo articolo si propone di esplorare l'impatto della digitalizzazione sul controllo di gestione della sostenibilità (SMC) delle aziende, nonché di comprendere gli effetti che l'SMC digitalmente potenziato ha nel promuovere le prestazioni di sostenibilità delle aziende. Questa ricerca utilizza un approccio qualitativo di studio di casi raccogliendo dati empirici da una società che opera all'interno di un settore sensibile dal punto di vista ambientale (settore del cemento), considerato altamente inquinante. Il contesto di cui sopra è stato scelto perché si ritiene

che offra spunti concreti in relazione all'integrazione delle logiche di sostenibilità in un più ampio quadro aziendale e di SMC. L'azienda selezionata utilizza i sistemi e le pratiche SMC, nonché vari strumenti e tecnologie digitali per supportare le sue operazioni di sostenibilità, la valutazione delle prestazioni e i processi di innovazione. Fondamentalmente, questo articolo fornisce ai lettori evidenze empiriche che evidenziano il ruolo che le tecnologie digitali hanno nel facilitare i processi di raccolta, analisi e valutazione delle SMC. Tuttavia, questo studio rileva che l'integrazione delle tecnologie digitali in SMC solleva nuove sfide e preoccupazioni per i manager e le aziende. Le intuizioni derivanti da questo corpus di lavori dovrebbero rivelarsi utili per sottolineare l'importanza dell'effetto delle tecnologie digitali sulle prestazioni di sostenibilità delle aziende, supportando così il concetto di duplice transizione. Da un punto di vista teorico, questo lavoro amplia il filone della letteratura sulla doppia transizione e sulla SMC digitalmente potenziata. Da un punto di vista manageriale, questo articolo sottolinea il ruolo che le tecnologie digitali hanno all'interno delle prestazioni e delle pratiche di SMC e sostenibilità, promuovendone l'integrazione all'interno delle aziende che operano in settori sensibili e controversi dal punto di vista ambientale.

---

**Keywords:** sustainability, digitalization, management accounting, management control systems, corporate social responsibility, twin transition.

---

## 1 – Introduction

### 1.1 – Framework

In recent years, scholars, managers and policymakers have directed their efforts towards addressing sustainability and corporate responsibility in an attempt to handle corporate actions and their consequences for the environment and society (Fatima and Elbanna, 2023). The raising awareness of global issues such as climate change, global poverty, gender equality and health crises has mobilised policymakers, international organisations and governments to develop and formulate joint strategies to tackle the foregoing hurdles (Eckert and Kovalevska, 2021; Pavione *et al.*, 2020). Prominent examples of such policies are the EU Green Deal (Eckert and Kovalevska, 2021) and the United Nations' (UN) Agenda for Sustainable Development Goals (SDGs) (United Nations, 2023).

The private corporate sector plays an important role in pursuing a sustainable future (Atkinson, 2000; Gorini *et al.*, 2021) and corporations increasingly recognise the potential for sustainability practices to yield a competitive advantage (Porter and Kramer, 2011). However, businesses must commit significant organisational and financial resources towards incorporating sustainability into their strategic plan, decision making and managerial processes (Lisi, 2015). Indeed, organisations and managers struggle to integrate sustainability practices, as these environmental and social performance proves difficult to measure and can often conflict with corporations' financial objectives (Beusch *et al.*, 2022). Nonetheless, managers can rely on and engage with accounting practices, such as sustainability management control (SMC), to facilitate the identification of desired social and environmental impacts, as well as the collection, communication and analysis of information related to sustainability practices (Beusch *et al.*, 2022; Henning *et al.*, 2023; Schaltegger *et al.*, 2022). SMC can be defined as management accounting tools and systems that link the organisational strategy with operations, offering guidance, information and direction, thus helping organisations monitor their sustainable

practices and procedures to enhance businesses sustainability performance (Lueg and Radlach, 2016; Johnstone, 2019).

The integration of sustainability logics into management control has undoubtedly evolved significantly since the initial formulation of SMC. Nonetheless, scholarly articles continue to underscore a potential lack of engagement and action from corporations, leaving SMC susceptible to the accusation of greenwashing (Beusch *et al.*, 2022; Gond *et al.*, 2012; Henning *et al.*, 2023). The inherent complexities of corporate sustainability, the lack of appropriate internal communication and data sharing technology, and the lack of suitable data or data collection technology could undermine SMC impact and hinder their contribution to corporate sustainability (Broccardo *et al.*, 2023; Fährdrich, 2023; Omran and Yaaqbeh, 2023; Owusu and Korankye, 2023). However, part of the scholarly discourse surrounding SMC argues that advanced information and communication technology, machines and data analysis tools amongst other could facilitate businesses effective use and integration of SMC to promote sustainability performance and nurture actual change over greenwashing (Bhimani, 2020; Gazzola and Amelio, 2014; Möller *et al.*, 2020; Omran and Yaaqbeh, 2023; Ranta *et al.*, 2023). Consequently, SMC must undergo profound changes because of digital technologies such as artificial intelligence (AI), enterprise resource planning (ERP) systems and information communications technology (ICT) amongst others (Bhimani, 2020; Broccardo *et al.*, 2023; Fährdrich, 2023; Quattrone, 2016). Additionally, SMC practices should play an active role in addressing digital opportunities since digitalization is one of the most important pillars of the Fourth Industrial Revolution (Bargoni *et al.*, 2023; Bresciani *et al.*, 2021a). Indeed, by mixing traditional and digital management control practices, corporations and managers have the opportunity to develop new key performance indicators (KPIs), organisational strategies, objective and key results systems whose purpose is to address global challenges and nurture the organisations competitive advantage and positioning (Korhonen *et al.*, 2020; Möller *et al.*, 2020; Pashkevich *et al.*, 2023; Ranta *et al.*, 2023). Finally, digitally empowered SMC should help corporations integrate sustainability and financial performance into their sustainability strategy, performance evaluation and innovation practices (Broccardo *et al.*, 2023; Fährdrich, 2023).

Integrating digital technologies with SMC to pursue corporate sustainability should lead to what has been defined as “Twin Transition” (Ferreira *et al.*, 2022). The foregoing notion refers to organisations and economies double transition towards a sustainable and digital economy. However, the scholarly literature contribution to unravel the role of digital tools in promoting a more sustainable economy and business practices remain limited and fragmented (Ferreira *et al.*, 2022; Foquet and Hippe, 2022). Indeed, scepticism persists regarding the actual positive effects of the digitization process and its synergies with environmentally sustainable economies (Ferreira *et al.*, 2022; Foquet and Hippe, 2022). Therefore, since digital transformation cannot be stopped, additional empirical research is required to further clarify the link between digitalization and sustainability and how corporations can adopt an ethical approach to it (Guandalini, 2022). Fundamentally, there is a need to explore the twin transition from an organisational perspective (Guandalini, 2022). Henceforth, recognizing the call for additional empirical research on the effects of SMC on corporate sustainability (Beusch, *et al.*, 2023; Gosh *et al.*, 2019), and the influence of digitalization on SMC (Begkos *et al.*, 2023; Fährdrich, 2023; Pashkevich *et al.*, 2023) in promoting corporate sustainability practices and performance (Henning *et al.*, 2023; Knudsen, 2020; Möller *et al.*, 2020; Ranta *et al.*, 2023; Schaltegger *et al.*, 2022)

the authors have formulated the following research question to address the foregoing research gaps and contribute to the literature strand concerning twin transition, SMC and digitalization:

*RQ: How can digitalization empower corporations' SMC and promote their sustainability performance and practices?*

## **1.2 – Methods and aim of this research**

Considering the scope and aim of this study, the authors deemed relevant the utilisation of the “contingency theory” since it examines how context variables affect management accounting practices (Henning *et al.*, 2023; Knudsen, 2020). To address this manuscript research question, the authors employ a qualitative case study approach since it allows for the provision of an holistic perspective towards: a) examining the role of digitalization within the SMC processes of a firm; b) investigate in depth an exemplar case thereby uncovering the participants opinions on digitalization effect on sustainability performance and practices; and c) capture potentially new emerging concepts thus extending the existing literature strand in the field of digitally empowered SMC and twin transition.

Following the proposal made by Chatterji and Toffel (2010), as well as the industry-based classification (Cho and Patten, 2007) and score developed by Emma and Jennifer (2021), the authors chose a corporation operating within the cement sector as the focus of this study because it exists in an industry defined as environmentally sensitive. Therefore, the potential sustainability impact of a firm operating within the cement sector provides contextual elements that are fertile ground for sustainability rationales associated with SMC practices and the notion of twin transition (Henning *et al.*, 2023).

Overall, this manuscript provides the following main insights: 1) digitally empowered SMC facilitates corporations monitoring (data collection, analysis and communication) activities of their sustainability performance and operations; 2) the integration of digital tools within SMC helps managers and decision makers establish new KPIs and initiatives aimed at promoting sustainability; 3) digital technologies help streamline processes thus reducing the costs associated with SMC; 4) digital technologies enable stakeholder engagement hence promoting a collaborative approach amongst various actors to develop appropriate SMC systems and sustainability operations; and 5) digitally empowered SMC challenges companies data security and privacy and it creates a risk for an overreliance on technology and data visualisation.

The paper offers the following theoretical and practical contributions. First, it explores whether the influence of digital technologies integration in corporations' SMC systems and practices helps enhance and promote companies' sustainability performance and operations. This approach is novel as it addresses the various research gaps discussed in the foregoing paragraphs. Second, since digitalization has been one of the main vectors for economic growth and it has the potential to retain that role for a long period of time (Popkova *et al.*, 2022), it is important to address its potential synergies and role in pursuing the twin transition as defined by Ferreira *et al.* (2022). Therefore, this paper informs managers of digital technologies' effect on corporate SMC practices and systems thus underlining digitalization impact on sustainable development. Finally, this study contributes to the literature underlying the contingency theory as an appropriate notion to examine how context variables affect SMC (Henning *et al.*, 2023; Knudsen, 2020).

The remainder of this paper is structured as follows: *Section 2* contains a brief review of the existing literature concerning the examined topics. *Section 3* depicts the methodological approach adopted, while *Section 4* illustrates this study's empirical findings. *Section 5* features the discussion and the analysis of how the obtained results fit within the existing literature. *Section*, this manuscript concludes with its practical and theoretical implications, along its limitations and suggestions for future research directions.

## **2 – Theoretical background**

The present manuscript finds its theoretical foundation with the utilisation of the contingency theory since it is considered an appropriate theoretical framework to examine the variables affecting management and accounting practices (Henning *et al.*, 2023; Knudsen, 2020). The contingency theory approach positions SMC effectiveness as dependent on whether certain contingency factors (economic, contextual, operational amongst others) allow for companies to implement SCM (Henning *et al.*, 2023; Knudsen, 2020).

### **2.1 – From traditional to sustainability management control**

Management control systems have been defined by Malmi and Brown (2008:) as “systems, rules, practices, values and other activities” that gather information and data to evaluate the performance of various actors and processes within an organisation. Indeed, management control should shape organisations practices, strategy and pursuit of corporate goals (Lisi, 2015). However, traditional management control focuses on the economic rationale behind corporate actions thus failing to integrate the environmental and social elements of the sustainability logics (Bhimani, 2020; Henning *et al.*, 2023). Therefore, considering today's societal and organisational interest in promoting sustainable development, companies should integrate social and environmental concerns into their management control practices fostering green and ethical performance and behaviours (Henning *et al.*, 2023). The foregoing shortcoming of traditional management control and the ever-increasing need for companies to address environmental, social and ethical issues led to the development of SMC (Beusch *et al.*, 2022; Henning *et al.*, 2023; Schaltegger *et al.*, 2022). SMC supports companies' identification, collection, communication and analysis of their social and environmental impact thus dealing with the sustainability notion in its entirety (social, environmental and economic) (Schaltegger *et al.*, 2022). Hence, SMC offers guidance, information and direction concerning businesses sustainable practices and procedures to promote sustainability performance (Lueg and Radlach, 2016; Johnstone, 2019). Indeed, there is empirical evidence suggesting SMC influence over management teams and employees' behaviours and commitment (Lisi, 2015).

### **2.2 – Digital transformation of sustainability management control**

Over the last few years, scholars and companies have observed the pervasiveness of digital technologies into SMC practice and systems (Broccardo *et al.*, 2023). Indeed, digitalization has disrupted the company landscape and has led to the creation of new business models (Broccardo *et al.*, 2023; Fähndrich, 2023; Quattrone, 2016). Therefore, organisations can exploit the opportunities brought by digital technologies to enhance their performance and value creation processes (Broccardo *et al.*, 2023; Quattrone, 2016).

Knudsen (2020) defines digitalization or digital transformation as the organisational shift driven by digital technologies and data to create new revenue streams, enhance business, transform processes and create an environment promoting digital business models. At the core of digitalization remains digital information since it has the potential to disrupt strategies, decision making processes, norms and notions (Knudsen, 2020) thus underlining the link that exists between digital tools, analogue information and corporations' SMC (Begkos *et al.*, 2023; Fährndrich, 2023; Pashkevich *et al.*, 2023). However, despite the link that exists between digital technologies and SMC, the literature on the foregoing research topic remains at its infancy (Begkos *et al.*, 2023; Fährndrich, 2023; Pashkevich *et al.*, 2023). Indeed, scholars call for additional empirical research investigating the effects digital technologies have on SMC and whether digitally empowered SMC can nurture corporations' sustainability performance and practice (Henning *et al.*, 2023; Knudsen, 2020; Möller *et al.*, 2020; Ranta *et al.*, 2023; Schaltegger *et al.*, 2022). Therefore, this manuscript is a first attempt at shedding light on the foregoing notions by addressing the research gaps discussed in section 1 of this article.

### 3 – Research design

The aim of this article is to inquire into how digitalization affects corporations' SMC and sustainability performance and practices. The authors employed a case study method because it allows in-depth and contextually rich analysis of accounting and management practices within a specific context (Lillis, 1999; Yin, 2013). In fact, case study methods are appropriate for asking "how" questions concerning complex and contemporary phenomena and events (Yin, 2013). Furthermore, the authors deemed the case study approach relevant because this manuscript's aim is to describe and understand (Eisenhardt, 1989) the digitalization effects on SMC and how the relationship between the two elements unfolds without defining their prior correlations (Cavaye, 1996).

This research seeks to explore and explain the meanings attached to digitalization and the SMC. This is done by considering them within the general corporate context and examining the behaviours and opinions of the various internal stakeholders involved (Cepeda and Martin, 2005; Walsham, 2006; Walsham, 1995). Consequently, the authors deemed appropriate to conduct an interpretive case study. According to interpretivism, reality and our knowledge of it are products of social processes enacted and shaped by the involved actors (Cepeda and Martin, 2005; Jyoti and Efpraxia, 2023; Walsham, 2006). Therefore, considering the studied phenomenon, it is important for researchers seeking to gain a comprehensive understanding of digitalization contribution and effects of SMC performance and practices to thoroughly examine the world and context of the actors partaking into those processes and norms (Orlikowski and Baroudi, 1991).

#### 3.1 – Empirical setting

This interpretative case study focuses on the European division of an Italian cement company. The company name has been anonymized thus the selected organisation will be referred to as ItaCem.

ItaCem was founded in 1907 and it is headquartered in Piedmont, Italy. Nonetheless, ItaCem spans its presence in over 14 countries, and it is listed in the FTSE Italia Mid Cap of the Milan Stock Exchange with a capitalization of over 6 billion euro. The authors deemed appropriate to

focus on ItaCem European division since most of its operations are located within European countries. The selected corporation produces cement, concrete and natural aggregates. Therefore, following the industry classification (Cho and Patten, 2007) and score (Emma and Jennifer, 2021), ItaCem should be considered as a corporation operating in an environmentally sensitive sector. Henceforth, ItaCem sustainability impact provides fertile ground for researchers to investigate the effects of digitally empowered SMC and its effects on sustainability performance and practices (Henning *et al.*, 2023).

ItaCem was selected because of its commitment to sustainability. In fact, ItaCem first introduced SMC practices in 2008 and has started to integrate digital technologies into its SMC operations since 2015. Furthermore, ItaCem sustainability commitment transpires from its many initiatives aimed at promoting the economic wellness and safety of rural communities, grants aimed at promoting students' education, its collaboration with Lega Ambiente, Lipu Onlus amongst others, and its intensive programmes of environmental recovery. Finally, ItaCem has integrated environmental and social sustainability concerns into its strategy and business model.

### 3.2 – Data collection and analysis

The authors gathered empirical material from prolonged engagement with ItaCem through interviews, documentary evidence and reports such as sustainability reports, code of conducts, guidelines, minutes of meetings, action lists, status KPIs reports and budgets. The foregoing process occurred for over three months in which the first author visited various ItaCem establishments and was able to conduct field observations on three occasions. During said visits, the first author was able to take field notes and make onsite observations. Therefore, this manuscript ensures triangulation and internal validity since the empirical material utilised are derived from several sources (Miles and Huberman, 1994).

The authors employed theoretical sampling to interview individuals from all involved parties to ensure maximum coverage and sample diversity (Eisenhardt, 1989). Convenience and snowball sampling were also utilised which meant that participants involved in SMC were asked to take part in the empirical research which meant that the actors involved were mainly from the accounting, operational and administrative departments. However, following the work of Robinson, 2014, the authors conducted preliminary interviews to then select the final interviewees. Those initial interviews were meant to assess actors' knowledge, understanding and involvement in the digitization process of SMC and sustainability evaluation practices.

The authors conducted interviews that followed an open-ended structure. The interviews took place on ItaCem properties and were conducted face-to-face. The interviews lasted from 20 to 90 minutes. The interviews were recorded and then transcribed so that the interviewees could review, make corrections and provide clarifications on the transcripts (Hayne, 2022). Table 1 presents the interviewees profile. The authors approach to interviews is to position themselves as active learners and listeners. Therefore, the authors tried to keep their own words to a minimum so that participants could express their experiences, think out loud and provide examples (Yin, 2013). The authors did use prompting questions to refocus participants to talk about the digitalization and SMC link by pointing out examples they previously mentioned. Furthermore, the initial parts of the interviews were used to gain additional contextual knowledge of ItaCem beyond the publicly available reports.



Theoretical saturation was achieved after 18 interviews. The authors assessed and interpreted the empirical material while conducting other interviews and this led to the conclusion that there was no need for additional interviews since the introduction of novel concepts come to a halt, while the existing and already established themes were well developed (Malsch and Salterio, 2016).

**Table 1 – Interviewees Profile and Interviews Length**

Identifier	Job Position	Interview Length (min.)
CO1	Controller	60
PM	Performance Manager	65
CO2	Controller	60 and 15
PPD	Production Plant Director	70
PM1	Production Manager	60
SOM	Sustainability Operational Manager	90
SM	Strategic Manager	30
UP	Unit Planner	45
PLM	Production and Logistics Manager	60 and 30
CH1	Chemist	45
PH	Physicists	90 and 15
CH2	Chemist	30
CAM	Cost Accounting Manager	50 and 15
CM	Compliance Manager	80

When it comes down to the data analysis, the authors followed a bottom-up approach thus applying the interpretative paradigm (Cepeda and Martin, 2005; Walsham, 2006; Walsham, 1995). In doing so, the authors of this manuscript were able to investigate the interactions occurring between the actors and the digitization process of SMC within their broader context and constructed understanding and meanings. Indeed, this led to the opportunity to better comprehend and study the digitalization aspects of SMC and sustainability performance practices and evaluation. The empirical material was continuously inquired to link the identified concepts with those emerging from the existing scholarly literature. Therefore, the authors of this manuscript conducted cross comparison between the empirical material obtained from archival data, documentary evidence and interviews (Eisenhardt, 1989).

The authors utilised the existing literature to analyse and interpret the obtained empirical material since the coding process was informed and built upon a coding scheme derived from

the scholarly literature and previous work on digitalization, SMC, twin transition, sustainability performance and practices.

The authors conducted the data interpretation process as follows. The first order data consists of interviewees' constructs whereas the second order concepts are developed by the authors of this manuscript through an analysis of the extant literature (Cepeda and Martin, 2005; Walsham, 2006; Walsham, 1995). The authors' interpretation of the empirical material was informed by the contingency theory.

## 4 – Findings

### 4.1 – Digital tools effect on SMC monitoring and sustainability performance

The authors were able to observe a common theme surrounding digitally empowered SMC systems' positive effect on ItaCem monitoring (data collection, analysis and communication) activities. Indeed, respondents typified and stated:

*“The introduction of technologies has strengthened and empowered our colleagues. Through ICT, we are able to innovate together our SMC processes and commit to the three pillars of sustainability.”*

*“...sensors and internal data sharing platforms enable the collection and analysis of data from various departments and divisions. In doing so, we are able to quickly adapt our production and sourcing practices to ensure we meet our internal code of conduct and the expected performance concerning environmental and social sustainability.”*

More specifically, ItaCem digitally empowered SMC monitoring activities allows them to track their sustainability impact on various processes and operations. For examples, some respondents stated:

*“the introduction of digital tools within our SMC has greatly improved our monitoring ability and accuracy across all of our European factories...for example, we can now reliably track the environmental impact of our finished goods and assess our production impact on our workforce and local community amongst other elements.”*

ItaCem's digitally empowered SMC system helped accounting and administrative departments establish internal reports that promoted the identification of new KPIs. Through digital tools, ItaCem professionals and managers were able to enhance the data analysis practices and better support the decision-making process and strategic vision of the company. Indeed, some respondents report:

*“the communication and visual representation of status KPIs has fastened and simplified the steps required to produce quarterly action lists whose sole target is to guide and assess managers and departments alignment and achievement of our sustainability objectives.”*

*“...data management platform facilitates the collection and analysis of measurable variables associated with our production. Consequently, it is easier to add new KPIs to our first time right (FIT) assessment and enterprise resource planning. This allows us to promote decision making rationales supporting social and environmental sustainability.”*

*"...digital technologies facilitate the process necessary to certify all manufacturing sites to the ISO 14001, ISO 45001..."*

#### **4.2 – Operational and sustainability benefits**

The empirical data obtained from ItaCem does underline the positive effect that digitally empowered SMC has on companies' operational costs and sustainability performance. Indeed, some interviewees report:

*"The integration of technology within our ERP and FIT systems has allowed us to reduce the costs normally associated with production lines since it is possible to identify inefficiencies and reduce waste and faulty outcomes."*

*"...formulating with renewable materials and re-refined sources is possible because of our effective use of SMC, technology and our strategic commitment to sustainability goals as depicted within our code of conduct and global sustainability statement."*

*"Indeed, I would agree with the idea that SMC should help companies reduce operational costs...however, it is important to appropriately utilize digital tools insights..."*

Furthermore, interviewees underline the importance of integrating and innovating traditional tools of management accounting such as budgets and forecasted estimates to promote SMC practices and performance.

*"...budgets, real-time data and estimates nurture SMC ability to evaluate operational costs and sustainability projects and objectives..."*

#### **4.3 – Collaborative endeavours**

Digitalization does enable collaborative activities and stakeholder engagement practices within the context of SMC and performance evaluation. For example, some of the quote gathered from the interviewee say:

*"It is much easier now [since digital tools have been integrated into SMC] to consider our suppliers data, KPIs and performance for the life cycle assessment of our products."*

*"It [supply management tool] require of us to gather and manage large quantities of data from our suppliers and the use of tech surely does help integrate those evaluations into SMC"*

*"the SMC process is a participatory one...chemists and physicists contribute to it... thanks to managers' interest in collaborating with ItaCem's internal actors. This was possible thanks to ICT, data sharing and knowledge management systems."*

#### **4.4 – Challenges associated with digitally empowered SMC**

Despite the previously identified concepts, the interviewees discussed some challenges and risks associated with digitally empowered SMC. The overreliance on digital tools could hinder the SMC. For examples, some actors typified and stated:

*“...there are risks associated with the over reliance on visual modes...our deviation visualization system, if used improperly, does dilute quarterly measurement evaluation processes and status KPIs reports.”*

*“Machine and data analysis systems cannot be considered a substitute to management and accounting analysts’ interpretation of data”.*

*“The implemented tools cannot position and interpret the company’s KPIs in relation to our goals, vision and long-term targets. Therefore, the human component remains central to our SMC practices.”*

The use of data visualization modes to shorten reports does create the opportunity for managers and other employees to misrepresent sustainability performance to obtain bonuses and other benefits.

*“Technologies can dilute sustainability data to numerical indicators and visual modes ...managers can decontextualize information and intentionally misinterpret it to promote their own personal agenda...”*

Whereas there are some empirical materials underlining the necessity for ItaCem to enhance their data security and privacy systems to ensure that susceptible information is not leaked.

*“Communicating our products formulation across various departments does expose us to cyber security risks.”*

*“Of course, there are risks associated with digital tools integration in SMC operations. ...we have to be mindful when sharing information...”*

## 5 – Discussion

This manuscript empirical data supports the notion of twin transition as it showcases the positive effects digitally enabled SMC systems have on corporations’ sustainability performance and practices (Ferriera *et al.*, 2022; Popkova *et al.*, 2022). Corporations must take into account sustainability concerns within their decision-making processes; hence, this means management accounting plays a significant role in detecting companies and operations impact on environmental, social and economic aspects of sustainability (Beusch *et al.*, 2023; Broccardo *et al.*, 2023; Fährndrich, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012; Schaltegger *et al.*, 2022). When SMC is supported and well integrated with digital technologies, large corporations can easily adopt and evaluate effective sustainability plans and strategies (Beusch *et al.*, 2023; Broccardo *et al.*, 2023; Fährndrich, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012; Schaltegger *et al.*, 2022). This is possible because digitalization allows a more realistic and reliable collection, analysis and communication of information meant to support the efficient utilisation of corporations’ available resources (Abdelhalim, 2023; Fährndrich, 2023). Indeed, digitally empowered SMC systems and practices are then able to better support corporations decision-making practices by informing managers of the company’s sustainability performance (Abdelhalim, 2023; Henning *et al.*, 2023). However, it is important to underline that it is essential for firms to support sustainability actions through strategies, business models and management support since digital SMC can only serve as a supporting system to the decision making process (Abbas *et al.*, 2023; Abdelhalim, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012).

The digitalization of SMC should help companies assess the sustainability of the supply chain since tools such as ICT and big data support operational performance through real-time monitoring activities and stock management (Abdullah *et al.*, 2022). Through digital tools, corporations can guide suppliers to address challenges associated with sustainability issues since digitalization allows for the analysis of operational contexts, financial and economic outcomes thus promoting strategic objectives targeted towards a sustainable development (environmental, social and economic) (Abdelhalim, 2023; Zhang *et al.*, 2018).

The use of digital tools within SMC allows companies to measure, observe and establish new KPIs for different operations since digital tools should enable strong monitoring and evaluation activities at a lower cost in comparison with traditional modes (Bergmann *et al.*, 2020; Lisi, 2015). This is possible because digital technologies can help corporations integrate product life cycle analysis and FIT metrics into SMC (Abdelhalim, 2023; Lisi, 2015).

Digital SMC can also support companies sustainability ambitions by assisting managers with the calculation and evaluation of the costs and potential revenues associated with the execution of sustainability activities (Abdelhalim, 2023; Bergmann *et al.*, 2020; Henri *et al.*, 2014; Schaltegger *et al.*, 2022; Warren *et al.*, 2015). Indeed, digitally empowered SMC should easily help managers monitor the progress of sustainability projects and promote the achievement of the set objectives thanks to real-time data, budgets, financial analytics and forecasted estimates (Alvarez *et al.*, 2021; Bergmann *et al.*, 2020).

Digital tools help companies streamline accounting practices thus reducing the costs normally associated with SMC (Bergmann *et al.*, 2020; Henning *et al.*, 2023; Henri *et al.*, 2014; Korhonen *et al.*, 2020; Quattrone, 2016). Big data, ERP and ICT help companies reduce the financial impact traditionally associated with SMC, thereby improving firms financial performance (Knudsen, 2020). Digitally empowered SMC helps companies improve cost control and productivity practices thus enhancing companies returns (Warren *et al.*, 2015). The obtained empirical results showcase how digitally empowered SMC helped ItaCem strengthen their FTR metrics thus reducing their manufacturing costs while also improving the manufacturing sustainability performances. This main concept developed from the empirical data obtained contributes to the discourse surrounding the conflicting nature of sustainability and economic rationales (Henning *et al.*, 2023). Indeed, this manuscript supports the literature strand that links companies' economic motivations with sustainability practices and performance evaluations (Henning *et al.*, 2023; Knudsen, 2020; Quattrone, 2016).

The empirical data obtained suggests that digitally empowered SMC fosters collaboration between companies various departments and professionals (internal perspective) thus different experiences, expertise and knowledge of a corporation processes and practices can be fed into SMC to promote sustainability (Möller *et al.*, 2020; Popkova *et al.*, 2022). For example, ICT technologies can nurture appropriate stakeholder engagement practices within SMC formulation and development to promote agile organisational forms and control models (Oesterreich *et al.*, 2019). Furthermore, digital communication and cooperation allows professionals outside the management and administrative departments to participate in the formulation of new KPIs and practices to support companies sustainability actions (Broccardo *et al.*, 2023; Fährdrich, 2023; Möller *et al.*, 2020). Indeed, the empirical data of this study underlines the contribution some physicists and chemists had in promoting and supporting the integration of new norms and practices that greatly reduced the environmental and social impact of some ItaCem production lines. This collaborative environment nurtured through

digital technologies does positively affect employees' behavioural aspects since they believe their suggestions can impact SMC thus promoting bottom-up support of sustainability operations (Malmi and Brown, 2008).

From an external stakeholders' perspective, digitally empowered SMC helps companies gather information concerning their suppliers and distributors sustainability endeavours. By doing so, organisations are able to assess the sustainability of their value chain and select partners that align with their principles and values of sustainability (Broccardo *et al.*, 2023; Fähndrich, 2023). However, it is important to note that data sharing with external stakeholders does challenge digitally empowered SMC data security and privacy (Fähndrich, 2023) hence companies must spend resources and knowledge to ensure their SMC security.

This manuscript findings also highlight some of the challenges that can be associated with companies and managers overreliance on digitally empowered SMC systems and practices. Management accounting is a tool that helps communicate the necessary information to support informed decision making and promote communicative actions between firms, various actors and departments (Abbas *et al.*, 2023; Quattrone, 2016). Equally, the foregoing notion must be applied to digitally empowered SMC since digital tools do not transform SMC into an "answer machine" (Quattrone, 2016). Digitally empowered SMC improves companies ability to know their organisation performance, practices and impact thus revolutionising decision making processes and knowledge gathering systems and actions (Begkos *et al.*, 2023; Beusch *et al.*, 2022; Henning *et al.*, 2023). However, the numerical and qualitative data obtained and measured through digital tools cannot be taken as immutable truths (Gosh *et al.*, 2019; Quattrone, 2016). Indeed, managers and the actors involved in strategic and operative functions which consume data from digitally empowered SMC systems must consume those insights while maintaining and exercising judgement over it so to question and interrogate SMC outputs (Fähndrich, 2023; Pashkevich *et al.*, 2023). This is because the digital revolution focuses on the measurable elements of social and environmental performances thus promoting the use of measurable and controllable KPIs enforcing the "tyranny of transparency" (Quattrone, 2016). Consequently, what cannot be measured and reported by digitally empowered SMC risks to remain marginalised and unaccounted for. Therefore, managers and decision makers should carefully balance digitally empowered SMC information with considerations concerning the company's strategy, operational nature, vision, biases, politics, and epistemological logics and limitations (Quattrone, 2016).

Finally, the empirical findings obtained from ItaCem challenge previous publications of empirical findings concerning the use of visual modes to report companies' performance measurement (Busco and Quattrone, 2015; Cooper *et al.*, 2017; Davison, 2014; Jordan *et al.*, 2018) gathered through digitally empowered SMC. Indeed, this manuscript highlights the positive and potentially negative effects of visual modes generated through digital tools. Digital technologies allow companies and managers to transform their sustainability performance into measurement practices which can heavily rely on visuals relative to the established KPIs and practices. Indeed, the use of visual modes can greatly improve reports length, readability and enhance SMC ability to convey notions and meanings (Knight and Tsoukas, 2019). Moreover, digitally empowered SMC use of visuals can help the communication of new ideas and practices to support corporate sustainability from a bottom-up perspective (Meyers *et al.*, 2018).

However, the empirical material gathered to conduct this study underlines the risks associated with an overreliance on digital technologies capabilities to translate SMC numerical

and textual results into visuals. The overreliance on the visual mode can dilute the information associated with the various sustainability practices and KPIs thus reducing the details of performance reports (Ronzani and Gatzweiler, 2022). Moreover, visual modes can be easily appropriated by different internal stakeholders operating within the organisation to showcase sustainability practices or downplay sustainability risks (Ronzani and Gatzweiler, 2022). In fact, some of the interviewees report the risk of senior managers employing visual modes obtained from digital technologies to mitigate potential failures associated with sustainability practices through interpretative ambiguity (Qu and Cooper, 2011).

## 6 – Conclusion

The present study explores digital technologies' effect on SMC and sustainability practices of a firm operating within an environmentally sensitive industry sector. The obtained findings highlight a potentially positive effect of digitalization on companies SMC effectiveness and sustainability practices thus further supporting the notion of twin transition (Ferreira *et al.*, 2022). However, the empirical material obtained underlines the importance for managers and decision makers to integrate sustainability within companies strategy, values, vision and culture otherwise digitally empowered SMC and management accounting risk to remain peripheral (Abdelhalim, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012). Second, this study empirical findings underlining digital technologies as potential tools to promote SMC effectiveness through cooperative activities and bottom-up innovation in KPIs and sustainability practices (Broccardo *et al.*, 2023; Fähndrich, 2023; Möller *et al.*, 2020). Finally, the obtained empirical results shed light on some potential challenges associated with digitally empowered SMC systems. Examples include over reliance on machine generated data, over reliance on visual modes to communicate sustainability performance, and data impoverishment (Gosh *et al.*, 2019; Quattrone, 2016; Ronzani and Gatzweiler, 2022).

### 6.1 – Theoretical implications

From a theoretical point of view, this study presents empirical material supporting the notion of twin transition (Ferreira *et al.*, 2022; Popkova *et al.*, 2022) since it underlines the positive effects digital technologies have on companies SMC and corporations sustainability performance and practices (Beusch *et al.*, 2023; Broccardo *et al.*, 2023; Fähndrich, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012; Schaltegger *et al.*, 2022). Henceforth, the obtained findings further corroborate the need for larger firms to implement digital tools such as big data, ICT, ERP amongst others within their SMC processes (Beusch *et al.*, 2023; Fähndrich, 2023; Gosh *et al.*, 2019). The obtained findings also highlight the potential for digitally empowered SMC systems and practices to improve the effectiveness of management accounting through stakeholder engagement (Möller *et al.*, 2020; Popkova *et al.*, 2022).

Nonetheless, this manuscript presents empirical evidence further corroborating SMC as a tool supporting decision making processes (Abdelhalim, 2023; Henning *et al.*, 2023). Indeed, it is essential for firms to integrate sustainability notions and rationales within their strategy, vision, common values, norms and culture otherwise digitally empowered SMC systems might remain peripheral and lack real impact (Abdelhalim, 2023; Fähndrich, 2023; Henning *et al.*, 2023). Moreover, the empirical material highlights some potential challenges that firms might encounter when implementing digitally enabled SMC. First, managers should contextualise

data and ensure that there is not an over reliance on machine generated evaluation (Gosh *et al.*, 2019; Quattrone, 2016). Second, data visualisation could prove useful but it could also lead to potential challenges such as data dilution and decontextualization (Busco and Quattrone, 2015; Cooper *et al.*, 2017; Davison, 2014; Jordan *et al.*, 2018). Moreover, this manuscript addresses the research gaps developed in section 1 of this article thus contributing to the body of knowledge surrounding the twin transition, digitalization and SMC. Additionally, this manuscript furthers the literature on contingency theory and its application within the management accounting research field (Henning *et al.*, 2023; Knudsen, 2020). Finally, considering the nature of this literature stream, this paper proposes some directions for future research.

## 6.2 – *Practical Implications*

This manuscript carries several practical implications that could prove useful to managers, CEOs, governments and other legislative entities seeking to promote a sustainable future. First, the empirical evidence analysed within this body of literature suggests the positive effects digital tools should have on companies' SMC practices and systems (Beusch *et al.*, 2023; Broccardo *et al.*, 2023; Fähndrich, 2023; Gosh *et al.*, 2019; Gond *et al.*, 2012; Schaltegger *et al.*, 2022). Second, this body of work emphasises the necessity for companies to establish strategies, cultures, norms, visions and common values that nurture the sustainability dimension of operations. Without such measures, digitally empowered SMC might inadvertently engage in greenwashing, as there is no actual change being implemented (Abdelhalim, 2023; Fähndrich, 2023; Henning *et al.*, 2023). Third, this paper does present some potential challenges and risks that might arise from the introduction of digital tools within corporations SMC (Busco and Quattrone, 2015; Cooper *et al.*, 2017; Davison, 2014; Jordan *et al.*, 2018). Fourth, the obtained findings underline the importance of ICT in promoting collaborative activities aimed at improving SMC effectiveness (Möller *et al.*, 2020; Oesterreich *et al.*, 2019; Popkova *et al.*, 2022). Employees outside of the managerial sphere were able to voice their opinions and expertise (bottom-up support) (Malmi and Brown, 2008). Fifth, this manuscript presents empirical evidence supporting the notion of sustainability performance as positive for the economic rationales of corporations (Abdelhalim, 2023; Bergmann *et al.*, 2020; Henning *et al.*, 2023; Henri *et al.*, 2014; Schaltegger *et al.*, 2022; Warren *et al.*, 2015). Indeed, tools such as FTR metrics can help companies enhance their cost efficiency. Finally, this manuscript underscores the importance of conveying to legislators the necessity to foster professionals and companies' interest in sustainability notions. Moreover, the obtained empirical results stress the concept of digitalization as potentially empowering to practitioners seeking to pursue sustainability matters (Ferreira *et al.*, 2022).

## 6.3 – *Limitations and future research avenues*

This body of work carries several limitations. First, the authors have concentrated their efforts towards exploring a single corporation operating in a sector that is considered to be environmentally sensitive. Therefore, the obtained results refer to a very specific company and cannot be generalised. Second, the authors followed an holistic examination thus there are limitations associated with the employed methodology and theoretical approach. Third, digital tools were grouped within one unique notion (digitalization) thus it was not possible to evaluate potential differences between the various tools and techniques adopted and implemented by



ItaCem. However, future scholarly literature could investigate the effects of one single digital tool on corporations' SMC practices. Moreover, future empirical bodies of work could explore the digitalization effect on SMC through quantitative research methodology to further clarify their relationship. Additionally, it should be interesting to conduct a longitudinal study regarding digitally empowered SMC. Future studies could also investigate the effects various levels of digital readiness and digital literacy have on companies' ability to reap the benefits of digitally empowered SMC. Finally, although the findings of this research cannot be universally applied, they provide a general view of digitally empowered SMC and its impact on sustainability practices and performance. These findings can serve as a foundation for the formulation of new issues concerning data visualisation risk for managers evaluations, data security risks, collaborative efforts and stakeholder engagement effects on digitally empowered SMC amongst others.

## 7 – References

- Abdelhalim, A. M. (2023). How management accounting practices integrate with big data analytics and its impact on corporate sustainability. *Journal of Financial Reporting and Accounting*. <https://doi.org/10.1108/jfra-01-2023-0053>
- Abdullah, N. H. N., Sanusi, S., & Savitri, E. (2022). The role and implications of big data on strategic management accounting practices: a case study in a Malaysian manufacturing company. *Management, and Accounting Review*, 21.
- Atkinson, G. (2000). Measuring corporate sustainability. *Journal of Environmental Planning and Management*, 43(2), 235–252. <https://doi.org/10.1080/09640560010694>
- Begkos, C., Antonopoulou, K., & Ronzani, M. (2023). To datafication and beyond: Digital transformation and accounting technologies in the healthcare sector. *The British Accounting Review*, 101259. <https://doi.org/10.1016/j.bar.2023.101259>
- Bergmann, M., Brück, C., Knauer, T., & Schwering, A. (2020). Digitization of the budgeting process: determinants of the use of business analytics and its effect on satisfaction with the budgeting process. *Journal of Management Control*, 31(1–2), 25–54. <https://doi.org/10.1007/s00187-019-00291-y>
- Beusch, P., Frisk, J. E., Rosén, M., & Dilla, W. (2022). Management control for sustainability: Towards integrated systems. *Management Accounting Research*, 54, 100777. <https://doi.org/10.1016/j.mar.2021.100777>
- Bhimani, A. (2020). Digital data and management accounting: why we need to rethink research methods. *Journal of Management Control*, 31(1–2), 9–23. <https://doi.org/10.1007/s00187-020-00295-z>
- Bresciani, S., Ferraris, A., Romano, M., & Santoro, G. (2021). *Digital transformation management for agile organizations: A compass to sail the digital world*. Emerald Group Publishing.
- Bresciani, Stefano, Ferraris, A., Santoro, G., Premazzi, K., Quaglia, R., Yahiaoui, D., & Viglia, G. (2021). The seven lives of Airbnb. The role of accommodation types. *Annals of Tourism Research*, 88(103170), 103170. <https://doi.org/10.1016/j.annals.2021.103170>
- Broccardo, L., Truant, E., & Dana, L.-P. (2023). The interlink between digitalization, sustainability, and performance: An Italian context. *Journal of Business Research*, 158(113621), 113621. <https://doi.org/10.1016/j.jbusres.2022.113621>
- Busco, C., & Quattrone, P. (2015). Exploring how the balanced scorecard engages and unfolds: Articulating the visual power of accounting inscriptions. *Contemporary Accounting Research*, 32(3), 1236–1262. <https://doi.org/10.1111/1911-3846.12105>

- Cavaye, A. L. M. (1996). Case study research: a multi-faceted research approach for IS. *Information Systems Journal*, 6(3), 227–242. <https://doi.org/10.1111/j.1365-2575.1996.tb00015.x>
- Cepeda, G., & Martin, D. (2005). A review of case studies publishing in Management Decision 2003-2004: Guides and criteria for achieving quality in qualitative research. *Management Decision*, 43(6), 851–876. <https://doi.org/10.1108/00251740510603600>
- Chatterji, A. K., & Toffel, M. W. (2010). How firms respond to being rated. *Strategic Management Journal*, 31(9), 917–945. <https://doi.org/10.1002/smj.840>
- Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, 32(7–8), 639–647. <https://doi.org/10.1016/j.aos.2006.09.009>
- Cooper, D. J., Ezzamel, M., & Qu, S. Q. (2017). Popularizing a management accounting idea: The case of the balanced scorecard. *Contemporary Accounting Research*, 34(2), 991–1025. <https://doi.org/10.1111/1911-3846.12299>
- Davison, J. (2014). Visual rhetoric and the case of intellectual capital. *Accounting, Organizations and Society*, 39(1), 20–37. <https://doi.org/10.1016/j.aos.2014.01.001>
- Eckert, E., & Kovalevska, O. (2021). Sustainability in the European Union: Analyzing the discourse of the European Green Deal. *Journal of Risk and Financial Management*, 14(2), 80. <https://doi.org/10.3390/jrfm14020080>
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550. <https://doi.org/10.5465/amr.1989.4308385>
- Emma, G.-M., & Jennifer, M. F. (2021). Is SDG reporting substantial or symbolic? An examination of controversial and environmentally sensitive industries. *Journal of Cleaner Production*, 298(126781), 126781. <https://doi.org/10.1016/j.jclepro.2021.126781>
- Fähndrich, J. (2023). A literature review on the impact of digitalisation on management control. *Journal of Management Control*, 34(1), 9–65. <https://doi.org/10.1007/s00187-022-00349-4>
- Fatima, T., & Elbanna, S. (2023). Corporate social responsibility (CSR) implementation: A review and a research agenda towards an integrative framework. *Journal of Business Ethics*, 183(1), 105–121. <https://doi.org/10.1007/s10551-022-05047-8>
- Ferreira, J. J., Fernandes, C. I., Veiga, P. M., & Caputo, A. (2022). The interactions of entrepreneurial attitudes, abilities and aspirations in the (twin) environmental and digital transitions? A dynamic panel data approach. *Technology in Society*, 71(102121), 102121. <https://doi.org/10.1016/j.techsoc.2022.102121>
- Fouquet, R., & Hippe, R. (2022). Twin transitions of decarbonisation and digitalisation: A historical perspective on energy and information in European economies. *Energy Research & Social Science*, 91(102736), 102736. <https://doi.org/10.1016/j.erss.2022.102736>
- Gazzola, P., & Amelio, S. (2014). Valutazione della Performance Finanziaria delle Imprese. Reddito Allargato o Reddito Netto? *Economia Aziendale Online*, 5(4), 223–238.
- Ghosh, B., Herzig, C., & Mangena, M. (2019). Controlling for sustainability strategies: findings from research and directions for the future. *Journal of Management Control*, 30(1), 5–24. <https://doi.org/10.1007/s00187-019-00279-8>
- Gond, J.-P., Grubnic, S., Herzig, C., & Moon, J. (2012). Configuring management control systems: Theorizing the integration of strategy and sustainability. *Management Accounting Research*, 23(3), 205–223. <https://doi.org/10.1016/j.mar.2012.06.003>
- Gorini, A., Gazzola, P., Amelio, S., & Pavione, E. (2021). Comunicare l'esperienza del vino attraverso il family business. *Economia Aziendale Online*, 12(1), 13–26.

- Guandalini, I. (2022). Sustainability through digital transformation: A systematic literature review for research guidance. *Journal of Business Research*, 148, 456–471. <https://doi.org/10.1016/j.jbusres.2022.05.003>
- Hayne, C. (2022). The effect of discontinuous and unpredictable environmental change on management accounting during organizational crisis: A field study. *Contemporary Accounting Research*, 39(3), 1758–1796. <https://doi.org/10.1111/1911-3846.12767>
- Hennig, J. C., Firk, S., Wolff, M., & Coskun, H. (2023). Environmental management control systems: Exploring the economic motivation behind their implementation. *Journal of Business Research*, 169(114283), 114283. <https://doi.org/10.1016/j.jbusres.2023.114283>
- Henri, J.-F., Boiral, O., & Roy, M.-J. (2014). The tracking of environmental costs: Motivations and impacts. *The European Accounting Review*, 23(4), 647–669. <https://doi.org/10.1080/09638180.2013.837400>
- Johnstone, L. (2019). Theorising and conceptualising the sustainability control system for effective sustainability management. *Journal of Management Control*, 30(1), 25–64. <https://doi.org/10.1007/s00187-019-00277-w>
- Jyoti, C., & Efpraxia, Z. (2023). Understanding and exploring the value co-creation of cloud computing innovation using resource based value theory: An interpretive case study. *Journal of Business Research*, 164(113970), 113970. <https://doi.org/10.1016/j.jbusres.2023.113970>
- Knight, E., & Tsoukas, H. (2019). When Fiction Trumps Truth: What ‘post-truth’ and ‘alternative facts’ mean for management studies. *Organization Studies*, 40(2), 183–197. <https://doi.org/10.1177/0170840618814557>
- Knudsen, D.-R. (2020). Elusive boundaries, power relations, and knowledge production: A systematic review of the literature on digitalization in accounting. *International Journal of Accounting Information Systems*, 36(100441), 100441. <https://doi.org/10.1016/j.accinf.2019.100441>
- Korhonen, T., Selos, E., Laine, T., & Suomala, P. (2020). Exploring the programmability of management accounting work for increasing automation: an interventionist case study. *Accounting Auditing & Accountability*, 34(2), 253–280. <https://doi.org/10.1108/aaaj-12-2016-2809>
- Kramer, M. R., & Porter, M. (2011). *Creating shared value* (Vol. 17). Boston, MA, USA: FSG.
- Lillis, A. M. (1999). A framework for the analysis of interview data from multiple field research sites. *Accounting and Finance*, 39(1), 79–105. <https://doi.org/10.1111/1467-629x.00018>
- Lisi, I. E. (2015). Translating environmental motivations into performance: The role of environmental performance measurement systems. *Management Accounting Research*, 29, 27–44. <https://doi.org/10.1016/j.mar.2015.06.001>
- Lueg, R., & Radlach, R. (2016). Managing sustainable development with management control systems: A literature review. *European Management Journal*, 34(2), 158–171. <https://doi.org/10.1016/j.emj.2015.11.005>
- Malmi, T., & Brown, D. A. (2008). Management control systems as a package—Opportunities, challenges and research directions. *Management Accounting Research*, 19(4), 287–300. <https://doi.org/10.1016/j.mar.2008.09.003>
- Malsch, B., & Salterio, S. E. (2016). Doing good field research”: Assessing the quality of audit field research. *Auditing: A Journal of Practice & Theory*, 35(1), 1–22. <https://doi.org/10.2308/ajpt-51170>
- Meyer, R. E., Jancsary, D., Höllerer, M. A., & Boxenbaum, E. (2018). The role of verbal and visual text in the process of institutionalization. *Academy of Management Review*, 43(3), 392–418. <https://doi.org/10.5465/amr.2014.0301>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. SAGE.

- Möller, K., Schäffer, U., & Verbeeten, F. (2020). Digitalization in management accounting and control: an editorial. *Journal of Management Control*, 31(1–2), 1–8. <https://doi.org/10.1007/s00187-020-00300-5>
- Oesterreich, T. D., Teuteberg, F., Bensberg, F., & Buscher, G. (2019). The controlling profession in the digital age: Understanding the impact of digitisation on the controller's job roles, skills and competences. *International Journal of Accounting Information Systems*, 35(100432), 100432. <https://doi.org/10.1016/j.accinf.2019.100432>
- Omran, M. S. Y., & Yaaqbeh, M. N. S. (2023). Climate change and business accountability, empirical evidence on the roles of environmental strategy and environmental accounting. *Business Ethics, the Environment & Responsibility*, 32(4), 1592–1608. <https://doi.org/10.1111/beer.12591>
- Orlikowski, W. J., & Baroudi, J. J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research, ISR*, 2(1), 1–28. <https://doi.org/10.1287/isre.2.1.1>
- Owusu, G. M. Y., & Korankye, G. (2023). The state of ethical decision-making research in accounting: A retrospective assessment from 1987 to 2022. *Business Ethics, the Environment & Responsibility*, 32(2), 419–434. <https://doi.org/10.1111/beer.12519>
- Pashkevich, N., von Schéele, F., & Haftor, D. M. (2023). Accounting for cognitive time in activity-based costing: A technology for the management of digital economy. *Technological Forecasting and Social Change*, 186(122176), 122176. <https://doi.org/10.1016/j.techfore.2022.122176>
- Pavione, E., Gazzola, P., Amelio, S., & Magrì, J. (2020). Smart Industry e sviluppo sostenibile, imprese intelligenti e SDGs 2030. *Economia Aziendale Online*, 11(1), 41–53.
- Popkova, E. G., De Bernardi, P., Tyurina, Y. G., & Sergi, B. S. (2022). A theory of digital technology advancement to address the grand challenges of sustainable development. *Technology in Society*, 68(101831), 101831. <https://doi.org/10.1016/j.techsoc.2021.101831>
- Qu, S. Q., & Cooper, D. J. (2011). The role of inscriptions in producing a balanced scorecard. *Accounting, Organizations and Society*, 36(6), 344–362. <https://doi.org/10.1016/j.aos.2011.06.002>
- Quattrone, P. (2016). Management accounting goes digital: Will the move make it wiser? *Management Accounting Research*, 31, 118–122. <https://doi.org/10.1016/j.mar.2016.01.003>
- Ranta, M., Ylinen, M., & Järvenpää, M. (2023). Machine learning in management accounting research: Literature review and pathways for the future. *The European Accounting Review*, 32(3), 607–636. <https://doi.org/10.1080/09638180.2022.2137221>
- Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), 25–41. <https://doi.org/10.1080/14780887.2013.801543>
- Ronzani, M., & Gatzweiler, M. K. (2022). The lure of the visual: Multimodality, simplification, and performance measurement visualizations in a megaproject. *Accounting, Organizations and Society*, 97(101296), 101296. <https://doi.org/10.1016/j.aos.2021.101296>
- Schaltegger, S., Christ, K. L., Wenzig, J., & Burritt, R. L. (2022). Corporate sustainability management accounting and multi-level links for sustainability – A systematic review. *International Journal of Management Reviews*, 24(4), 480–500. <https://doi.org/10.1111/ijmr.12288>
- The 17 goals. (n.d.). Sdgs.un.org. Retrieved October 26, 2023, from <https://sdgs.un.org/goals>.
- Walsham, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems: An Official Journal of the Operational Research Society*, 4(2), 74–81. <https://doi.org/10.1057/ejis.1995.9>
- Walsham, Geoff. (2006). Doing interpretive research. *European Journal of Information Systems: An Official Journal of the Operational Research Society*, 15(3), 320–330. <https://doi.org/10.1057/palgrave.ejis.3000589>

- Warren, J. D., Jr, Moffitt, K. C., & Byrnes, P. (2015). How Big Data will change accounting. *Accounting Horizons*, 29(2), 397–407. <https://doi.org/10.2308/acch-51069>
- Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation (London, England: 1995)*, 19(3), 321–332. <https://doi.org/10.1177/1356389013497081>
- Zhang, Y., Ma, S., Yang, H., Lv, J., & Liu, Y. (2018). A big data-driven analytical framework for energy-intensive manufacturing industries. *Journal of Cleaner Production*, 197, 57–72.