

ESSAYS ON DIGITALIZATION IN ACCOUNTING

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Dedicated to Lisbeth, David, and Olivia

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INTRODUCTORY CHAPTER

1. Introduction

Digitalization is a pervasive and continuously growing phenomenon that creates significant alterations, dilemmas, and possibilities for organizations (Bhimani and Willcocks, 2014). Its impact on accounting is increasing, as a range of interconnected technologies are jointly generating a depth, breadth, and variety of data that exceeds what we have seen in previous technological waves (Bhimani, 2020). In this dissertation, the broad aim is to investigate the ways in which digitalization influences accounting information and control practices.

However, before proceeding, there is a need to address the thorny issue of definitions. Consistent with the demarcation problems encountered when attempting to itemize any socially defined construct, generating definitive confines for a concept like digitalization is bound to be difficult. When reflecting on the elusive sense of technology, Weick (1990, p. 1, as cited in Orlikowski and Scott, 2008, p. 437) asserted that technologies may be understood in terms of an equivocal—“something that admits of several possible or plausible interpretations and therefore can be esoteric, subject to misunderstandings, uncertain, complex, and recondite.”

In this sense, “digitalization” can be understood as an equivocal, as it is often used under the assumption that the reader has an intuitive understanding of the term. However, based on recent publications in both the accounting and the information systems fields, digitalization can be understood as the broader organizational and social processes that are enabled by, or build on, digital technology (Gebre-Mariam and Bygstad, 2019; Knudsen, 2020; Leonardi and Treem, 2020). On the one hand, *digitalization* represents a more comprehensive change than *digitization*, which refers to the mere technical process of encoding analog information into a digital format. On the other hand, digitalization should not be confused with *digital transformation*, which entails major organizational changes that profoundly alter organizational strategy.

Historically, interest in the role of technology within organizations has been deeply rooted in the accounting literature. Granlund and Mouritsen (2003, p. 78) state that “from its early days, accounting and information technology were related.” In the early 2000s, the introduction of integrated information systems (IIS) and, in particular, the widespread adoption of enterprise resource planning (ERP) systems attracted significant attention from a range of accounting scholars who sought to understand the influence of this technological wave on accounting.

Given ERP's direct impact on finance functions and management control, there was an evident relationship between the implementation of ERP systems and accounting.

Today, digitalization represents a new wave of technological advancement that is expected to change accounting and accounting information, although the effects will arguably be more indirect than those of ERP systems. However, by enabling new forms of information acquisition, collation, and use (Appelbaum et al., 2017), digitalization has the potential to fundamentally change accounting and accounting information (Arnaboldi et al., 2017b; Bhimani and Willcocks, 2014; Quattrone, 2016; Warren et al., 2015). Despite claims that digitalization will substantially change organizational realities (Porter and Heppelmann, 2014; Schwab, 2017), including those of accountants, surprisingly few studies in the accounting literature have sought to unearth the actual influence of digitalization on accounting and the work of accountants. More work is needed in this sphere to enhance our understanding of digitalization's role in changing accounting and organizational practices.

Settings concerning the production and use of accounting information represent a space in which the influx of digitalization may be complicated. This is because digitalization involves a flow of information that "bypasses [traditional] accounting information systems since they lack any direct link to verifiable economic impact" (Bhimani, 2020, p. 15). The central topic of this dissertation is the relationship between digitalization and accounting information. By exploring the influence of digitalization on accounting information, this dissertation addresses and, to some extent, challenges "the margins of accounting" (Miller, 1998). Not so much that it calls prior knowledge about the margins of accounting into question; on the contrary. However, by building on past reflections and available insights, this dissertation adds to the body of accounting literature that aims to understand the ways in which the nature of accounting is influenced—and possibly extended—by the influx of new technologies.

1.1. Background and Motivation

My motivation for writing this dissertation on digitalization in accounting was twofold. First, the opportunity to study this profound and ubiquitous phenomenon seemed highly timely and relevant, as academics and practitioners alike are making claims about the deep-rooted consequences of digitalization (Arnaboldi et al., 2017b; Bhimani and Willcocks, 2014; McKinsey and Company, 2017; Quattrone, 2016; Warren et al., 2015). Given my interest in organizational workings, studying digitalization's influence on contemporary organizations

seemed like an opportunity that would only present itself once. Second, while the fact that developments in technology and accounting unfold in parallel is well documented (Bhimani, 2003; Davenport, 1998; Granlund and Mouritsen, 2003; Kaplan and Johnson, 1987), the extant literature on digitalization in accounting appeared to be both nascent and scarce. Hence, I was motivated by the opportunity to contribute to an emerging stream of literature that aims to unpack the relationship between accounting and digitalization. Given the influence of previous technological advancements on accounting, there is reason to believe that much can be learned about the organizational opportunities and challenges brought about by this new technological wave.

Although initial studies in this domain typically centered on the ways in which digitalization influences accounting information in a broad sense (i.e., information for both external and internal reporting), my empirical studies are mainly focused on accounting information produced and used for internal purposes. Thus, this dissertation examines how digitalization changes what is referred to as “management accounting information”¹—that is, accounting information used mainly for intra-organizational purposes. Therefore, the overarching research question is oriented towards management accounting information. Throughout the dissertation, the term “accounting information” is typically used to refer to accounting information produced for internal purposes (i.e., management accounting information).

1.2. Structure of the Doctoral Dissertation

This dissertation consists of four chapters, including an introductory chapter. The introductory chapter presents the common thread of the dissertation. It does so by tying together the different, yet interrelated, pieces, and explaining the reflections made along the way. Chapter 1 presents a systematic literature review of the emerging literature on digitalization in accounting. Chapter 2 investigates how the workings of digital platforms and the logic of surveillance capitalism may foster changes in the nature of management accounting information. Lastly, Chapter 3 examines the role of big data in the production of management accounting information in the form of non-financial performance measures.

The overall research question that this dissertation examines is the following:

¹ Management accounting is concerned with the identification, production, and communication of information that assists executives in fulfilling organizational needs. A synonym is “internal accounting” (Horngren and Foster, 1987, as cited in Nilsson et al., 2011, p. 52).

How does digitalization change management accounting information and what are the implications for control practices?

To answer this broad research question, which encompasses many dimensions, this dissertation presents three distinct but interrelated papers that answer three subsequent questions. As digitalization is an emergent area of investigation in accounting, the first paper seeks to understand how digitalization influences accounting differently from previous technological advancements. As such, it sets out to answer the following sub-research question:

(1) How is digitalization influencing accounting practice and how do those effects compare to the effects of IIS on accounting practice? What are the most important avenues for future research on digitalization in accounting?

The second and third papers are empirical investigations about how digitalization changes management accounting information and control practices. They approach these issues by posing the following research questions:

(2) Whether and how do digital platforms change the nature of centers of calculation?

(3) How do performance measures change in a big data context and what are the implications for mobilizing action?

The three papers are thus tightly linked through their common aim of providing insights into how digitalization changes management accounting information and control practices. The common focus of the three dissertation papers is a direct consequence of the findings and conclusions drawn in the first paper—the systematic literature review. That paper concludes with an outline of three important avenues for further research on digitalization in the accounting literature. Figure 1 illustrates the three directions for future research presented in Paper 1, which subsequently determined the direction for the empirical papers in this dissertation—Papers 2 and 3.

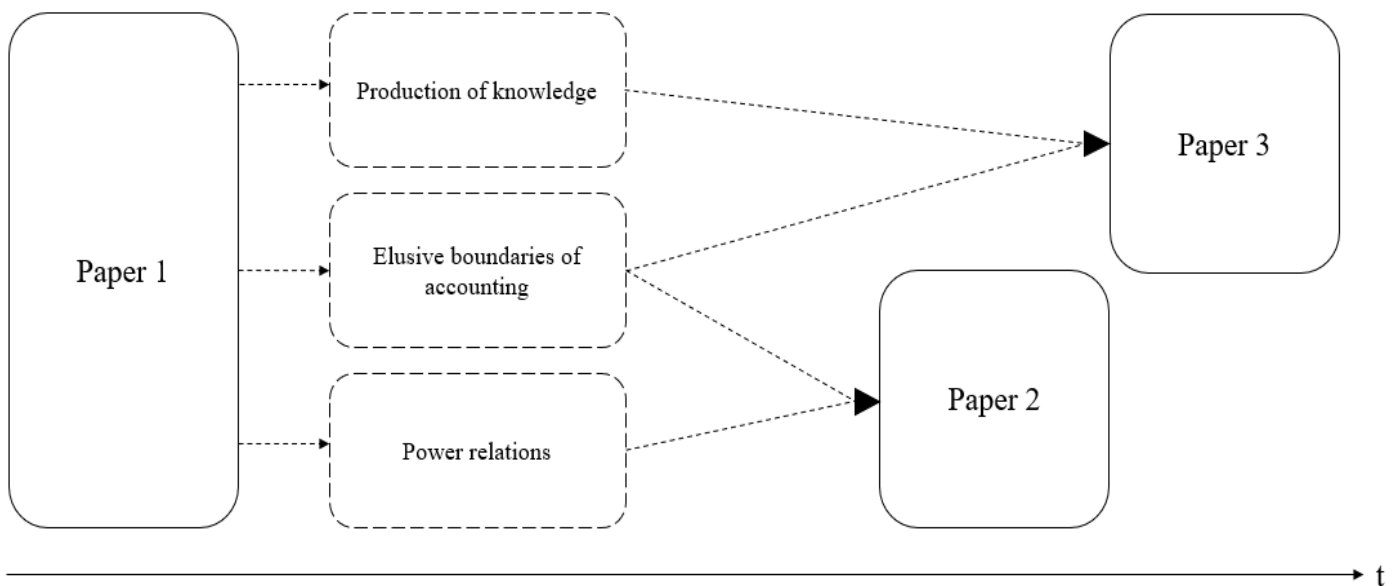


Figure 1: The connections among the three papers in the dissertation

By undertaking a thorough and systematic review of the extant literature on digitalization in accounting, Paper 1 concludes that this stream of literature is still immature. In addition, it highlights three avenues for future research.

First, digitalization seems to be driving a shift towards increasingly *elusive boundaries of accounting*. A number of accounting scholars (Al-Htaybat and von Alberti-Alhtaybat, 2017; Arnaboldi et al., 2017b; Bhimani and Willcocks, 2014; Viale et al., 2017; Warren et al., 2015) point to the introduction of externally generated, non-financial information to explain why we should expect digitalization to alter “the margins of accounting” (Miller, 1998). The notion of increasingly elusive boundaries of accounting sparked my interest in undertaking empirical investigations into how digitalization changes management accounting information. As illustrated in Figure 1, this enquiry fed into both Paper 2 and Paper 3.

Second, the literature review unveils that digitalization is expected to raise new questions related to the *production of knowledge*. In digital contexts, the production and use of information risk becoming de-contextualized, which would pose challenges for humans’ interpretation of information (Quattrone, 2016). Big data encompasses non-traditional forms of information that enter organizations with unknown consequences for knowledge production. In Paper 3, we engage with this avenue of research by considering how reliance on big data

changes the production of management accounting information through the introduction of new categories of non-financial performance measures.

Lastly, Paper 1 concludes that digitalization entails changing *power relations* both within and outside organizational boundaries. In Paper 2, therefore, we investigate the role of digitalization in shaping the development of inter-organizational power relations between global digital platform owners and a local platform organization.

Based on the aim of enhancing our understanding of digitalization's influence on management accounting information, this dissertation is anchored in theories that shed different lights on management accounting information. As such, it draws on method theories (Lukka and Vinnari, 2014), such as the accounting inscriptions literature (Latour, 1987; Robson, 1992), and an emerging theory of the production of information (Graham, 2008; Macintosh et al., 2000; Vollmer, 2007, 2019). Based on insights and perspectives from these theories, this dissertation advances our theoretical understanding of management accounting information and points to implications for control practices.

1.3. Structure of the Introductory Chapter

This introductory chapter has already provided an overview of the stream of literature in which this dissertation is positioned as well as the background and my general motivation for engaging with the topic of digitalization. The remainder of this introductory chapter proceeds as follows. In section 2, I provide insights into my philosophical underpinnings and present the methodological foundations of the dissertation. In section 3, I introduce extended abstracts of the three research papers as well as a brief synthesis of the papers. Lastly, section 4 offers a bird's-eye view of the articles in order to discuss the main contributions of this dissertation.

2. Research Methodology

2.1. Research Philosophy: On Ontology and Epistemology

Digitalization represents a new wave of technological advancement with deep, yet uncertain, consequences for contemporary organizations (Petani et al., 2021). As this shift is forging new realities, Bhimani (2020, pp. 14–15) advises accounting researchers operating in this space to critically reflect on “what conceptions of research become imported into new realms of analyses.” In these “new realms of analyses,” social and technical aspects are intricately interwoven (Orlikowski and Scott, 2008), and sociotechnical changes take place (Tilson et al., 2010). When reflecting on technology’s influence on organizations and society, I concur with Seaver’s (2018, p. 379) view that

[t]echnology is not an independent nonsocial variable that has an “impact” on society or culture. On the contrary, any technology is a set of social behaviors and a system of meaning. (...). When we examine the “impact” of technology on society, we are talking about the impact of one kind of social behavior on another.

Thus, in attempts to “make sense of human action and the meanings attached to issues in their everyday life” (Kakkuri-Knuuttila et al., 2008, p. 268) in the context of digitalization, I sympathize with the nominalist position that reality can be viewed as socially constructed (Burrell and Morgan, 1979; Modell, 2020). However, I endorse March’s (1987, p. 161) nuanced perspective that “human life is in many ways less a collection of choices than a mosaic of interpretations. It involves both discovering reality and constructing it.” Consequently, this dissertation adopts an interpretative stance that is “straddling between paradigms” (Kakkuri-Knuuttila et al., 2008) by appreciating both subjective elements and objective features. In short, it adopts an ontological position that integrates social constructivism with moderate forms of realism. Consequently, claims of constantly negotiated truths are rejected but notions of several possible truths are acknowledged (Lukka and Modell, 2010).

Consistent with the body of accounting studies that bridges objectivist structures and subjective interpretations (Ahrens, 2008; Chua, 1986; Hopper and Powell, 1985; Kakkuri-Knuuttila et al., 2008; Lukka, 2010; Lukka and Modell, 2010; Modell, 2010), this dissertation is grounded in a pragmatist epistemology (Lukka and Modell, 2010). Epistemology concerns assumptions about the forms of knowledge that can be obtained and how we may communicate knowledge to others (Burrell and Morgan, 1979). A pragmatic epistemological position acknowledges that

(social science) researchers should embrace both an emic and an etic perspective in accumulating knowledge. Thus, these two perspectives represent a practical resolution to adopting both objective and subjective features.

An emic perspective seeks to understand things from the viewpoint of the research object (i.e., “a native insider”) to make sense of human action in everyday settings. This perspective is vital if the researcher aims to provide rich insights (Ahrens and Dent, 1998)—that is, the meanings of the examined actors, which are not accessible to distant observers. However, purely emic studies are assessed as relatively uninteresting, as they tend to provide rather descriptive narratives from a situated context (Kakkuri-Knuuttila et al., 2008). Consequently, interpretative researchers also need to mobilize an etic perspective, which offers a more detached and neutral perspective (Lukka and Modell, 2010). By assuming the role of theoretically informed outsiders, researchers can, to some extent, compensate for the fact that empirical observations only demonstrate partial reflections of generative mechanisms (Modell, 2020, p. 10). Hence, the inclusion of both emic and etic perspectives allows for a fuller construction of meaning about social practices (Lukka and Modell, 2010).

Based on the philosophical underpinnings of my ontological and epistemological stance, I seek to combine the emic and etic perspectives in my research. In mobilizing these perspectives, questions concerning research methods emerge, as the choice of research methods is inextricably linked to the researcher’s views on how we might derive knowledge from the world. In the next section, I elaborate on my methodological choices.

2.2. Research Method

This dissertation consists of three research papers: one systematic literature review and two empirical studies. In the two empirical papers, I seek to obtain emic perspectives from the viewpoint of “insiders.” To do so, I chose a qualitative research approach. The qualitative approach is common in interpretative studies and has been extensively applied in management accounting research (Northcott and Doolin, 2008), as it enables researchers to document how management accounting becomes intermingled with intricate organizational processes (Ahrens, 2021; Vaivio, 2008). Moreover, qualitative studies are well suited for exploring emergent phenomena, such as digitalization.

To explore how digitalization changes accounting, I conducted two case studies. Case studies can add holistic, rich, contextual understandings of topics or phenomenon in their real-life

settings (Modell, 2005). In addition, this approach is particularly appropriate when faced with emerging topics where the researcher aims to study complex social phenomena (Yin, 2014). Hence, case studies appeared to be a fitting approach for studying digitalization's influence on accounting from an interpretative stance.

Furthermore, I sought to combine the emic perspective with the etic perspective by drawing on abductive reasoning. For researchers grounded in pragmatic epistemologically, the process of abduction allows for iterative, back-and-forth movements between an empirical collection and theoretically informed explanations (Lukka and Modell, 2010). In this regard, Bhimani (2020, p. 18) stresses that in studies of digitalization in accounting, “what may be sought is abductive reasoning from the outset (...), [so that] primacy can be given to the unfolding interplay between data, method and theory and with regard to their co-constitution.”

In the first empirical paper in this dissertation, the abductive approach allowed us to fine-tune our understanding of the unfolding empirical events. In our study of the relationship between online travel agencies (OTAs) and a Nordic hotel chain, our initial focus was on pricing issues. However, a thorough assessment of the empirical material revealed novel understandings concerning big data in the form of customer behavior data. Consequently, we mobilized a different theoretical framing and developed a theoretical understanding of the empirical observations. This serves as an example of how the abductive approach “is fruitful if the researcher's objective is to discover new things” (Dubois and Gadde, 2002, p. 559).

2.3. Data Collection

The empirical material in this dissertation was collected from two different organizations. The aims and purposes of the two empirical papers emerged from the conclusions of the first paper. The first paper, a systematic review, highlighted three topics for further research. To avoid a “one size fits all” solution in which these research topics were forced into one case study, I sought access to two organizations for the two empirical studies. First, I gained access to CASE Hotel (the empirical setting in Paper 2) in 2019. In Paper 2, I drew on empirical material from 12 interviews. I was given access to MediaCorp, the empirical setting for Paper 3, in 2020. There, I conducted 25 interviews over the course of 13 months. Table I summarizes the collection of primary data from both CASE Hotel and MediaCorp. In the following, I detail the data-collection process in CASE Hotel (section 2.3.1) and MediaCorp (section 2.3.2).

| | 2019 | | 2020 | | 2021 | | Total |
|----------------------------|--------------|-------------------------|--------------|-------------------------|--------------|-------------------------|--|
| | # Interviews | Duration | # Interviews | Duration | # Interviews | Duration | # Interviews Duration |
| Paper 2: CASE Hotel | 11 | 760 mins./ 12.7 hrs. | 1 | 60 mins./ 1 hr. | N/A | N/A | 12² interviews 820 mins./13.7hrs. |
| Paper 3: MediaCorp | N/A | N/A | 12 | 625 mins./ 10.4 hrs. | 13 | 675 mins./ 11.2 hrs. | 25 interviews 1,300 mins./21.7hrs. |
| | 11 | 760 mins./ 12.7 hrs. | 13 | 685 mins./ 11.4 hrs. | 13 | 675 mins./ 11.2 hrs. | 37 interviews 2,120 mins./35.4 hrs. |

Table 1: Primary data: overview of interviews, 2019-2021

2.3.1. Data Collection in CASE Hotel

Access to CASE Hotel was facilitated by the fact that senior researchers in my research group had gained access to the organization in 2015. Consequently, a research agreement and personal relations between the research group and CASE Hotel were already in place. On this basis, the case selection serves as an example of “convenience sampling” in qualitative research (Brewis, 2014). However, together with my supervisor and co-supervisor, I assessed the extent to which CASE Hotel represented an appropriate empirical setting given the aim of our research. Based on our research colleagues’ familiarity with the company, we concluded that CASE Hotel’s company profile (i.e., a large, complex organization) and its dynamic relationships with global, digital-platform organizations stood out as an interesting starting point for our study.

We collected primary data in two rounds. The first round focused on interviews previously conducted by our colleagues. As a part of the research group, I was granted legal access to this material. By listening to audio recordings of interviews and reading verbatim transcripts, I assessed which interviews that would fit our initial research interest in this case. Material from four interviews conducted in this first round was directly included in the study. In the second round, I conducted eight additional interviews. The respondent identification in this round of data collection primarily unfolded in line with a snowball sampling technique (Noy, 2008).

² Please see section 4.2 and Appendix 1 in Paper 2 for details.

Before each interview, each respondent was provided with an informative email and a consent form after they had verbally agreed to participate in the study.

The interviews in the second round were targeted in nature but semi-structured in form, thus allowing for surprises to surface. This proved to be a fruitful strategy, as, for example, the insight about CASE Hotel's changing relation with the online travel agencies (OTAs) emerged through the surprising statements made by some respondents. Six of the interviews were conducted by phone due to time limitations on the respondents' behalf, while two were conducted in person at CASE Hotel locations. One of these interviews allowed for participant observations at CASE Hotel's headquarters. We also gathered data from participant observations in other settings (see Appendix 1 in Paper 2 for details). Throughout the interviews, intensive note taking took place. In this study, I conducted all of the interviews without the participation of my supervisor. After the interviews, most of the audio recordings were transcribed.

We also collected secondary data that offered highly relevant information about the ways in which CASE Hotel's established relationship with OTAs as well as its aim of appropriating customer data and the consequent influence on the production of inscriptions. We were provided with seven annual reports, stretching from 2014 to 2020. These reports were produced for internal use only, as CASE Hotel was not listed on the stock exchange and was, therefore, not required to publish publicly available annual reports.

2.3.2. Data Collection in MediaCorp

Access to MediaCorp was initially gained through a network of academic colleagues. Through mutual acquaintances, personal contact was initiated with a member of MediaCorp's corporate management. This corporate manager formally sanctioned our access to the organization.

The primary data collection commenced with an interview with the corporate manager, which served as a platform for subsequent interviews. Although some of the subsequent respondents were identified through a snowballing process (Noy, 2008), potential respondents were also identified and contacted using LinkedIn, a social networking site for business professionals. While consent to conduct interviews in MediaCorp was granted by the corporate manager, all respondents received information about the study and were asked to read and sign a consent form before the interviews (see Appendix 1).

We conducted 25 interviews for the study. I conducted 20 interviews as a single researcher, while my supervisor took part in 5 interviews. Twenty-two interviews were semi-structured and three interviews were open, as the purpose of these interviews was to map potential respondents. In the semi-structured interviews, respondents were encouraged to explain their roles and experiences with MediaCorp's work with big data. As the interviews progressed, I aimed to center the discussion around three main themes: (i) the strategic development in MediaCorp over the course of the previous five years, (ii) changes in planning and control practices, including the emergence of potentially new KPIs following the launch of the MediaCorp data strategy in 2018/2019, and (iii) the role of new digital technologies and granular customer data in relation to accounting practices.

In the last five interviews, our focus was even narrower. In this stage, we focused primarily on rationales, assumptions, and consequences of new, non-financial performance measures. As the interviews followed unpredictable and often different paths, there was a need for note taking during the interviews to connect new and prior insights. Of the 25 interviews, 20 were audio recorded and transcribed manually. This process produced about 300 pages of written text. Due to restrictions related to the Covid-19 pandemic, all of the interviews (except one) were conducted using various video-conferencing platforms.

In addition to the primary data material, we collected secondary data. This included publicly available annual reports from 2010 to 2021 as well as two internal documents: "Data Strategy v.2" and "Beyond Budgeting in [MediaCorp]." In particular, the Data Strategy v.2 document helped us understand how reliance on big data was mobilized in MediaCorp, and how it influenced both the production of performance measures and control practices.

2.4. Data Analysis

The research agenda in both empirical papers was to understand the ways in which digital technologies may shape the role and nature of management accounting information in organizations. While this agenda remained the foundation throughout our studies, the data-collection and data-analysis processes were initially rather explorative to allow for the emergence of surprises. This approach is common in qualitative studies, and we viewed it as particularly adequate when facing a new empirical phenomenon, such as digitalization.

During and after the rounds of data collection, the abductive nature of our studies allowed us to iteratively fine-tune the theoretical angles that best explained the empirical events while still sticking to the original research agenda. After collecting the data, I read the transcripts in detail.

Based on the empirical material, I then identified a range of initial concepts (Gioia et al., 2012) that could be of interest and relevance to our research agenda. This process enabled me to identify patterns in the data material, which were subsequently logically systemized. For example, in Paper 2, this process yielded about half a dozen themes, such as the competitive situation, performance measures, central actors, customer data, and historical development.

Thus, the focus and scope and of the papers narrowed as I deepened my theoretical understandings and undertook iterative readings of the data material, which enabled me to more closely “connect the dots” between empirics and theory. Admittedly, the process of analyzing data was facilitated by peer feedback, which further enhanced my theoretical understanding. By combining elevated theoretical insights with the improved understanding of the key empirical themes, I then connected our findings to earlier literature, thereby making new contributions to the literature.

As noted, our aim was to combine an emic and an etic perspective in analyzing the data material. However, one may question the degree to which any researcher working with interview data can develop sufficient embeddedness to properly understand the emic perspective if that researcher does not become a part of the organization over time. In addition, a challenge for interpretative researchers who seek to convey their interview-based findings through a narrative approach is that even though the researcher gets a sense that “there is something amiss, it is neither clear nor obvious what it is (there are many false clues), this ‘something’ must be explained” (Czarniawska, 1999a, p. 19). Hence, qualitative data material may be subject to several interpretations (Miles et al., 2013), which poses a challenge in writing up the field (Baxter and Chua, 2008).

We sought to maintain the emic perspective by building on data from several sources, thereby providing a more holistic and nuanced picture of the social realities in which we engaged. Furthermore, in both empirical studies, we subscribed to a narrative approach (Czarniawska, 1999b), which allowed us to convey the richness of our findings and to maintain their transparency (Reay et al., 2019).

2.5. Data Treatment and Ethical Considerations

When collecting and processing personal data, it is imperative that researchers notify the research participants and obtain informed consent to collect data (The Norwegian National Research Ethics Committees, 2016). In both empirical studies, informed consent was ensured by providing each participant with a tailored consent form. Prior to approaching any

respondents, the consent forms were submitted to and assessed by the Norwegian Centre for Research Data (NSD). NSD confirmed that the prescribed data treatment was in line with current data-privacy guidelines and, thus, approved our subsequent collection of data.

The consent forms described the purpose of the study, why and how the participants were identified as potential respondents, and their rights as respondents. They also provided extensive information on data treatment and privacy issues. This included, for example, detailed information about which researchers were granted access to audio recordings. In addition, we informed participants of their right to remain anonymous. Consent to audio-record interviews was obtained verbally at the start of each interview in which recording took place. Lastly, the respondents were informed that the audio-recorded interviews would be transcribed. The consent form provided to respondents in Paper 3 is available in Appendix 1 as an example.

Obtaining informed and volunteer consent is an essential step in ensuring that research lives up to ethical standards. However, formal requirements are not the only reason to comply with ethical guidelines in research. The importance of upholding ethical standards relates to the fact that the research we produce is likely to be evaluated as trustworthy, and may be read, referenced, and even applied by others. As such, I concur with Saunders et al.'s (2005) view that research ethics are particularly important with regard to the subjects of my work and those affected by the conclusions.

3. Presentation and Discussion of the Articles in this Dissertation

3.1. Article 1: Elusive Boundaries, Power Relations, and Knowledge Production: A Systematic Review of the Literature on Digitalization in Accounting

The aim of the first article in the dissertation is to synthesize and critically review the extant literature on digitalization in accounting. Digitalization represents a third wave of technological advancements that affects organizations across the board (Horlach et al., 2016; Porter and Heppelmann, 2014), and especially the accounting and finance functions (Bhimani and Willcocks, 2014). While a significant stream of research at the intersection of information systems and accounting has studied integrated information systems (IIS) and, in particular, ERP systems (Granlund and Malmi, 2002; Granlund and Mouritsen, 2003; Hyvönen, 2003; Quattrone and Hopper, 2001; Scapens and Jazayeri, 2003), this study takes a novel approach by investigating the literature concerned with the intersection of digitalization and accounting. The study is timely because digital technologies are transforming and expanding the types and sources of data used by accountants (Al-Htaybat and von Alberti-Alhtaybat, 2017; Warren et al., 2015) as well as important accounting processes (Arnaboldi et al., 2017b). By systematically reviewing the emerging literature on digitalization in accounting, the paper aims to flesh out how digitalization affects accounting in new ways and, thereby, suggest avenues for future research. Consequently, this paper addresses the following research questions:

How is digitalization influencing accounting practice and how do those effects compare to the effects of IIS on accounting practice? What are the most important avenues for future research on digitalization in accounting?

To answer these questions, the paper first sets out to clarify the term “digitalization,” which is often used to refer to the joint emergence of a number of technologies that have a profound impact on how organizations operate (Karimi and Walter, 2015; Parviainen et al., 2017), including the work of accountants. As the differences between “digitalization” and other terms are often unclear, this paper initially offers a clarification of the term. It suggests that “digitalization” should be understood as a less comprehensive change than “digital transformation” but more profound than the mere technical process of “digitization.” In short, digitalization is associated with important changes related to socio-technical structures (Yoo et al., 2010).

When conducting a systematic literature review, the analysis should to be structured in accordance with an analytical framework (Massaro et al., 2016). To structure and analyze the emerging literature on digitalization in accounting, we modified a framework from the literature on information systems in management accounting introduced by Rom and Rohde (2007). We utilized the Scopus database to detect relevant literature within the confines of our study. Based on a highly conscious selection of search criteria, the search process returned a selection of 103 articles, 33 of which were included in this study. By forming and contrasting a comprehensive picture of the emerging literature on digitalization in accounting with extant literature on IIS in accounting, the paper develops knowledge by connecting the past with the future (Massaro et al., 2016). Through a guided analysis of the relevant literature, the paper concludes by highlighting three notable differences between the effects of digitalization and IIS on accounting.

First, we suggest that digitalization is the impetus for the increasingly *elusive boundaries of accounting*, as digitalization is enabling a move beyond a transactional focus (Bhimani and Willcocks, 2014) as well as a significant change in information acquisition and use (Arnaboldi et al., 2017b). As shown in Figure 1 in section 1.2., this finding serves as a steppingstone for both Paper 2 and Paper 3. In these two empirical papers, we investigate the practical ways in which new forms of management accounting information contribute to the increasingly elusive boundaries of accounting.

Second, digitalization entails *changing power relations* both within and outside the organizational boundaries. Within the organization, IIS allowed for vertical power shifts through increased decentralization (Dechow and Mouritsen, 2005; Granlund and Mouritsen, 2003). In contrast, digitalization may result in horizontal power shifts in organizations, as power seems to accrue in the professions that show initiative and take the lead in mobilizing digital technologies with the purpose of reengineering business processes and business models (Arnaboldi et al., 2017a). Moreover, digitalization may lead to changes in power relations outside the organizational boundaries by placing more power in the hands of external stakeholders, such as platform owners (Scott and Orlikowski, 2012; Suddaby et al., 2015). This finding is accounted for in Paper 2. In that paper, we trace the dynamic trajectory of inter-organizational power relations between a platform owner and a platform organization, and we show how this dynamic relationship subsequently changes internal control practices in the case organization.

Third, the systematic literature review shows that digitalization raises new questions related to the *production of knowledge for decision making*. While IIS studies indicated that the implementation of ERP systems did not entail inclusion of new types of information, the literature on digitalization emphasizes how new types of information enter an organization (Agostino and Sidorova, 2017; Quattrone, 2016). Thus, this paper contributes to the literature by clarifying the concept of digitalization, pointing to how digitalization may influence accounting in new ways, and building a foundation for suggesting avenues for future research. This conclusion is further explored in Paper 3, in which we first identify how big data plays a role in the production of new non-financial performance measures before we discuss the challenges associated with producing relevant information from new forms of management accounting information (i.e., big data).

3.2. Article 2: Centers of Data Appropriation: Evidence from a Nordic Hotel Chain Competing with Online Travel Agencies

The purpose of the second article in this dissertation is to examine the concept of centers of calculation (CoCs) in the context of the digital economy and the question of whether the nature of CoCs (Agostino and Sidorova, 2017) changes under the prevailing logic of surveillance capitalism (Zuboff, 2015, 2019). Over the past two decades, the emergence of a range of interconnected technologies has allowed for the production of more granular personal data (Al-Htaybat and von Alberti-Alhtaybat, 2017; McAfee and Brynjolfsson, 2012). In this regard, digital platforms arguably represent a space in which the acquisition and collection of customer data are highly visible (Bulgakov, 2018). With the aim of improving our understanding of the relationship between digital platforms and accounting, this paper poses the following research question:

Whether and how do digital platforms change the nature of centers of calculation?

By conducting an in-depth single case study, we empirically investigate how a Nordic hotel chain competed with online travel agencies (OTAs) for access to customer data. The paper demonstrates how the case organization created a local alternative to global digital platforms with the aim of appropriating customer data, thereby moving from a center of calculation (CoC) to what we label a “center of data appropriation” (CDA).

Extant research suggests that CoCs—empowered by accounting inscriptions—are similar to “maps”—they provide a useful, albeit simplified, version of reality. However, we contend that CDAs are constructed around accounting inscriptions with other properties that enable digital “mirrors” of the economic domain. In examining how CDAs differ from CoCs, we find two governance effects. First, under CDAs, there might be multiple centers (local and global) that compete for access to a new kind of periphery (i.e., the customer). Second, we find that existing notions of the future trajectory of surveillance capitalism seem to be deterministic (Zuboff, 2015, 2019). Based on the empirical material, we show how the local hotel chain manages to compete with the global, digital platform owners. Thus, we suggest that future forms of competition can follow dynamic trajectories where mutual dependence between CDAs may lead to a shift from competition to *coopetition*.

In introducing the concept of CDAs, we contribute to the literature on accounting inscriptions and CoCs (Latour, 1987; Miller and Napier, 1993; Qu and Cooper, 2011; Robson, 1992; Rose and Miller, 2010) by re-evaluating the nature of CoCs under the prevailing logic of surveillance capitalism. The case material, which illustrates a clear focus on appropriating personal data, offers a unique window into how accounting inscriptions are moving from *homogenous, complexity-reducing pieces of information* (Cuganesan, 2008; Robson, 1992) to *heterogeneous, highly detailed pieces of individual information*. As such, we demonstrate the role of new inscriptions (Ezzamel et al., 2004) and how they are used to convey information about a new and increasingly digital reality—a reality in which data appropriation is not only an important competitive factor but also expected to be the fertile soil from which future economic benefits may be reaped.

3.3. Article 3: Weak Links but Strong Assumptions: A Case Study of the Production of Non-Financial Performance Measures in a Big Data Context

The third and final article in the dissertation investigates the production of management accounting information in a big data context. The purpose of the paper is to provide empirical flesh to the debate concerning the role of big data in shaping management accounting and control practices (Appelbaum et al., 2017; Arnaboldi et al., 2017a; Arnaboldi et al., 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015). It does so by focusing on big data’s influence on new performance measures (PMs). Specifically, the paper raises the following research question:

How do performance measures change in a big data context and what are the implications for mobilizing action?

From the extant literature, we know that technological progress may engender the development of new PMs (Catasús and Gröjer, 2006; Mouritsen, 1998; Vaivio, 1999a). This is not surprising, as PMs provide maps of reality (Lowe and Koh, 2007), which organizations use to navigate. However, little has been said about how the pervasive reliance on big data in contemporary organizations has shaped the development of new PMs. Given this identified gap in the literature, we draw on a single case study to help remedy the empirical deficit in studies on the relationship between big data and accounting. In answering the research question, our study provides evidence of how big data influenced the production of PMs in the case organization.

The findings in this study allow us to make two contributions. First, we contribute to the literature on non-financial performance measures (NFPMs) (Burfitt et al., 2020; Catasús and Gröjer, 2006; Catasús et al., 2007; Mouritsen, 1998, 2004; Vaivio, 1999b, 1999a, 2004, 2006) by introducing a typology of NFPMs emerging in a big data context. We explain how NFPMs developed in a big data context differ from traditional NFPMs: some of the new measures are characterized by *weak links* to the financial domain but rely on *strong assumptions*.

Second, we contribute to the emerging literature on big data in management accounting (Appelbaum et al., 2017; Arnaboldi et al., 2017a; Arnaboldi et al., 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015) by critically examining the relationship between information produced in a big data context and control practices. We show that, in a big data context, there is a complicated relationship between what is represented and what is perceived as relevant. This complex relationship makes it difficult for local managers to interpret the information produced and determine its relevance for local business purposes. We argue that the characteristics of the new NFPMs explain why they are unsuccessful in providing a “focus potential” (Vaivio, 1999b) and, thereby, fails to mobilize organizational action.

3.4. Summary of the Dissertation

| | <i>Paper 1</i> | <i>Paper 2</i> | <i>Paper 3</i> |
|--------------------------|---|---|--|
| Purpose | Synthesize and critically review the extant literature on digitalization in accounting and, in so doing, flesh out how digitalization affects accounting in new ways, thereby suggesting avenues for future research. | Examine whether and how digital platforms change the nature of CoCs and improve our understanding of the relationship between digital platforms and accounting. | Add to our understanding of how reliance on big data influences the production of accounting information by studying the emergence of new NFPMs and how they may differ from conventional NFPMs. |
| Research question | How is digitalization influencing accounting practice and how do those effects compare to the effects of IIS on accounting practice? What are the most important avenues for future research on digitalization in accounting? | Whether and how do digital platforms change the nature of centers of calculation? | How do performance measures change within a big data context and what are the implications for mobilizing action? |
| Method | Systematic literature review | Single case study | Single case study |
| Findings | Digitalization increasingly makes the boundaries of accounting elusive, as it drives new forms of power relations and raises new issues related to the production of knowledge for decision making. | Digital platforms play a role in a shift towards what is labelled “centers of data appropriation” (CDAs). Such centers compete for the appropriation of data. Local CDAs might compete against global CDAs, which points to dynamic trajectories of new, competing forms, leading to a situation of <i>cooptation</i> . | Reliance on big data leads to the emergence of new categories of non-financial PM, some of which are based on <i>weak links</i> to the financial domain but <i>strong assumptions</i> . The properties of the new non-financial PM have implications for information representation and relevance. |
| Contribution | I contribute by clarifying the concept of digitalization, synthesizing the emerging literature on digitalization in accounting, and contrasting this stream of literature with the literature on IIS in accounting. I thus point to several new research paths. | We contribute to the accounting inscriptions literature by proposing the emergence of CDAs. While CoCs enable “mapping” of the economic domain, CDAs enable digital “mirrors” of the economic domain. We also contribute to the interdisciplinary literature on surveillance capitalism by discussing the future trajectory of competitive forms. | We contribute to the literature on NFPMs by developing a typology of NFPMs, and we contribute to the literature on big data in accounting by problematizing what we understand as relevant accounting information. |

Table 2: Summary of the dissertation papers

Paper 1 presents a thorough synthesis of the extant literature on digitalization in accounting. It defines—and clarifies—the concept of digitalization in relation to other related terms. The paper argues that digitalization represents a third wave of technological advancements that influences accounting and accountants differently than the two previous technological waves. The analysis shows that digitalization influences accounting practice in several ways, three of which we view as particularly significant. Digitalization is the impetus for: (i) increasingly elusive boundaries of accounting, (ii) changing power relations, and (iii) questions concerning the production of knowledge for decision making.

Paper 2 is an in-depth, single case study that investigates how a Nordic hotel chain competed with global online travel agencies (OTAs) in the quest for the “new oil”—customer data. In so doing, the paper aims to understand the role of accounting in the context of digital platforms. As surveillance capitalism has brought a logic of appropriation into many organizational settings, including that of digital platforms, we theorize that this logic fuels a shift from centers of calculation (CoCs) to what we label “centers of data appropriation” (CDAs). The paper demonstrates that CoCs are guided by accounting inscriptions that enable the “mapping” of the economic domain, while CDAs are constructed around accounting inscriptions with other properties that enable digital “mirrors” of the economic domain.

Paper 3 offers an empirical examination of how reliance on big data changes the production of information in a large media conglomerate. Specifically, the paper traces how NFPMs changes in a big data context. The paper contributes to the extant literature by developing a typology that lays out the anatomy of NFPMs and, thereby, shows how NFPMs developed in a big data context differ from traditional NFPMs. Furthermore, the case indicates that the ambition of mobilizing big data to produce a panacea can be challenging. While the case company’s central (global) management believed that processes of standardized data collection and lateral data sharing would produce new and improved information, decentralized (local) managers found that this kind of information lacked relevance to their local concerns. Thus, the new NFPMs failed to mobilize action, despite fulfilling the requirements proposed in the extant literature of doing so. This is explained, in part, by the different features of the new NFPMs, which were characterized by *weak links* to the financial domain *but strong assumptions*.

4. What Have We Learned?

4.1. Setting the Stage

This final section of the introductory chapter takes a bird's-eye view of the whole dissertation. The purpose is to lift our perspective by discussing the key implications from the papers both individually and as a collective unit. In this regard, I aim to unearth the overall contributions of this research project by highlighting the theoretical and the practical lessons that have emanated from studying *how digitalization changes management accounting information and the implications for control practices*. I first present the starting point for the dissertation and stress how this dissertation's focus differs from the extant literature on digitalization in accounting. Thereafter, I connect the dots among the three papers to present the contributions and key lessons.

This research project commenced with an expectation that digitalization would influence accounting and management accounting information. This expectation was built partly on the general discourse on digitalization in the business media and partly on indications from the scarce accounting literature on the topic. In conceptualizing the interplay between digitalization³ and accounting, Arnaboldi et al. (2017b) assert that we can understand digitalization either as an *object* (the information produced, e.g., new KPIs) or a *process* (the process of generating information, e.g., control practices).

4.2. Theoretical Implications

In the first paper, we argue that digitalization creates more elusive boundaries of accounting. By taking an overarching approach, the paper shows that digitalization changes accounting as an object and as a process. We find that digitalization changes accounting as an *object* because it redraws the boundaries of what is regarded as management accounting information. As externally generated, non-financial information is increasingly acknowledged as relevant for accounting, it exemplifies the emergence of new calculative practices at the margins of accounting (Miller, 1998). Moreover, this paper finds that digitalization changes accounting as a *process*. By uncovering the broad trend in which other professional groups are increasingly taking part in producing information,⁴ we find that digitalization is bringing accounting into non-accounting functions. In addition, digitalization may change accounting as a process

³ In studying digitalization, Arnaboldi et al. (2017b) center their attention on social media and big data.

⁴ In line with Horngren et al. (2005), the purpose of management accounting is to “produce information” (for managerial decision making), traditionally through quantitatively oriented analyses.

because it gives rise to new questions regarding how—and to what degree— humans should be involved in the processes of information analysis and decision making (Quattrone, 2016).

While the first paper lays out a set of theoretically deduced insights into how digitalization changes accounting information, the second paper offers an empirical understanding of the role of digital platforms in changing management accounting information and control practices. Placed in the setting of digital platforms, we show that the appropriation of customer data not only becomes an important competitive factor but is also expected to be the fertile soil from which future economic benefits may be reaped. The paper thus exemplifies how digitalization leads to more *elusive boundaries of accounting* (information). The underpinnings of the new competitive environment, which is centered on data appropriation, prompted a shift in management accounting information from homogenous, complexity-reducing pieces of information (Cuganesan, 2008; Robson, 1992) to heterogeneous, highly-detailed pieces of individual information—that is, a move from maps to mirrors. Consequently, this chapter of the dissertation shows not only how management accounting information as an object “changes in both content and form over time” (Miller and Napier, 1993, p. 631) but also how digital platforms contribute to the alteration of the competitive environment.

While this paper teaches us how digitalization can change management accounting information, its focus on governance effects also provides insights into the implications of digitalization for control practices. By tracing the competitive relationship between a local hotel chain (a platform organization) and online travel agencies (platform owners), the study is illustrative of dynamic inter-organizational *power relations*. As the platform owner deprived the platform organization of access to customer data, it exerted a form of centralized control (Leoni and Parker, 2019), which forced the platform organization into a phase of innovation and renewal. As such, we demonstrate that future forms of competition are not necessarily deterministic (Zuboff, 2015, 2019) but can follow highly dynamic trajectories in which mutual dependence between firms may lead to a shift from competition to cooperation.

The third paper in the dissertation offers insights into a novel empirical phenomenon—the deep-rooted reliance on big data—and its influence on management accounting information. While prior literature on management accounting information accounts for the role of technological advancements in relation to NFPMs (Catasús and Gröjer, 2006; Mouritsen, 1998; Vaivio, 1999a), we investigate how a big data context changes NFPMs. We conclude that management accounting information (as an object) in the form of NPFM changes in a big data context. The NFPMs that emerge in a big data context are built on weak links to the financial domain, but

on the strong assumption that future economic benefits will materialize from the collection of customer data. This finding offers additional evidence that digitalization is the impetus for the *increasingly elusive boundaries of accounting*.

These findings also suggest that digitalization is a central driver of changes in the production process of information. A range of actors are involved in this process, which gives rise to questions about the future role of accountants as organizations increasingly aim to become data driven. Lastly, the dissertation comes full circle as this chapter illuminates challenges in relation to the *production of knowledge*. In a big data context, when NFPMs are based on weak links to the financial domain, managerial attention to accounting information (Jørgensen and Messner, 2010) is not enough to mobilize managerial action. In mobilizing action among managers at local levels, we suggest that the ways of linking accounting information to financial value creation are just as important as paying attention to certain measures. Hence, it seems key to tie new forms of non-financial information to the financial domain if the information is to be perceived as relevant.

Overall, the dissertation is grounded in the accounting literature that discusses the relationship between technology and accounting (Bhimani, 2003; Bhimani and Willcocks, 2014; Davenport, 1998; Granlund, 2011; Granlund and Mouritsen, 2003). In the second wave of technological advancements, the introduction of ERP systems affected accounting and the work of accountants in direct and rather obvious ways. For example, they improved the supply of transactional data (Rom and Rohde, 2007). In contrast, digitalization did not initially spark enthusiasm among accounting scholars. One explanation could be that digitalization produces information that has previously been discarded by accountants due to its lack of a direct link to economic transactions (Bhimani and Willcocks, 2014). However, this dissertation highlights that digitalization should attract attention from accounting scholars, as it shows how digitalization changes accounting and management accounting information as both an object and a process. Figure 2 illustrates how the main conclusions from the empirical papers may be understood as either *objects* or *processes*, and whether the changes to management accounting information are mainly internally or externally driven (i.e., inside or outside organizational boundaries).

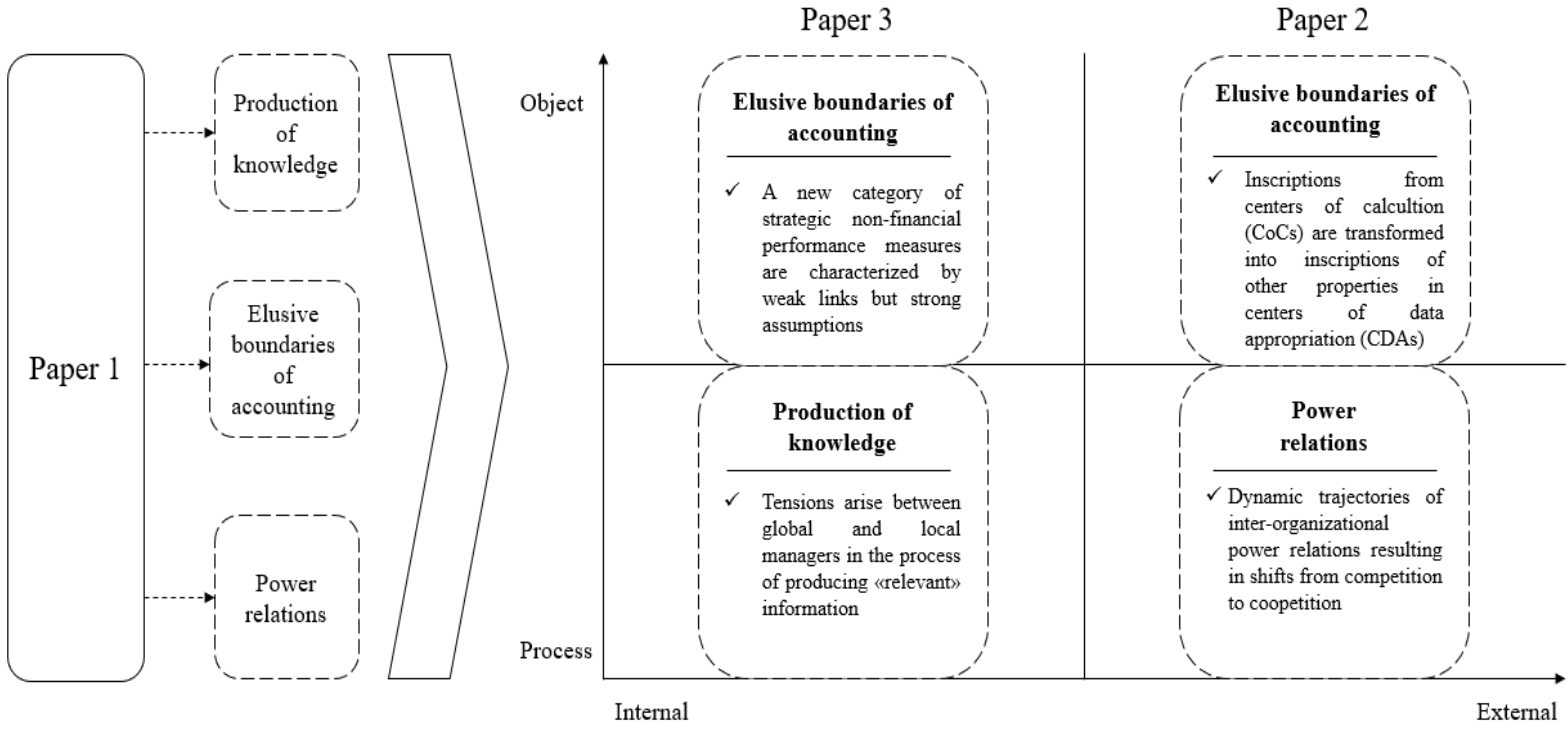


Figure 2: Main conclusions in the empirical papers (Papers 2 and 3) and their connections to the conclusions from the systematic literature review (Paper 1)

As Figure 2 illustrates, the main conclusions in the two empirical papers are closely linked to the findings from the systematic literature review (Paper 1). First, the dissertation shows how digitalization changes management accounting information by making the boundaries of accounting more elusive. When we view management accounting information as an *object*, we find that digitalization can drive more elusive boundaries of accounting through the internal production of strategic NFPMs. These NFPMs are characterized by weak links to the financial domain but strong assumptions (as seen in Paper 3). In Paper 2, we also find that management accounting information changes as an object by studying the changing nature of inscriptions (Latour, 1987; Robson, 1992) in the shift from CoCs to CDAs. As the change from CoCs to CDAs was driven by actors outside the boundaries of the case organization, we refer to this as a change from the external environment.

Lastly, this dissertation indicates that digitalization may change the internal production *process* of management accounting information.⁵ In Paper 3, we find that, in a big data context, tensions arise between global and local managers in the process of producing “relevant information.” In

⁵ From Paper 1, we conclude that digitalization raises questions concerning the production of “knowledge.” In Paper 3, we study the production of “information.” Although these are dissimilar terms, information eventually turns into knowledge (see Bhimani and Willcocks, 2014). In that sense, the terms are closely related.

addition, Paper 2 provides empirical evidence that digitalization plays an important role in sparking highly dynamic trajectories of inter-organizational power relations. This external process drives a change from conventional competition to a state of coopetition (Luo, 2007).

4.3. Practical Implications

For practitioners, this dissertation offers two central conclusions related to control practices. First, digitalization spurs competition between professions. While previous waves of technological advancements contributed to vertical power shifts in organizations, digitalization results in horizontal power shifts. As the implementation of digitalization initiatives typically involves a range of actors, this represents an opportunity for accountants to define their future role. However, seizing this opportunity will require a proactive approach. Second, and relatedly, digitalization requires a mix of competencies to produce information that will be perceived as relevant. Technical proficiency is needed to extract insights from big data. At the same time, merely descriptive analyses of big data are not perceived as relevant for strategic decision making. For accountants, one way forward could be to combine digital curiosity with business acumen in order to unite insights from big data with issues of strategic importance. Once again, the proactivity of management accountants will be important if they want to define their future role.



Appendix 1: Example of Consent Form

Do You Want to Participate In The Research Project «From Data To Insights»?

This is an informative consent form designed to provide you with an opportunity to participate in a research project. The aim of the research project is to develop an understanding of how organizations capitalize on data and how that data may contribute to enhanced insights in management control settings. In this form, we detail the purpose of the study and what it means to take part in the study.

Purpose

- “From Data to Insights” is an in-depth study with the aim of exploring how large, complex organizations work to capitalize on their data. In this regard, we aim to map the process of how data moves from being raw data to producing information that is used in decision-making settings.
- In this process, we aim to examine how the organization acquires, analyzes, and uses data. In the study, we plan to conduct 15-20 interviews with various actors at different organizational levels. The study is a part of a doctoral dissertation and part of the ongoing *Digital Business* research project at NHH.

The information gathered through this study will not be used for other purposes.

Who is responsible for the research project?

The *Digital Business* research project at NHH is responsible for the study.

Equinor has provided financing for the research project, but the funding was provided on an unconditional basis and without any specifications regarding its use.

Why are we asking you to participate?

Your organization was chosen through a careful selection process, with the organization’s size and profile being deciding factors. Potential respondents have been identified based on their roles in relation to data.

Contact information has been provided by top-level managers within the organization, who have approved the study based on a project description.

What does participation involve?

If you choose to take part in the study, you will be interviewed by one or more researchers from the research team. Interviews typically last between 45 and 90 minutes. We will audio record the interviews and transcribe the content of the audio recordings after the interviews.

The interviews will mainly revolve around how you acquire, analyze, or use data to produce information that may eventually be used as inputs in decision-making processes and other related processes.

In cases where it may be relevant, we will ask for permission to gather written documentation (secondary sources) if you should want to share such documentation during the interviews.

Voluntary participation

Participation in this project is voluntary. Should you choose to participate, you may withdraw your participation at any time without providing a reason for your withdrawal. All recorded information will then be deleted. Withdrawing or restraining from participating in the study will not have any adverse consequences.

Your privacy—how we store and use your information

We will only use information about you for the purpose described in this form. We will treat your information confidentially and in accordance with current privacy regulations.

- Only project group members will have access to the information collected.
- Your name and contact details will be substituted with a code, which will be stored on a separate list and kept separate from other information collected.
- The company's name will be anonymized and will be replaced with a generic name that only references the industry in which the company operates. However, some company-specific information will be included in the study, such as the number of employees, the company's structure, and the company's history.

Your participation will not be identifiable in any future publication based on this study.

What happens with your information when the research project is completed?

The information is anonymized when the research project is completed. According to current plans, the research project will be finalized at the end of 2022.

What are your rights as a participant?

If you may be identified from the data material, you have the following rights:

- To gain insights into which personal information about you may have been used; you may ask to be provided with a copy of this information;
- To correct personal information;
- To ask that personal information be deleted; and,
- To file a complaint with the Data Protection Agency concerning the use of your personal information.

Which rights do we have in treating your personal information?

We treat information about you based on your consent.

Based on a request from NHH, the Norwegian Center for Research Data AS (NSD) has assessed that the treatment of personal information in this project complies with current privacy regulations.

Where can I find more information?

If you have any questions or queries regarding this study or wish to use you rights as participant, please contact:

- PhD research scholar Dan-Richard Knudsen at dan-richard.knudsen@nhh.no,
- Supervisor Katarina Kaarbøe at katarina.kaarboe@nhh.no, or
- Our privacy representative at personvernombud@nhh.no.

If you have any questions concerning NSD's assessment of this project, please contact:

- Norsk senter for forskningsdata AS at personverntjenester@nsd.no or by phone at 55 58 21 17.

Best regards,
Dan-Richard Knudsen and Katarina Kaarbøe

Declaration of Consent

I have received and understood the information about the research project *From Data to Insights* and was given the opportunity to ask questions. I agree to:

- Take part in the study

I agree that my personal information may be used until the completion of the research project.

References

- Agostino, D., & Sidorova, Y. (2017). How social media reshapes action on distant customers: some empirical evidence. *Accounting, Auditing and Accountability Journal* *Accountability*, 30(4), 777–794. <https://doi.org/10.1108/AAAJ-07-2015-2136>
- Ahrens, T. (2008). Overcoming the subjective – objective divide in interpretive management accounting research. *Accounting, Organizations and Society*, 33, 292–297. <https://doi.org/10.1016/j.aos.2007.03.002>
- Ahrens, T. (2021). Paper development in qualitative accounting research: bringing social contexts to life. *Qualitative Inquiry*. <https://doi.org/10.1108/QRAM-03-2021-0044>
- Ahrens, T., & Dent, J. F. (1998). Accounting and organizations: Realizing the richness of field research. *Journal of Management Accounting Research*, 10, 1–39. <https://doi.org/10.2139/ssrn.124433>
- Al-Htaybat, K., & von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing and Accountability Journal*, 30(4), 850–873. <https://doi.org/10.1108/AAAJ-07-2015-2139>
- Appelbaum, D., Kogan, A., Vasarhelyi, M., & Yan, Z. (2017). Impact of business analytics and enterprise systems on managerial accounting. *International Journal of Accounting Information Systems*, 25(March), 29–44. <https://doi.org/10.1016/j.accinf.2017.03.003>
- Arnaboldi, M., Azzone, G., & Sidorova, Y. (2017). Governing social media: the emergence of hybridised boundary objects. *Accounting, Auditing and Accountability Journal*, 30(4), 821–849. <https://doi.org/10.1108/AAAJ-07-2015-2132>
- Arnaboldi, M., Busco, C., & Cuganesan, S. (2017). Accounting, accountability, social media and big data: revolution or hype? *Accounting, Auditing and Accountability Journal*, 30(4), 762–776. <https://doi.org/10.1108/AAAJ-03-2017-2880>
- Baxter, J., & Chua, W. F. (2008). The field researcher as author-writer. *Qualitative Research in Accounting & Management*, 5(2), 101–121.
- Bhimani, A. (2003). Digitization and Accounting Change. In *Management Accounting in the Digital Economy* (pp. 1–12). New York: Oxford Press.
- Bhimani, A. (2020). Digital data and management accounting : why we need to rethink

- research methods. *Journal of Management Control*, 31(1), 9–23.
<https://doi.org/10.1007/s00187-020-00295-z>
- Bhimani, A., & Willcocks, L. (2014). Digitisation, Big Data and the transformation of accounting information. *Accounting and Business Research*, 44(4), 469–490.
<https://doi.org/10.1080/00014788.2014.910051>
- Brewis, J. (2014). The Ethics of Researching Friends: On Convenience Sampling in Qualitative Management and Organization Studies. *British Journal of Management*, 25, 849–862. <https://doi.org/10.1111/1467-8551.12064>
- Bulgakov, A. L. (2018). *Financial and Economic Tools Used in the World Hospitality Industry*. (F. L. Gaol, F. Filimonova, & V. Maslennikov, Eds.). London, UK: Taylor & Francis Group.
- Burfitt, B. A., Baxter, J., & Mouritsen, J. (2020). Separating and integrating non-financial and financial measures: a case study of a sporting organization playing the value-in-kind (VIK) game. *Accounting, Auditing and Accountability Journal*, 33(8), 1871–1907.
<https://doi.org/10.1108/AAAJ-06-2018-3543>
- Burrell, G., & Morgan, G. (1979). PART I: IN SEARCH OF A FRAMEWORK. In *Sociological paradigms and organisational analysis* (pp. 1–37). Aldershot: Ashgate Publishing Company.
- Catasús, B., & Gröjer, J.-E. (2006). Indicators: on visualizing, classifying and dramatizing. *Journal of Intellectual Capital*, 7(2), 187–203.
<https://doi.org/10.1108/14691930610661854>
- Catasús, B. J., Ersson, S., Gröjer, J.-E., & Wallentin, F. Y. (2007). What gets measured gets. *Accounting, Auditing and Accountability Journal*, 20(4), 505–521.
<https://doi.org/10.1108/09513570710762566>
- Chua, W. F. (1986). Radical Developments in Accounting Thought. *The Accounting Review*, 61(4), 601–632.
- Cuganesan, S. (2008). Calculating customer intimacy: Accounting numbers in a sales and marketing department. *Accounting, Auditing and Accountability Journal*, 21(1), 78–103.
<https://doi.org/10.1108/09513570810842331>
- Czarniawska, B. (1999a). Management she wrote: organization studies and detective stories.

- Studies in Cultures, Organizations and Societies*, 5(1), 13–41.
<https://doi.org/10.1080/10245289908523519>
- Czarniawska, B. (1999b). *Writing Management: Organization Theory as a Literary Genre*. Oxford: Oxford University Press.
- Davenport, T. H. (1998). Putting the Enterprise into the Enterprise System. *Harvard Business Review*, 1–12. <https://doi.org/Article>
- Dechow, N., & Mouritsen, J. (2005). Enterprise resource planning systems, management control and the quest for integration. *Accounting, Organizations and Society*, 30(7–8), 691–733. <https://doi.org/10.1016/j.aos.2004.11.004>
- Dubois, A., & Gadde, L.-E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research*, 55(7), 553–560. [https://doi.org/10.1016/s0148-2963\(00\)00195-8](https://doi.org/10.1016/s0148-2963(00)00195-8)
- Ezzamel, M., Lilley, S., & Willmott, H. (2004). Accounting representation and the road to commercial salvation. *Accounting, Organizations and Society*, 29, 783–813. <https://doi.org/10.1016/j.aos.2003.10.004>
- Gebre-Mariam, M., & Bygstad, B. (2019). Digitalization mechanisms of health management information systems in developing countries. *Information and Organization*, 29(1), 1–22. <https://doi.org/10.1016/j.infoandorg.2018.12.002>
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2012). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Graham, C. (2008). Fearful asymmetry : The consumption of accounting signs in the Algoma Steel pension bailout. *AOS*, 33(7–8), 756–782. <https://doi.org/10.1016/j.aos.2008.01.001>
- Granlund, M. (2011). Extending AIS research to management accounting and control issues: A research note. *International Journal of Accounting Information Systems*, 12(1), 3–19. <https://doi.org/10.1016/j.accinf.2010.11.001>
- Granlund, M., & Malmi, T. (2002). Moderate impact of ERPS on management accounting: A lag or permanent outcome? *Management Accounting Research*, 13(3), 299–321. <https://doi.org/10.1006/mare.2002.0189>

- Granlund, M., & Mouritsen, J. (2003). Special section on management control and new information technologies. *European Accounting Review*, *12*(1), 77–83.
<https://doi.org/10.1080/0963818031000087925>
- Hopper, T., & Powell, A. (1985). Making sense of research into the organizational and social aspects of management accounting: a review of its underlying assumptions [1]. *Journal of Management Studies*, *22*(5), 429–465.
- Horlach, B., Drews, P., & Schirmer, I. (2016). Bimodal IT: Business-IT Alignment in the Age of Digital Transformation. *Proceedings of the Multikonferenz Wirtschaftsinformatik, Ilmenau*, (March), 1417–1428. <https://doi.org/10.1006/mpev.1999.0667>
- Horngren, C. T., Bhimani, A., Datar, S. M., & Foster, G. (2005). *Management and Cost Accounting*. FT Prentice Hall.
- Hyvönen, T. (2003). Management Accounting and Information Systems: ERP Versus BoB. *European Accounting Review*, *12*(1), 155–173.
<https://doi.org/10.1080/0963818031000087862>
- Jørgensen, B., & Messner, M. (2010). Accounting and strategising : A case study from new product development. *Accounting, Organizations and Society*, *35*(2), 184–204.
<https://doi.org/10.1016/j.aos.2009.04.001>
- Kakkuri-Knuuttila, M.-L., Lukka, K., & Kuorikoski, J. (2008). Straddling between paradigms: A naturalistic philosophical case study on interpretive research in management accounting. *Accounting, Organizations and Society*, *33*, 267–291.
<https://doi.org/10.1016/j.aos.2006.12.003>
- Kaplan, R. S., & Johnson, T. H. (1987). *Relevance Lost: The Rise and Fall of Management Accounting*. Boston, MA: Harvard Business School Press.
- Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry. *Journal of Management Information Systems*, *32*(1), 39–81. <https://doi.org/10.1080/07421222.2015.1029380>
- 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*. <https://doi.org/10.1016/j.accinf.2019.100441>
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through*

Society. Cambridge, MA, USA: Harvard University Press.

- Leonardi, P. M., & Treem, J. W. (2020). Behavioral Visibility: A new paradigm for organization studies in the age of digitization, digitalization, and datafication. *Organization Science*, *41*(12), 1601–1625. <https://doi.org/10.1177/0170840620970728>
- Leoni, G., & Parker, L. D. (2019). Governance and control of sharing economy platforms : Hosting on Airbnb. *The British Accounting Review*, *51*(6), 1–22. <https://doi.org/10.1016/j.bar.2018.12.001>
- Lowe, A., & Koh, B. (2007). Inscribing the organization : Representations in dispute between accounting and production. *Critical Perspectives on Accounting*, *18*, 952–974. <https://doi.org/10.1016/j.cpa.2006.05.001>
- Lukka, K. (2010). The roles and effects of paradigms in accounting research. *Management Accounting Research*, *21*(2), 110–115. <https://doi.org/10.1016/j.mar.2010.02.002>
- Lukka, K., & Modell, S. (2010). Validation in interpretive management accounting research. *Accounting, Organizations and Society*, *35*(4), 462–477. <https://doi.org/10.1016/j.aos.2009.10.004>
- Lukka, K., & Vinnari, E. (2014). Domain theory and method theory in management accounting research. *Accounting, Auditing and Accountability Journal*, *27*(8), 1308–1338. <https://doi.org/10.1108/AAAJ-03-2013-1265>
- Luo, Y. (2007). A coopetition perspective of global competition. *Journal of World Business*, *42*, 129–144. <https://doi.org/10.1016/j.jwb.2006.08.007>
- Macintosh, N. B., Shearer, T., Thornton, D. B., & Welker, M. (2000). Accounting as simulacrum and hyperreality : perspectives on income and capital. *Accounting, Organizations and Society*, *25*, 13–50.
- March, J. G. (1987). Ambiguity and accounting: The elusive link between information and decision making. *Accounting, Organizations and Society*, *12*(2), 153–168.
- Massaro, M., Dumay, J., & Guthrie, J. (2016). On the shoulders of giants: undertaking a structured literature review in accounting. *Accounting, Auditing & Accountability Journal*, *29*(5), 767–801.
- McAfee, A., & Brynjolfsson, E. (2012). Big data: The Management Revolution. *Harvard*

Business Review, 90(October).

McKinsey & Company. (2017). The case for digital reinvention. *McKinsey Quarterly*, (1), 26–41. Retrieved from <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/the-case-for-digital-reinvention>

Miles, M. B., Huberman, A., & Saldaña, J. (2013). *Qualitative Data Analysis - A Methods Sourcebook* (3rd ed.). Thousand Oaks: SAGE Publications.

Miller, P. (1998). The margins of accounting. *European Accounting Review*, 7(4), 605–621. <https://doi.org/10.1080/096381898336213>

Miller, P., & Napier, C. (1993). Genealogies of Calculation. *Accounting, Organizations and Society*, 18(7), 631–647.

Modell, S. (2005). Triangulation between case study and survey methods in management accounting research : An assessment of validity implications. *Management Accounting Research*, 16, 231–254. <https://doi.org/10.1016/j.mar.2005.03.001>

Modell, S. (2010). Bridging the paradigm divide in management accounting research: The role of mixed methods approaches. *Management Accounting Research*, 21(2), 124–129. <https://doi.org/10.1016/j.mar.2010.02.005>

Modell, S. (2020). Across the Great Divide: Bridging the Gap between Economics- and Sociology-Based Research on Management Accounting. *Journal of Management Accounting Research*, 32(2), 1–15. <https://doi.org/10.2308/jmar-52567>

Moll, J., & Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping the work of accountants : New directions for accounting research. *The British Accounting Review*, 51, 1–22. <https://doi.org/10.1016/j.bar.2019.04.002>

Mouritsen, J. (1998). Driving Growth: Economic Value Added Versus Intellectual Capital. *Management Accounting Research*, 9, 461–482. <https://doi.org/10.1006/mare.1998.0090>

Mouritsen, J. (2004). Measuring and intervening : how do we theorise intellectual capital management ? *Journal of Intellectual Capital*, 5(2), 257–267. <https://doi.org/10.1108/14691930410533687>

Nilsson, F., Olve, N.-G., & Parment, A. (2011). *Controlling for competitiveness*. Malmö: Liber Copenhagen Business School Press.

- Northcott, D., & Doolin, B. (2008). Qualitative Research in Accounting & Management – the journey so far. *Qualitative Research in Accounting & Management*, 5(1), 5–10.
<https://doi.org/10.1108/11766090810856732>
- Noy, C. (2008). Sampling knowledge : the hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*, 11(4), 327–344.
<https://doi.org/10.1080/13645570701401305>
- Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the Separation of Technology, Work and Organization. *The Academy of Management Annals*, 2(1), 433–474. <https://doi.org/10.1080/19416520802211644>
- Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: how to benefit from digitalization in practice. *International Journal of Information Systems and Project Management*, 5(1), 63–77.
<https://doi.org/10.12821/ijispm050104>
- Petani, F. J., Ramirez, C., & Gendron, Y. (2021). Special issue on Digitalization, work , and professions. *Critical Perspectives on Accounting*, 79(July).
<https://doi.org/10.1016/j.cpa.2021.102354>
- Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming companies. *Harvard Business Review*, 92(November).
<https://doi.org/10.1017/CBO9781107415324.004>
- 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>
- Quattrone, P., & Hopper, T. (2001). What does organizational change mean ? Speculations on a taken for granted category. *Management Accounting Research*, 12, 403–435.
<https://doi.org/10.1006/mare.2001.0176>
- Reay, T., Zafar, A., Monteiro, P., & Glaser, V. (2019). Presenting Findings From Qualitative Research: One Size Does Not Fit All! In T. Zilber, J. M. Amis, & J. Mair (Eds.), *The*

Production of Managerial Knowledge and Organizational Theory: New Approaches to Writing, Producing and Consuming Theory (pp. 201–216). Bingley, UK: Emerald Publishing Limited. <https://doi.org/10.1108/S0733-558X20190000059011>

Robson, K. (1992). Accounting Numbers as “Inscription”: Action at a Distance And The Development of Accounting. *Accounting, Organizations and Society*, 17(7), 685–708.

Rom, A., & Rohde, C. (2007). Management accounting and integrated information systems: A literature review. *International Journal of Accounting Information Systems*, 8(1), 40–68. <https://doi.org/10.1016/j.accinf.2006.12.003>

Rose, N., & Miller, P. (2010). Political power beyond the State: problematics of government. *The British Journal of Sociology*, 61(1), 271–303. <https://doi.org/10.1111/j.1468-4446.2009.01247.x>

Saunders, M., Lewis, P., & Thornhill, A. (2005). *Research Methods for Business Students*. New Delhi: Pearson Education Limited.

Scapens, R. W., & Jazayeri, M. (2003). *ERP systems and management accounting change: opportunities or impacts? A research note*. *European Accounting Review* (Vol. 12). <https://doi.org/10.1080/0963818031000087907>

Schwab, K. (2017). *Industry 4.0* (1st ed.). Crown Business.

Scott, S. V., & Orlikowski, W. J. (2012). Reconfiguring relations of accountability: Materialization of social media in the travel sector. *Accounting, Organizations and Society*, 37(1), 26–40. <https://doi.org/10.1016/j.aos.2011.11.005>

Seaver, N. (2018). WHAT SHOULD AN ANTHROPOLOGY OF ALGORITHMS DO? *Cultural Anthropology*, 33(3), 375–385. <https://doi.org/10.14506/ca33.3.04>

Suddaby, R., Saxton, G. D., & Gunz, S. (2015). Twittering change: The institutional work of domain change in accounting expertise. *Accounting, Organizations and Society*, 45, 52–68. <https://doi.org/10.1016/j.aos.2015.07.002>

The Norwegian National Research Ethics Committees. (2016). *Guidelines for Research Ethics in the Social Sciences, Humanities, Law and Theology* (4th ed.). Oslo: Oktan Oslo AS.

Tilson, D., Lyytinen, K., & Sørensen, C. (2010). *Digital Infrastructures: The Missing IS*

- Research Agenda. *Information Systems Research*, 21(4), 748–759.
<https://doi.org/10.1287/isre.1100.0318>
- Vaivio, J. (1999a). Examining “The Quantified Customer.” *Accounting, Organizations and Society*, 24, 698–715.
- Vaivio, J. (1999b). Exploring a “non-financial” management accounting change. *Management Accounting Research*, 10, 409–437.
- Vaivio, J. (2004). Mobilizing local knowledge with “Provocative” non-financial measures. *European Accounting Review*, 13(1), 39–71.
<https://doi.org/10.1080/0963818032000102971>
- Vaivio, J. (2006). The accounting of “The Meeting”: Examining calculability within a “Fluid” local space. *Accounting , Organizations and Society*, 31, 735–762.
<https://doi.org/10.1016/j.aos.2005.12.007>
- Vaivio, J. (2008). Qualitative management accounting research: rationale, pitfalls and potential. *Qualitative Research in Accounting & Management*, 5(1), 64–86.
<https://doi.org/10.1108/11766090810856787>
- Viale, T., Gendron, Y., & Suddaby, R. (2017). From “mad men” to “math men.” *Accounting, Auditing & Accountability Journal* (Vol. 30). <https://doi.org/10.1108/AAAJ-12-2014-1887>
- Vollmer, H. (2007). How to do more with numbers* Elementary stakes, framing, keying, and the three-dimensional character of numerical signs. *Accounting , Organizations and Society*, 32, 577–600. <https://doi.org/10.1016/j.aos.2006.10.001>
- Vollmer, H. (2019). Accounting for tacit coordination : The passing of accounts and the broader case for accounting theory. *Accounting, Organizations and Society*, 73, 15–34.
<https://doi.org/10.1016/j.aos.2018.06.003>
- Warren, J. D., 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. (2014). *Case Study Research: Design and Methods* (5th ed.). Thousand Oaks: SAGE Publications.
- Yoo, Y., Lyytinen, K., Boland, R., Berente, N., Gaskin, J., Schutz, D., & Srinivasan, N.

(2010). The Next Wave of Digital Innovation: Opportunities and Challenges. *Report on the Research Workshop: "Digital Challenges in Innovation Research,"* 1–37.

<https://doi.org/10.2139/ssrn.1622170>

Zuboff, S. (2015). Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1), 75–89.

<https://doi.org/10.1057/jit.2015.5>

Zuboff, S. (2019). *The Age of Surveillance Capitalism* (1st ed.). New York: Public Affairs.

CHAPTER I

Elusive boundaries, power relations, and knowledge production: A systematic review of the literature on digitalization in accounting

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Abstract

A third wave of technological advancements, which is often referred to as “digitalization,” is affecting organizations across the board. This paper aims to present a comprehensive synthesis of the extant scholarly work on digitalization in the accounting literature. It does so through a systematic literature review that focuses on articles on digitalization published by the highest-ranked accounting journals in the period 2007-2017. By conducting a thorough review, we extend Rom and Rohde’s (2007) literature review on integrated information systems (IIS) in management accounting. Furthermore, we utilize a modified version of the framework proposed by Rom and Rohde (2007) to classify and interpret the literature. This allows us to understand the differences between IIS and digitalization in accounting, and to illuminate avenues for future research. The paper concludes with an overview of three main differences in how IIS and digitalization have influenced accounting, and three concurrent avenues for future research on digitalization in accounting: the elusive boundaries of accounting, power relations, and knowledge production for decision making.

Key words

Digitalization, Systematic literature review, Accounting, Professional boundaries, Power, Decision making

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1. Introduction

The objective of this paper is to synthesize and critically review the extant literature on digitalization in accounting. In doing so, it aims to flesh out how digitalization affects accounting in new ways and, thereby, suggest avenues for future research.

Digitalization, the third phase of technological advancement, is currently creating an upheaval in organizational reality (Horlach et al., 2016; Porter and Heppelmann, 2014), especially in the accounting and finance functions (Bhimani and Willcocks, 2014). There has been an enduring interest in the relationship between technology and accounting in the accounting literature (Granlund and Mouritsen, 2003). Even though an extensive stream of literature examines technology's impact on accounting (see, e.g., Rom and Rohde, 2007, for an overview), more recently, commentators have argued that the extant research focuses on outdated technologies or is too narrow from an accounting perspective (e.g., Granlund, 2011). Critics argue that more research on technology's impact on accounting is needed, as technology is a dynamic organism (Prasad and Green, 2015). Consequently, its impact on accounting is also dynamic. Other researchers have specifically asked for more studies on the relationship between digitalization and accounting (Arnaboldi et al., 2017b; Payne, 2014). These calls are important because digitalization is expected to affect organizations in new ways—it enables the acquisition, collation, and use of new types of information (Arnaboldi et al., 2017a), it can lead to the reconfiguration of power relations (Scott and Orlikowski, 2012) and the introduction of novel decision-making practices (Quattrone, 2016).

In order to unravel how digitalization changes accounting and to identify key avenues for future research, we present a systematic literature review. The review includes material published in renowned and established accounting journals from 2007 to 2017. To analyze the material, the paper utilizes a modified version of an analytical framework proposed by Rom and Rohde (2007), who conducted a systematic review of the literature on integrated information systems (IIS) in management accounting. By comparing and contrasting the literature on digitalization with the literature on IIS, we are able to demonstrate that digitalization does not necessarily represent a sudden paradigm shift. Instead, it is a third wave of (interconnected) technologies that have profound social and technical implications for accounting and accountants. Furthermore, this paper contributes to the literature on digitalization in accounting by clarifying the pervasive concept of digitalization. In addition, the paper sheds light on three possible areas

for future research: the elusive boundaries of accounting, changing power relations within and outside organizations, and the complex production of knowledge for decision making.

Historically, the work of accountants has evolved in line with IT developments (Granlund and Mouritsen, 2003). Granlund and Mouritsen (2003, p. 78) even argue that “from its early days, accounting information and technology were related”. The literature speaks of two technological phases that had deep consequences for organizations.

The first phase of technological advancements that significantly altered how organizations and accountants operated was the emergence of computerized information systems (Granlund and Mouritsen, 2003; Porter and Heppelmann, 2014). These systems, which were introduced throughout the 1960s and 1970s, enabled accountants to record data in a more detailed manner and to produce more accurate analyses. The second phase was mainly characterized by the advancement of the world wide web and IIS (Porter and Heppelmann, 2014). In this context, IIS are systems that support management accounting (Rom and Rohde, 2007). In the late 1990s and early 2000s, IIS in general and enterprise resource planning (ERP) systems in particular were some of the in-vogue topics in IT. In fact, Davenport (1998, p. 122) claims that, despite the wide-ranging media attention paid to the internet, “the business world’s embrace of enterprise systems may in fact be the most important development in the corporate use of information technology in the 1990s.” Rom and Rohde (2007, p. 43) maintain that “ERP systems are examples of transaction-oriented information systems.” Such systems allowed accountants to acquire and provide information across the organization in a different and much more efficient manner.

A third phase of technological advancement is currently evolving. The joint emergence of a number of technologies has profound impact on how organizations operate, including the work of accountants. This third phase is commonly referred to as “digitalization” (Karimi and Walter, 2015; Parviainen et al., 2017). Although digitalization entails significant alterations in accounting practices, both IIS and digitalization can be understood as IT, because IT is generally conceptualized as “bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software” (Orlikowski and Iacono, 2001, p. 121). From a technological point of view, one can argue that digitalization emerged from several previous technological advancements, including IIS. At the same time, IIS is viewed as a somewhat narrow example of IT (i.e., software), while digitalization represents IT in a broader sense (i.e., a number of technological artefacts bundled with socio-technical properties). Hence, distinctions between the two can be made from a technological point of view. More importantly,

there are reasons to make the distinction from an accounting perspective. Digital technologies transform and expand the types and sources of data used by accountants. They also alter important accounting processes (Arnaboldi et al., 2017b). In that light, we suggest that the IIS-digitalization distinction is appropriate.

A uniform understanding of the term *digitalization* is lacking. It is often used interchangeably with other related terms, such as *digitization* or *digital transformation*. Moreover, the term is typically used under the assumption that the reader intuitively understands it. However, there are some fruitful distinctions to be made between digitalization and other related terms that help establish the boundaries of digitalization.

Digitalization is not to be confused with *digitization*. The latter refers to the technical process of encoding analog information into a digital format, which makes the digitized content programmable, addressable, traceable, and communicable (Hylving and Schultze, 2013; Yoo et al., 2010). As such, digitization is a less comprehensive change than digitalization. On the other hand, *digital transformation* entails major organizational changes driven by digital technologies and, consequently, profound alterations in strategy and the conduct of business (Bharadwaj et al., 2013; Fitzgerald and Kruschwitz, 2013). *Digitalization* lies somewhere between digitization and digital transformation. It involves more than a mere technical process (e.g., digitization), but it does not necessarily entail a reconfiguration of strategy or profound changes in the conduct of business (e.g., digital transformation). However, digitalization is associated with important changes related to socio-technical structures (Yoo et al., 2010). Those structures are reconfigured through the questioning of the underlying assumptions for the design and use of digital technologies (Thorseng and Grisot, 2017).

This paper reviews the extant research on digitalization in accounting by conducting a systematic literature review. Based on the findings from the literature review, the paper seeks to answer the following research questions:

How is digitalization influencing accounting practice and how do those effects compare to the effects of IIS on accounting practice? What are the most important avenues for future research on digitalization in accounting?

The literature review suggests that digitalization represents a third technological phase with deep organizational consequences. The findings show that digitalization influences accounting practice in a number of new ways, three of which we view as particularly significant. First, digitalization makes the boundaries of accounting increasingly elusive. Second, digitalization

is driving new forms of power relations. Third, digitalization raises new issues related to the production of knowledge for decision making. These three observations highlight key questions for future research: How does digitalization affect the boundaries of accountants' work and the accounting profession itself? How will digitalization affect the relative power of various organizational actors in organizations and who will determine how digitalization is adopted and implemented? How does digitalization affect the production of knowledge relevant for decision making?

The remainder of the paper is organized as follows. The theoretical framework for synthesizing research within the field is described in Section 2. The method used for the literature review is presented in Section 3. In Section 4, we present the literature review, which centers on concepts and their relationships to accounting by identifying: (i) the theoretical logic, (ii) the research findings, and (iii) the applied research methods and paradigms. In Section 5, we draw our conclusions and suggest directions for future research.

2. Analytical framework

When conducting a systematic literature review, the analysis should be structured in accordance with an analytical framework. The use of a framework reduces the risk of summarizing the literature in a tedious and nebulous manner (Massaro et al., 2016). Silverman (2013) suggests developing focused and critical reviews in order to alleviate such risks. Similarly, Massaro et al. (2016) argue that researchers should develop frameworks derived from previous reviews in related fields. By building a review on existing frameworks, researchers are better able to demonstrate how and why the emerging literature differs from the extant literature, which is the aim of this paper. Furthermore, Eisenhardt (1989) suggests that contrasting extant and emergent literature is essential in theory building. As such, conducting well-crafted literature reviews that contrast extant and emerging literature is an imperative task for researchers aiming to advance knowledge within a field.

In order to structure and analyze the emerging literature on digitalization in accounting, we modified a framework from the literature on information systems in management accounting, namely the framework developed by Rom and Rohde (2007). Their framework is a generic but detailed framework that helps scholars map and analyze research on information systems in accounting. We chose to utilize a modified version of Rom and Rohde's (2007) framework, as this framework offers an adequate description of the components of (management) accounting based on Booth et al. (2000).

We argue that digitalization will not change the components of accounting (the components in the framework; see Figure 1) but rather its inner workings (the dynamics within the framework's general components). For example, robotic process automation (RPA) will not remove tasks altogether, but it will clearly change the tasks that need to be handled by human actors. In other words, accountants will still play a role in organizations, but digitalization seems likely to substantially challenge that role. Thus, we propose that Rom and Rohde's (2007) framework is adequate for analyzing digitalization. Digitalization appears likely to not only bring about important changes in accounting but also push the boundaries of how accounting will be conducted and by whom. Furthermore, Rom and Rohde's (2007) framework appears relevant for painting a picture of how dominant technologies have shaped accounting over the past two decades⁶. Thus, their review serves as an appropriate foundation for critically assessing how digitalization is influencing accounting. As such, we are able to create a continuous picture of the impact of prevalent technologies on accounting in recent years.

2.1. Description of Rom and Rhode's framework

Rom and Rohde's (2007) framework serves as a mapping tool for research within IIS and management accounting. This framework allows for the identification of research gaps within management accounting.

The main constituents of the framework are the following. First, the two core elements in the framework—management accounting and IIS—are introduced. Second, IIS is decomposed into components and characteristics. The most relevant example of an IIS component is the ERP system. In terms of characteristics, Rom and Rohde (2007) highlight integration. Third, the authors divide management accounting into four subparts: tasks (Booth et al., 2000); techniques and design (Granlund and Malmi, 2002); organization of management accounting (Quattrone and Hopper, 2005); and behavior, use, and perceptions (Dechow and Mouritsen, 2005). Fourth, the authors explain the relationship between management accounting and IIS. They ascertain that the two elements stand in a bidirectional relationship: IIS might affect or enable management accounting (Granlund and Malmi, 2002), while management accounting might have an influence on IIS (although this influence works at a slower pace). Hence, they draw a bidirectional arrow between the two core elements of the framework. Fifth, the authors introduce both mediating and moderating variables in the relationship between management

⁶ We considered Mauldin and Ruchala's (1999) framework for accounting information systems (AIS) research as an alternative, but we deemed it too task oriented.

accounting and IIS. In this regard, they point to context variables as well as power and politics as possible examples. Sixth, they include performance as an outcome variable. Although not directly a part of the relationship between management accounting and IIS, a “relatively large stream of research investigates the performance effects of investments in IT, especially in the literature on information systems and accounting information systems” (Rom and Rohde, 2007, p. 44). The authors view the relationship between performance and management accounting as bidirectional, as “management accounting can in some studies be considered as the driver of performance and in other studies as a part of the performance measure as a leading indicator” (Rom and Rohde, 2007, p. 44). Seventh, the framework is understood as independent of any one research paradigm, such that constructs and interrelationships can be researched using a functionalist, interpretative, or critical research paradigm (Rom and Rohde, 2007).

We developed a modified version of Rom and Rohde’s (2007) framework by changing the two core elements. First, our modified framework examines digitalization instead of IIS. Second, we extend the domain from *management accounting* to *accounting*, as digitalization is a novel concept only recently embraced by accounting scholars. Hence, in order to present a fruitful overview of the extant literature, it was relevant to broaden the scope. In addition, digitalization brings changes to information acquisition and provision both internally (management accounting) and externally (financial accounting).

The modified framework, which is shown in Figure 1 below, serves as a tool for examining the relationship between digitalization and accounting.

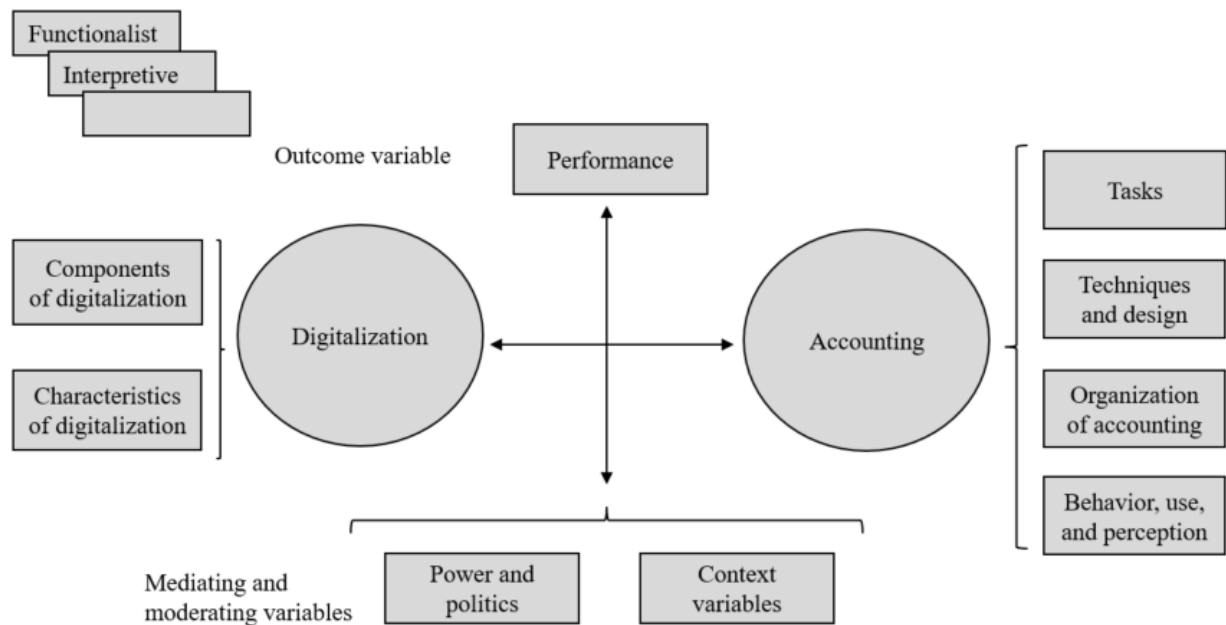


Figure 1: Modified framework for research on accounting, where the two main constituents have been replaced: digitalization has replaced IIS and accounting has replaced management accounting. Original source: Rom and Rohde (2007)

3. Research methodology

Knowledge of prior relevant literature is an essential feature in all academic work, as it forms the foundation for new knowledge creation (Webster and Watson, 2002). Massaro et al. (2016) cite Light and Pillemer (1984, p. 169), who argue that “the need for a new study is not as great as the need for the assimilation of already existing studies.” Literature reviews offer an effective way to synthesize the extant literature and to uncover the accumulated insights of a number of scholars within a field.

In order to derive a comprehensive picture of the extant literature on digitalization in accounting, we conducted a systematic literature review. Systematic literature reviews require rigorous and precise examination of the search results (Kitchenham, 2004; Okoli and Schabram, 2010). Massaro et al. (2016) distinguish between “systematic” and “structured” literature reviews, but situate both at the rigorous end of a continuum ranging from “no rules” to “rigid rules.” Rigid literature reviews do not have a rich history in accounting studies, although notable exceptions can be found (e.g., Guthrie et al., 2012; Hoque, 2014). Nevertheless, their application in accounting is appropriate, as both quantitative and qualitative studies are commonly accepted (see Appendix 4) and as systematic literature reviews represent an appropriate way of synthesizing studies’ results (Britten et al., 2002; Massaro et al., 2016).

3.1. Planning the literature review

The review process began with two meetings during which we discussed our research goals with scholars from the management accounting field and the information systems field. After clearly defining the goals of our research, we formulated our research questions. In order to answer the research questions, we found a systematic literature review to be the most appropriate methodological approach. Systematic literature reviews are suitable when the goal is to derive an overview of an emerging issue or concept (Webster and Watson, 2002), such as digitalization. In addition, a systematic literature review appears relevant when the researcher aims to shed light on future research opportunities (Massaro et al., 2016), which is in accordance with the aim of this paper. Thereafter, we developed a review protocol that included the research strategy as well as inclusion and exclusion criteria.

3.2. Inclusion and exclusion criteria

In order to identify the targeted articles, we established four inclusion and exclusion criteria. First, using the Scopus online database, we limited the search for relevant literature to published articles, and excluded proceedings and other unpublished material. Second, only articles written in English were considered. Third, to ensure academic rigor and quality, we exclusively reviewed articles published in the highest-ranked accounting journals. More specifically, we limited the search to articles published in the 27 journals⁷ ranked 3 or 4 in the Association of Business Schools (ABS) list. We made one exception to this rule—we included the *International Journal of Accounting Information Systems*, as this journal was likely to have published material pertinent to this review (see Appendix 1 for a publication overview by journal). Fourth, our search was limited to research published between January 1, 2007 and December 31, 2017 (see Appendix 2 for an overview of the number of publications per year). This allowed us to build on Rom and Rohde's (2007) literature review on IIS in management accounting in terms of crystallizing how digitalization's impact on accounting differs from the impact of earlier technologies discussed in the accounting literature. Much of the research on IT's impact on (management) accounting in the 2000s revolved around IIS in general and ERP systems in particular (Sangster et al., 2009). Today, the center of attention is shifting towards digitalization and the effects of its related features (see, e.g., Appelbaum et al., 2017; Arnaboldi

⁷ The *British Tax Review* (level 3) was not available in Scopus or any other database accessible by the author. Consequently, eventual relevant publications in this journal were not included in this study.

et al., 2017b; Bhimani and Willcocks, 2014; Quattrone, 2016).

3.3. *The search process*

The search process was organized in keeping with the recommendations of Webster and Watson (2002) and Kitchenham (2004). The literature search included the following steps:

- 1 Keyword search using the Scopus online database,
- 2 Review of relevant articles (see Appendix 4),
- 3 Review of references to publications identified in steps 1 and 2, and
- 4 Identification of publications citing the key publications.

The search process was initiated with a keyword search of the Scopus⁸ online database aimed at detecting relevant articles on the subject of digitalization in accounting. We set out by searching for articles using “digitali?ation”⁹ in the title, abstract, or keywords. As expected, few articles employed the exact term “digitalization.” Most researchers focus on a specific feature of digitalization without employing the term “digitalization.”

Consequently, we broadened the keyword search to identify other relevant articles. In this process, we included keywords closely related to digitalization: “digital,” “big data,” “analytics,” “cloud,” “cyber,” “mobile,” “social media,” “robotization,” “automatization,” “artificial intelligence,” “blockchain,” “platforms,” and “internet of things.” These keywords were included because they appear as part of an academic definition of digitalization (see Nwankpa and Roumani, 2016), in influential articles on the topic (e.g., Bharadwaj et al., 2013), in acknowledged books (e.g., Westerman et al., 2014), or in the business media’s discourse on the topic. We found it appropriate to include features of digitalization appearing outside the academic discourse, as business practice tends to be ahead of academia in discussions of new technologies and emerging fashions (Abrahamson, 1996). By employing a broad search scope, we reduced the likelihood of overlooking relevant articles.

This broad search scope (see Appendix 3 for the full query string from Scopus) resulted in a set of 103 articles. The second step in the process was to review this set of articles to determine which articles were pertinent for further examination. We found that about 20% of the 103 articles had been included in the search results due to the occurrence of the word “platform” in

⁸ <https://www.scopus.com/search/form.uri?display=basic>.

⁹ The use of a question mark in “digitali?ation” allows for detection of articles written in British English (“digitalisation”) and American English (“digitalization”).

the abstract even though the articles were not related to digitalization. Moreover, another 20% of the articles subscribed to the auditing literature, which is beyond the scope of this review.¹⁰ Another set of articles was deemed irrelevant due to a lack of emphasis on novel digital technologies or digitalization as a concept. After excluding this last group of articles, we were left with 33 relevant articles.

The third step in the process was to review the reference lists in these 33 articles in order to identify other relevant literature not captured in steps 1 and 2. This step did not provide us with any additional material and neither did step four, which confirmed the comprehensive catchment area of the chosen database.

Of the 33 articles analyzed, 37% were conceptual studies, 33% deployed a quantitative method, 20% used a qualitative method, and 10% drew on mixed methods. A detailed overview of the methods used in the articles discussed in this review is provided in Appendix 5.

4. Data description and analysis

Rom and Rohde's (2007) framework guides the structure of our data analysis. Under each constituent of the framework, we analyze: (i) the logic of the relationship between digitalization and accounting, (ii) the reported findings, and (iii) the prevalent research methods and paradigms in the extant literature. This structure enables us to systematically crystallize the impacts of digitalization on accounting practices and to compare them to the influence of IIS. We present the analysis by first looking at the relationship between digitalization and each of the four constituents of accounting (tasks; techniques; organization; and behavior, use, and perceptions) in sections 4.1-4.4. Thereafter, we analyze the relationship between digitalization and performance (section 4.5) before concluding our analysis by studying power (section 4.6) and context as moderating or mediating variables (section 4.7).

¹⁰ The review indicates that digitalization is altering information-acquisition and information-provision processes. In this sense, it was deemed useful to investigate both the management accounting and the financial reporting literature, as management accounting focuses on internal information provision, while financial reporting focuses on external information provision (Horngren et al., 2015).

4.1 The relationship between accounting tasks and digitalization

4.1.1. The logic of the relationship

Rom and Rohde (2007) find that most research on the relationship between management accounting and IIS looks at IIS as the independent variable and management-accounting tasks as the dependent variable. All articles in our review use digitalization—or a specific feature of digitalization—as the independent variable and accounting tasks as the dependent variable. A more granular analysis of the articles reveals that social media and big data are the most commonly used independent variables, while accounting tasks rarely appear unaccompanied as the dependent variable.

4.1.2. Findings: The relationship between accounting tasks and digitalization

Rom and Rohde (2007) build on Booth et al.'s (2000) decomposition of management-accounting tasks into three parts: transaction processing, reporting, and decision support. Based on the IIS literature, Rom and Rohde (2007) report that ERP systems are particularly effective in improving the supply of transaction data.

The literature investigated in the present study devotes some space to information processing in general and transaction processing in particular. Bhimani and Willcocks (2014) endeavor to contribute insights into how the new digital reality may alter transaction-processing dynamics in organizations. In the past, organizations “designed accounting systems to produce formal information which systems users purposefully deploy to gain an understanding of how economic transactions reveal information about the types and trends of consumer purchases” (Bhimani and Willcocks, 2014, p. 475). These authors also observe that information previously discarded by organizations due to a lack of a direct link to economic transactions is now viewed as a valuable resource in business analytics. In fact, organizations such as eBay and Amazon now monitor buyer and seller activities even when no transactions take place (Bhimani and Willcocks, 2014). This development, which represents a move beyond a transactional focus, raises important questions regarding what accounting is and will be in an ever more digital future. The move beyond a transactional focus suggests that the boundaries of accounting are becoming more elusive.

A number of the studies covered in our review examine how digitalization affect reporting—both internal reporting (e.g. Agostino and Sidorova, 2017; Viale et al., 2017) and reporting to

external stakeholders (e.g. Lee et al., 2015; Yang and Liu, 2017). While Rom and Rohde (2007) found that ERP systems did not change reporting despite their ability to handle vast amounts of data, we find that digital technologies have changed reporting. In terms of internal reporting, Agostino and Sidorova (2017) scrutinize how social media changes actions in organizations. They discover that information on an organization's social media performance (e.g., number of followers, critical comments) become an important internal report, notwithstanding skepticism from controllers who still need to be convinced of social media's importance. This demonstrates the tendency toward conflicting perceptions among professional groups with regards to the inclusion of new sources of data in accounting practices. Both in this case and in the study by Arnaboldi et al. (2017a), members of the digital department or the marketing department gained influence relative to accounting departments, as top management became increasingly interested in social media performance.

In terms of corporate reporting, numerous scholars have pointed to the major opportunities that analytics can provide (Al-Htaybat and von Alberti-Alhtaybat, 2017; Bhimani and Willcocks, 2014; Vasarhelyi et al., 2015). For example, digital technologies may facilitate faster and broader provision of financial information to stakeholders (Bellucci and Manetti, 2017). Nevertheless, Payne (2014) calls for a cautious approach to the implementation of big data and analytics due to societal concerns, such as privacy and cybersecurity. Recent developments in China, where the implementation of a social-rating system is pending (Financial Times, 2018), point to the wide-ranging, privacy-related consequences of the employment of big data and analytics. Analogous systems, like the Chinese social-credit system, may easily be converted to organizational settings. In western communities, however, regulations like the EU's General Data Protection Regulative (GDPR) and US security policies appear to inhibit similar developments.

Quattrone (2016) raises the concern that the accounting dialogue may be lost in analytics, which could have implications for corporate reporting. He urges accountants and managers to aim for reasonable—not rational—decision making. Corporate reporting will always present simplified information. As such, it should be subject to discussion before decisions are made. A central realization in Quattrone's (2016) argument is that information does not equal knowledge. Increased real-time provision of information amplifies such concerns, because real-time reporting enables managers to make decisions even faster than in the IIS era.

Scott and Orlikowski (2012, p. 39) add to the discussion about the reporting-knowledge production interface. They find that user-generated reporting leads to “practices of detachment”

which play an integral role in knowledge production in social media. The result is what they refer to as “quasi-formalized knowledge,” which yields “a new species of authority” (Scott and Orlikowski, 2012, p. 39). According to the authors, this raises questions about how organizations will handle this kind of knowledge production. In a similar vein, Arnaboldi et al. (2017a) cite Miller and Skinner (2015, p. 222), who maintain that “changes in information technology, the media, and securities markets interact to affect the ways in which information about firms is produced, disseminated, and processed.” These authors also argue that social media has the potential to open up for a “hybridization of reporting, which has a direct impact on the managers’ decision making and actions” (Arnaboldi et al., 2017a, p. 840).

In terms of decision support and decision making, findings from the IIS literature suggest that ERP systems did not change how managers made decisions. Reporting and decision-making had become institutionalized activities in organizations (see, e.g., Fahy and Lynch, 1999; Granlund and Malmi, 2002), resulting in slow adoption and change. The digitalization literature stresses that although digital technologies, such as big data and analytics, may provide decision makers with support, achieving such an outcome requires effort. According to Al-Htaybat and von Alberti-Alhtaybat (2017), the expression “data is the new oil” implies that big data needs to be refined, structured, and processed before it can generate useful insights. The authors also find that accountants view the predictive possibilities of data analytics as useful for internal decision making, but that they need additional skills in order to use data analytics to make a contribution in practice. Consequently, they conclude that there is a need to update accounting curricula to ensure that accountants possess a relevant set of skills. Through an empirical study, Agostino and Sidorova (2017) endorse the view that centers of calculation connected to social media can change “action at a distance” (Latour, 1987). One distinctive finding in this regard is that social media tends to blur the distinction between the periphery and the center. This is explained by social media’s tendency to blur the lines between the organization and its external environment. Lastly, Schneider et al. (2015) discuss how data analytics can change the task processes that provide decision makers with inferences, predictions, and assurance, and argue that the impact of data analytics on accounting tasks needs further examination.

The findings on the relationship between accounting tasks and digitalization provide a few key insights. First, the review indicates that a move beyond a transactional focus makes the boundaries of accounting more elusive, which stands in contrast to Rom and Rohde’s (2007) findings from the IIS literature. Second, cybersecurity and privacy issues are expected to become increasingly important, as information spreads faster and broader thanks to new digital

technologies. Third, a number of studies problematize the rise of user-generated reporting and its consequences for managerial decision-making. As a result, the lines between the accounting domain and the external environment blur. Accountants and decision makers will need a new set of skills to analyze and interpret newfangled types of information.

4.1.3 Research method and paradigm

Rom and Rohde's (2007) literature review indicates that research into the relationship between management accounting tasks and IIS has generally applied the survey method. In-depth case studies are absent.

Our review demonstrates that three main methods are applied in studies of digitalization in accounting: case studies, content analysis, and conceptual papers. However, only three papers are empirical case studies. Hence, we find that accounting literature offering in-depth empirical findings on the effects of digitalization on accounting is scarce. More empirical research is warranted in this domain.

4.2. The relationship between accounting techniques and digitalization

4.2.1. The logic of the relationship

Rom and Rohde (2007) state that a unidirectional relationship is expected in most studies, such that IIS is believed to affect management-accounting techniques. This unidirectional relationship is partly explained by the fact that ERP systems are hard to change (Davenport, 1998; Granlund and Malmi, 2002). Thus, management accounting can only affect ERP systems to a certain extent in the post-implementation phase. If management accounting is to affect ERP, it should do so prior to implementation.

Our review of the digitalization literature indicates that the relationship between accounting techniques and digitalization is not unidirectional. Much of this research investigates how a certain feature of digitalization affects accounting. When discussing accounting techniques, the literature rarely pays attention to "heavyweight software systems" (Bygstad, 2015), such as ERP systems. Instead, the focus is on how digitalization affects accounting techniques in terms of how accountants acquire, interpret, and report information (Schneider et al., 2015). We also observe more endogenous and organic adoption and implementation of digital technologies (Suddaby et al., 2015), which are partly explained by the lightweight nature of digital

technologies (Bygstad, 2015). This lightweight nature makes these technologies easier to change in both the pre-implementation and post-implementation phases.

4.2.2. Findings: The relationship between accounting techniques and digitalization

Rom and Rohde (2007) point to empirical research in the IIS literature demonstrating that organizations struggle with disintegrated information systems (Granlund and Malmi, 2002; Malmi, 2001). They also find that management accounting techniques and IIS are not independent from each other.

In the emerging literature on digitalization, several novel accounting techniques are discussed. The inroads that social media and data analytics have made in organizations represent the basis for the emergence of new key performance indicators (KPIs). The goal of these new KPIs is to help make sense of economic performance, such as the conversion rate associated with a given action by a web user. The conversion rate could, for instance, indicate the number of shopping carts validated in relation to the number of visitors to a web page over a given period of time (Viale et al., 2017) or the number of tickets sold to a cultural event as a direct result of a post on Facebook (Arnaboldi et al., 2017a). Additional studies similarly unveil the effects of social media and big data on the development of performance indicators (Agostino and Sidorova, 2017), thereby responding to the call made by Ittner and Larcker (2009) to study accounting techniques, such as nonfinancial performance measures. Digitalization seems to be paving the way for the introduction of new KPIs based on new types of information and governed by new groups of professionals.

Other accounting techniques are also emerging as a result of digitalization. Tang (2017) and Arnaboldi et al. (2017b) suggest that the technological development enables a shift from forecasting to “nowcasting.” Nowcasting refers to the prediction of the present or very near future, and it is a technique based on real-time web-search data. Most studies on nowcasting examine market reactions, but nowcasting also gives rise to opportunities in the accounting domain. For example, management accountants may use this technique to predict customer sentiments regarding the launch of a new product, or, as stated by Tang (2017), financial accountants may predict the demand for financial information prior to earnings announcements. In general, more studies looking at the implications of nowcasting are warranted, as the decision-making implications of this technology have thus far been overlooked (Arnaboldi et al., 2017b).

Big data has also stimulated the emergence of new visualization tools that privilege increasingly aggregated views over detailed numbers (Arnaboldi et al., 2017b)—a development that might facilitate and improve decision making. At the same time, over-abstraction could impede an individual’s appreciation for important details, nuances, and heterogeneity in the data (Cuganesan and Dumay, 2009). Moreover, big data bears the potential to rejuvenate the balanced scorecard (BSC) by stimulating new visualizations. Innovative and transformed visualizations can give rise to new narratives that fuel “the rhetorical machine” functions (Arnaboldi et al., 2017b; Busco and Quattrone, 2015) of the BSC, laying the groundwork for improved discussions and knowledge generation. The inclusion of dynamic data visualizations in the BSC exemplifies a development from the IIS era, when the main emphasis was on system integration (Rom and Rohde, 2007).

The ways in which managers reflect upon numbers and visualizations are important for decision making. A central issue in this context is how decision makers interpret aggregated information. This is important given our knowledge of the power of numbers (Porter, 1995). It may be tempting to blindly follow the numbers wherever they may go, especially when powerful predictive models produce those numbers, which arguably limits the space for human judgement (Quattrone, 2016).

In terms of how accounting is shaping digitalization or vice versa, Arnaboldi et al. (2017a) indirectly discuss how the need for new decision-relevant information is influencing the development of data-analytics tools for social media. Social media platforms are offering information relevant for an increasingly wider selection of KPIs, which form the basis for what social media platforms monitor and report. This signals that accounting is shaping social media to some degree, just as social media is shaping accounting.

In summary, the emerging literature on digitalization in accounting points to several ways in which digitalization is changing accounting techniques. The rise of real-time data allows for novelty in KPI production, the shift from forecasting to nowcasting offers new predictive opportunities, and significant progress in data visualization can improve accounting techniques, such as the BSC. Notwithstanding these improvements, decision makers should be familiar with the potential risks of becoming overly reliant on data-driven numbers and visual representations.

4.2.3. Research method and paradigm

The research methods employed in studies on IIS are best described as diverse, but field studies are common. In these studies, findings are often tied to one setting (Rom and Rohde, 2007). In terms of research methods, the emerging literature on digitalization is largely limited to conceptual papers that either theorize about digitalization's impact on accounting or employ content analysis. A few studies (Al-Htaybat and von Alberti-Alhtaybat, 2017; Arnaboldi et al., 2017a) make use of in-depth qualitative case studies.

Rom and Rohde (2007) report that research on management-accounting techniques has primarily been conducted from a functionalist point of view. Research on digitalization and accounting techniques cannot be characterized as single tracked like the IIS literature. Studies on digitalization that explain their findings using economic factors are not significantly overrepresented relative to studies employing theoretical lenses that highlight other factors. A handful of studies emphasize stakeholder dynamics (see, e.g., Bellucci and Manetti, 2017; Manetti and Bellucci, 2016), or increases and decreases in organizational actors' involvement in digitalization processes (see, e.g., Agostino and Sidorova, 2017; Arnaboldi et al., 2017a). These studies are best described as subscribing to an interpretive paradigm. However, a number of studies accentuate economic factors (see, e.g., Blankespoor et al., 2014; Yang and Liu, 2017). They are consequently understood as functionalistic studies.

4.3. The relationship between the organization of accounting and digitalization

Rom and Rohde (2007, p. 52) find that in the 1980s, management accounting was a centralized task and that "management information was in the custody of the management accountants". However, they portray a different reality for management accounting in the new millennium. Their findings suggest a broadening of the accountant's role. More specifically, management accountants may carry out tasks traditionally performed by general management, while general management can perform management-accounting tasks.

Our study of digitalization in accounting suggests even more fundamental changes. While Rom and Rohde (2007) demonstrated that management accountants enjoyed organizational promotion in the IIS era,¹¹ the same is not true in the digital age. A number of new studies now

¹¹ Rom and Rohde (2007) refer to a number of studies that report an organizational promotion for management accountants (moving from bean counters to business consultants).

allude to a reality in which management accountants' organizational positions are challenged by other professional groups. Even though the picture is not complete, the literature implies an increasing tendency towards blurred lines and elusive boundaries (Hazgui and Gendron, 2015)¹² in the accounting profession itself (Agostino and Sidorova, 2017; Arnaboldi et al., 2017b; Suddaby et al., 2015).

4.3.1. The logic of the relationship

In terms of the logic of the relationship, Rom and Rohde (2007) suggest that a bidirectional relationship is plausible—IIS may drive changes in the accountant's role,¹³ while shifts in professional roles may influence IIS. In this review of digitalization, we also view a bidirectional relationship as plausible. That is, digitalization may be the impetus that drives changes in the organization of accounting (including the accountant's role), while changes in the organization of accounting may shape the use of digital technologies.

4.3.2. Findings: The organization of accounting

Research on the organization of (management) accounting primarily focuses on the role of the accountant. Rom and Rohde (2007) find that management-accounting tasks may be performed by a range of organizational actors at all levels. This finding is, in part, driven by ERP systems, which contribute to the automatic capture of management-accounting data in organizations. Therefore, Rom and Rohde (2007, p. 54) maintain that "management accounting has become a dispersed activity". Moreover, they emphasize that the ability of ERP systems to distribute information led to a decentralization of control.

New accounting research provides examples in which digitalization drives professionals to cross occupational boundaries as well as examples of situations in which the lines between professions are blurred. A telling example is provided by Arnaboldi et al. (2017a), who show how media marketers entered the field of performance management (i.e., the accounting domain) by taking the lead in social media management. Their study indicates that when professionals cross organizational boundaries, hybridization of professional roles becomes evident. In Arnaboldi et al. (2017a), hybridization refers to a situation in which organizational actors move into other organizational domains, such as when marketers enter traditional accounting terrain or when accountants take charge of digitalization initiatives. In one case, the

¹² In their article "Blurred roles and elusive boundaries," Hazgui and Gendron (2015) investigate the interplay among key actors as well as shifts in role boundaries in a distinct regulatory space. The study illustrates the elusiveness of the boundaries of actors' roles in contemporary forms of professional regulation.

¹³ The reviewed literature often refers to management accountants in discussions of "the role of the accountants."

advent of social media served to relax occupation boundaries, which resulted in hybridization (Arnaboldi et al., 2017a). In other words, the development of digital tools and techniques is the engine of change.

In another influential article, Scott and Orlikowski (2012) explore the organizational influence of the social media platform TripAdvisor.¹⁴ They conclude that TripAdvisor had significant implications for management practices because it reconfigured “relations of accountability” (Scott and Orlikowski, 2012, p. 26). Such reconfigurations might signify a dilution of accountants’ accountability, as accountability is directed into the domain of other professionals in the organization or even into the domain of actors outside the organization. Agostino and Sidorova (2017) echo Scott and Orlikowski’s (2012) view that digitalization might redistribute accountability relationships. Agostino and Sidorova (2017) state that social media’s “wisdom of the crowd” mechanism implies a redistribution of accountability. Furthermore, they argue that “all previous studies recognize that the emergent social media calculative practices are shaping accounting and accountability, by reconfiguring new organizational roles and positioning, experts and expertise, and accountability-type relationships” (Agostino and Sidorova, 2017, p. 780). The profound reconfiguration of roles, expertise, and accountability relationships raises important questions about what constitutes accounting in a digital world and the role of accountants in that world. Suddaby et al.’s (2015, p. 52) study corroborates the notion of increasingly blurred lines and elusive boundaries, as it demonstrates how “social media professionals, in pursuing their own professional project, generate change in the professional domain of accountancy”.

In terms of organizational control, Bhimani and Willcocks (2014) argue that digitalization leads to centralization and standardization. Low-value work is increasingly being standardized through automatization, and novel digital tools enable wide organizational control, which leads to the centralization of specific tasks. These changes thus represent a shift away from the decentralizing effects of ERP (Rom and Rohde, 2007), as business analysts and decision-support staff need to be situated closer to top management. However, Bhimani and Willcocks (2014) do not base their discussion on empirical data but on their conceptualization of the potential effects of digitalization.

Quattrone (2016) worries about more than a mere reconfiguration of accountants’ occupational

¹⁴ TripAdvisor, Inc. is the world’s largest travel website with more than 315 million users and more than 500 million user-generated reviews. It was an early adopter of user-generated content.

boundaries. He fears annihilation of the profession as we know it. In particular, he warns that digitalization is forcing organizations into a search for “truth” when examining big data and that this search for “truth” will mean the end of the accountant. His rationale is that accountants have historically contributed with insightful judgements about acquired information, but digitalization no longer leaves room for judgement or debate, as decisions are increasingly driven by data. Hence, digitalization puts accountants on the backburner where they might be relegated from the decision-making sphere.

Just as technology affects the configuration of organizational roles and boundaries, the configuration of roles and boundaries can influence technology. As demonstrated by Arnaboldi et al. (2017a), accountants tend to be sidelined by marketers leading the digital processes in organizations. This might affect an organization’s expectations for a technology. In other words, other technological features and KPIs might emerge when marketers head digital development than would have been the case if accountants took the lead. Therefore, accountants’ lack of involvement arguably shapes digital development within organizations.

In summary, the extant literature seems to suggest that digitalization, especially social media, challenges the conventional understanding of accounting, occupational boundaries, and the role of accountants. Accountants have traditionally been instrumental in acquiring and promulgating information in organizations, which served to fortify their importance. However, the studies covered in this review imply that, in the words of Miller and O’Leary (1993, p. 203), “accounting expertise [...] no longer automatically holds untrammelled sway.”

4.3.3. Research methods and paradigms

Rom and Rohde (2007) report that most publications on IIS apply the case-study method and that the literature is generally devoid of research based on survey methods. In terms of research paradigms, most studies make use of such theories as institutional theory (Burns and Scapens, 2000; Dimaggio and Powell, 1983), structuration theory (e.g., Giddens, 1976), or actor-network theory (e.g., Latour, 1987). Therefore, Rom and Rohde (2007) conclude that most research on IIS and the role of the management accountant adopts an interpretive stance.

Most of the studies in our review that focus on the organization of management and the changing nature of the accountant’s role make use of case studies or content analysis. The studies employing a case-study method rely on such theories as boundary objects (Arnaboldi et al., 2017a), action at a distance (Agostino and Sidorova, 2017), or institutional theory (Lee et al., 2015). The content-analysis studies are more geared towards stakeholder theories, such as

dialogic accounting (Bellucci and Manetti, 2017; Manetti and Bellucci, 2016). In terms of research paradigms, publications that focus on the role of accountants in organizations tend to observe the micro-dynamics at play in organizations. The theories employed in these studies reflect an interpretive stance. The first property of the boundary-objects theory employed by Arnaboldi et al. (2017a) is “interpretive flexibility,” which nicely encapsulates the paradigmatic view of most research on organization and roles found in the literature on digitalization in accounting.

4.4. The relationship between behavior, use, and perceptions, and digitalization

4.4.1. The logic of the relationship

“Behavior, use and perception are important aspects of management accounting,” according to Rom and Rohde (2007, p. 54). They argue that if the implementation and adoption of management-accounting techniques do not lead to changes in behavior or use, then those management-accounting techniques have no value for the organization adopting them.

The widespread use of technological features, such as big data, data analytics, and social media, is likely to influence behavior, use, and perceptions in organizations. Conversely, actors’ behaviors, use, and perceptions may change the nature of digitalization. We organize the remainder of part 4.4 in line with Rom and Rohde’s (2007) review. More specifically, we present the findings on behavior and use in one subsection (4.2.2) and the findings on perceptions in another (4.4.3).

4.4.2. Findings: Behavior and use in relation to accounting and digitalization

IIS studies indicate that information systems have stabilizing potential, which inhibits double-loop learning. Furthermore, the way in which IIS is used depends on the managerial level—lower-level managers do not rely as much on accounting information as higher-level managers (Rom and Rohde, 2007).

With regard to behavior and use in relation to accounting and digitalization, Al-Htaybat and von Alberti-Alhtaybat (2017) suggest that big data and analytics may illuminate irregular client or customer behavior, which then affects accountants’ behavior. However, adopting a specific behavior based on statistical trends carries a certain risk. In their empirical analysis, these authors also find that organizations need not only appropriate systems to generate insights from

big data but also people who can make proper use of the data. In another study, Suddaby et al. (2015) conclude that the adoption of social media in the accounting profession results in new practices that have the potential to bring about larger changes in behavioral norms among accountants. Bhimani and Willcocks (2014) paint a broad picture of digitalization's implications for accounting, and propose that the use of technologies, such as social media, big data, and analytics, is likely to lead to management and accounting dilemmas related to privacy and legitimacy. Interestingly, Warren et al. (2015, p. 400) discuss how big data can play a role in detecting "behaviors correlated with specific goal outcomes." In this context, they note that the BSC collects data in four areas and that "big data can identify new behaviors that influence respective goal outcomes" (Warren et al., 2015, p. 400). For example, measures based on digital activity can better indicate the degree to which organizational members are achieving specific learning goals.

Tang (2017) finds that social media can pressure stakeholders to conform with the actions of the majority. The mechanism that drives such conformist behavior is what Tang refers to as the "wisdom of crowds," which is clearly at play in social media. The "wisdom of crowds" effect influences people's assumptions about proper behavior. In relation to accounting, Tang (2017) argues that this mechanism can affect, for instance, the level of sales through the dissemination of production information on Twitter.

Kornberger et al. (2017) demonstrate how reputation systems on platforms such as Uber or TripAdvisor are characterized by "evaluative infrastructures"—infrastructures that describe accounting practices (e.g., rankings) and enable platform-based organization. The authors stress that such infrastructures can affect future behavior: "evaluative infrastructures embody expectations about the future. This can lead to self-fulfilling prophecies and other forms of reversed causality in which expectations of future behavior shape present behavior" (Kornberger et al., 2017, p. 92). Such self-fulfilling prophecies together with the new predictive capabilities of technologies represent a significant development in digitalization that can have far-reaching implications for accounting and accountants.

Lastly, Arnaboldi et al. (2017b) maintain that digitalization represents a change in the nature of decision making because social media and big data bring externally generated data into internal decision making. This could alter how accountants and decision makers acquire and use information, and how they make decisions.

When summarizing the relationships between behavior, use, and perceptions and digitalization, we find that social media can have several behavioral consequences. The adoption of social media in the accounting realm results in new practices that may change the role of accountants. Furthermore, social media can spur conformism among stakeholders. In addition, social media data fuel ranking-based evaluative infrastructures, which have the potential to shape future behavior through self-fulfilling prophecies. While the (lack of) learning effects of ERP systems was a central finding in the IIS literature (Rom and Rohde, 2007), few studies in the digitalization literature have shed light on this aspect. Hence, more studies that embrace the role of accounting as a learning machine (Burchell et al., 1980) in the digital age are needed.

4.4.3. Findings: Perceptions and translations in relation to accounting and digitalization

Rom and Rohde (2007) highlight interpretative studies on IIS and accounting, where the main message seems to be that human actors relate to non-human actors in the organization. For instance, one study testifies to how ERP systems can be used to both collapse and maintain the distance between the controller and the controlled (Quattrone and Hopper, 2005).

A number of studies examine how technology-enabled platforms, such as social media, can be utilized to influence stakeholders' perceptions of the organization (Bellucci and Manetti, 2017; Lee et al., 2015; Manetti and Bellucci, 2016). In their study, Lee et al. (2015) point out that accountants can take advantage of social media to communicate with stakeholders and fill the information vacuum in the wake of undesirable incidents. In so doing, they can reduce stakeholders' negative perceptions of the firm.

Moreover, Al-Htaybat and von Alberti-Alhtaybat (2017) refer to Heidegger's view on technology when discussing actors' perceptions. Heidegger (1969) suggests that technology is more than just an instrument; it is also an artefact with the ability to alter how we perceive the world. In this regard, Al-Htaybat and von-Alberti-Alhtaybat also draw on Jarvenpaa and Lang (2005), who propose that mobile technology is paradoxical, like a Janus face, as it both fulfils needs and creates new ones. As such, mobile technology represents an example of a digital technology that functions as an artefact that shapes our perception of the world.

Quattrone (2016) claims that decision makers perceive convincing numbers and visualizations stemming from data analytics as "the truth." When technologically-derived data are perceived as the truth, it "limits the space for judgement to the very last" (Quattrone, 2016, p. 3). While research on IIS highlighted that management accountants were becoming involved in general management as business consultants (e.g., Granlund and Mouritsen, 2003; Scapens and

Jazayeri, 2003), Quattrone (2016) warns that management accountants may no longer be needed in the decision-making sphere because the solutions derived from data analytics are perceived as reflecting the truth.

Solomons (1991, p. 287) argues that “the task of accountants is to provide information as free from bias as possible that will be useful to decision makers.” This view encompasses the realist assertion that the information provided through accounting information (numeric or textual) can, in fact, mirror the true world. In a digital reality, the assertion that accounting numbers may mirror the objective truth becomes increasingly challenging. The rise of user-generated reporting through evaluative infrastructures (Kornberger et al., 2017) and online rankings (Scott and Orlikowski, 2012) creates mountains of “knowledge” that managers can use to make decisions. However, there are definite risks associated with decision making based on this kind of knowledge.

First, the production and use of such knowledge risks becoming overly de-contextualized from the situation in which the information was generated. Second, user-generated information is arguably too opaque to be used in decision making. For example, writing sham five-star reviews has become a business (The Economist, 2015). This business intentionally creates results that present a skewed picture of the world. The power of a ranking, Scott and Orlikowski (2012, p. 39) argue, “is its capacity to present itself as objective fact, to reflect truth.” As such, rankings impose a way of seeing, without being seen (Roberts, 1991; Scott and Orlikowski, 2012). These issues feed into the discussion on the language of accounting and raise relevant questions regarding the extent to which accountants are able to engage in “successful reality constructions” (Kure et al., 2017, p. 211)

In summary, digital technologies seem to alter how accountants and stakeholders perceive the world. Social media enables organizations to engage with stakeholders and shape their perceptions in ways not seen before. Furthermore, ubiquitous data-driven analyses and widespread use of convincing visualizations present information that users easily perceive as objective truths, thereby throttling the exercise of human judgement. Lastly, user-generated content and (possibly deceptive) rankings represent new forms of information that entail a risk of bias, which challenges accountants’ abilities to provide information that is as free from bias as possible.

4.4.4. Research method and paradigms

As noted above, the IIS literature is largely divided into two research streams: studies that take a functionalist view and studies that take an interpretative view. Our review of the literature on digitalization in accounting reveals a corresponding pattern. Of the few empirical studies, the majority are exploratory case studies, which are often associated with an interpretive paradigm.

4.5. The relationship between digitalization and performance

4.5.1. The logic of the relationship

Do investments in IIS or digitalization affect financial performance? Rom and Rohde (2007) ascertain that this relationship is of interest. They find that the most commonly investigated relationship in the IIS literature is whether an improved IIS combined with improved management accounting can affect firm performance and market value.

4.5.2. Findings: Effects on performance

Rom and Rohde (2007) report that research on the payoff from IT investments has shown varying results over time. In the 1990s, firms investing in IT did not do significantly better than their peers. However, later research indicated that returns on IT investments were rising. Research on returns on ERP investments yielded ambiguous results, as demonstrated by the study of Poston and Grabski (2001) on the financial impact of ERP implementations.

An investigation of the literature on digitalization in accounting reveals that few studies have examined the relationship between digitalization initiatives and financial returns. However, more studies on this relationship would not necessarily improve the comparison of returns on IT investments in the IIS era and the digitalization era. From Rom and Rohde (2007), we learn that nearly all studies in the IIS era focus on ERP systems (i.e., *one* technological solution). In the digitalization literature, numerous technologies are discussed. As such, aggregated numbers assessing the financial returns of digitalization initiatives would not prove useful for comparisons with aggregated numbers on financial returns from IIS investments.

Despite the lack of research on the relationship between digitalization initiatives and financial returns, Warren et al. (2015) suggest that big data can assist organizations in keeping track of their costs, thereby improving their financial results. In general, Warren et al. (2015) propose that big data has the potential to improve cost control, productivity, and other aspects of the

organization and, thereby, enhance a firm's financial performance. However, more research is needed before conclusions can be drawn about the profitability of digital initiatives. It is plausible that high-performing firms invest more in digital initiatives with the result that digital initiatives appear to be attractive investments. Scholars need to observe the returns on investments in digital initiatives in the years to come in order to infer whether embracing digitalization is truly a profitable endeavor.

To summarize, few scholarly studies in the accounting literature examine the financial performance of digital investments. Despite the promises made by a cohort of consulting firms (e.g. Bughin et al., 2017), more studies are needed to clarify the rate of return on digitalization projects.

4.5.3. Research method and paradigm

In the IIS literature, most research on financial performance following IT investments applies quantitative methods, although there are a few exceptions. All studies are conducted from a functionalist perspective.

As none of the studies included in this paper explicitly investigate the relationship between digitalization investments and financial performance, there is no sample of papers on which to report on the research-method aspect. The few articles touching on this interesting relationship do so from a conceptual and functionalistic stance.

4.6. Power as a moderating or mediating variable

4.6.1. The logic of the relationship

Rom and Rohde (2007) cite den Hertog and Wielinga (1992), who argue that the impact of control systems depends, in part, upon power relations. Furthermore, Rom and Rohde (2007, p. 59) explain that “as a moderating variable, power changes the effect that the independent variable has on the dependent variable.” Power can also be seen as a mediating variable, such as when the introduction of an IIS changes power relations.

4.6.2. Findings: Power as a moderating or mediating variable

Rom and Rohde (2007) find that ERP systems lead to a decentralization of control. Thus, we argue that the implementation of ERP systems leads to vertical power shifts—power and control are transferred vertically from employees in the organization's upper echelons to employees at

lower levels through the dissemination of information. Consequently, the information monopoly formerly enjoyed by top management is dissolved. Moreover, power only travels intra-organizationally, moving from one locus in the organization to another.

Al-Htaybat and von Alberti-Alhtaybat (2017) conduct a case study in which they interview accountants about digitalization's influence on power relationships. One respondent "warned against ignoring such developments, as it may sideline the accounting profession" but also that "such development gives us [the accountants] more power but at the same time will also put more pressure on us" (Al-Htaybat and von Alberti-Alhtaybat, 2017, p. 865). In another study, the importance of digital expertise becomes apparent—the holders of this crucial know-how are able to legitimize their status (Viale et al., 2017). These results imply that if tasks previously handled by accountants are taken over by other professionals with more digital know-how, accountants risk losing legitimacy as well as power. This trend is portrayed in the study by Arnaboldi et al. (2017a), which shows that marketers increase their influence and power relative to accountants by collecting and providing information from the digital sphere, which becomes important material for managerial decision-making. Thus, in contrast to the effects of ERP systems, digitalization seems to lead to horizontal power shifts. The digitalization literature focuses on how power may shift among professional groups at corresponding organizational levels.

Scott and Orlikowski's study (2012, p. 39) "expands current knowledge on how social media accounting practices perform when more power is assigned to the crowd." Online platforms may have the ability to transfer the power center from inside the organization to outside "the black box," so that it ends up in the hands of consumers. Unlike the IIS literature, this study focuses on how digitalization can lead to *extra-organizational* power shifts by transferring power to external stakeholders. This point is also sketched out by Brivot et al. (2017), who empirically show that social media poses a threat to corporations' traditional controls and institutional power. This is particularly true for large and bureaucratic organizations, which are slow to adjust—social media, by its very nature, requires quick and fluid interactions with actors outside the organizational boundaries (Agostino and Sidorova, 2017).

Lastly, Kornberger et al. (2017) discuss how power is placed in the hands of platform owners in today's digital age. When a platform increases its user base, the platform owner simultaneously increases its influence. This tendency is what drives most of the winner-takes-it-all mechanism in the digital economy. Power is distributed across fewer and fewer hands, resulting in unnatural monopolies or oligopolies (The Economist, 2019). As Kornberger et al.

(2017) conclude, digital platforms represent a disruptive phenomenon in contemporary capitalism that redistributes wealth and, concomitantly, power.

In short, digital technologies have wide-ranging implications for power as a variable that shapes accounting and the role of accountants. Initial studies indicate that accountants must compete in horizontal power struggles—not vertical, as in the IIS era (Rom and Rohde, 2007). Moreover, social media platforms and rankings are imperative forces that may redistribute organizational power to extra-organizational actors, while digital platforms seem to lay the grounds for uneven power relations by assigning more power to platform owners.

4.6.3. Research method and paradigm

Rom and Rohde (2007) find that case studies are frequently used in investigations of power relations. Moreover, case studies on power relations are often conducted from an interpretative stance. In studies subscribing to the functionalist view, theoretical reasoning and archival studies are more common.

Similarly, we find that most studies on digitalization in accounting that assess power as a variable do so from an interpretative stance. Methodologically, the majority of the papers discussing power in our review utilize the case study method. Interestingly, all three studies published in *Accounting, Organizations and Society* (AOS) in our review devote significant attention to power relations.

4.7. Context variables as moderating or mediating variables

4.7.1. The logic of the relationship

In their review, Rom and Rohde (2007) comment that although context variables are not among the primary variables in their framework, such variables contribute important insights on the relationship between IIS and management accounting. The same line of reasoning holds true for the literature on digitalization. However, few studies direct attention to how context variables may influence digitalization.

4.7.2. Findings: Context variables as moderating or mediating variables

Rom and Rohde (2007) build their treatment of context variables on contingency theory, as this theory is particularly interested in context variables. They conclude that few articles explicitly

study context variables in the relationship between IIS and management accounting, but they stress changes in the environment as an important context variable.

Of the papers included in this review, Schneider et al. (2015) devote a section to discussing contingency theory in accounting. The authors state that contingency theory examines how context variables affect accounting-system choices. Similar to Rom and Rohde (2007), Schneider et al. (2015) mention the external environment as an important context variable along with firm size, firm structure, and production technology. Thereafter, these authors present a range of possible research questions related to data analytics. More specifically, they set out to identify certain organizational areas in which data analytics may create a competitive advantage or enhance a firm's innovative capacity. Furthermore, Bhimani and Willcocks (2014) discuss the external environment as a context variable and point out that digitalization is rapidly disrupting organizations' external environments. They argue that this disruption "is forcing deep changes in the *modus operandi* of management structures, decisions and strategies" (Bhimani and Willcocks, 2014, p. 475). Bhimani and Willcocks (2014) also suggest that these deep changes challenge the Chandlerian premise that strategy dictates organizational structure, which establishes the frame for accounting systems. They conclude that "what comprises relevant information [...] has to be reconsidered" (Bhimani and Willcocks, 2014, p. 475). In other words, digitalization is expected to force profound changes in how accountants think of information acquisition, information provision, and the use of information in decision making.

Brivot et al. (2017) indirectly add to the discussion of contingency variables by focusing on turmoil in the external environment. Their discussion centers on organizational control with an emphasis on organizational actors who try to reinvent control in dynamic and volatile environments. Their main message is that "professional knowledge templates are ephemeral, being subject to meaning contests" (Brivot et al., 2017, p. 811). This is particularly true when a field or domain experiences turmoil brought on by profound changes in the environment. For accounting, the changes resulting from digitalization may support Brivot et al.'s (2017) conclusion that professional knowledge is ephemeral. Their conclusion inevitably forces accounting scholars to contemplate the need for changes in accounting curricula.

In short, this review shows that the external environment is the most important and widely discussed context variable. Digitalization is forcing deep changes in the external environment that may challenge the definition of relevant information, how to best structure organizations, and the kind of professional knowledge that will be critical in the future.

4.7.3. Research methods and paradigms

According to Rom and Rohde (2007), IIS research that includes context variables applies both quantitative and qualitative methods. In the literature on digitalization in accounting, the studies that treat context in a somewhat explicit manner (e.g., Bhimani and Willcocks, 2014; Schneider et al., 2015) are mainly conceptual papers.

4.8. Synthesis of findings from data description and analysis

Based on the framework in Figure 1, sections 4.1-4.7 reported findings from the literature on digitalization in accounting and assessed how emerging digital technologies are influencing accounting. The data description and analysis unveil how digitalization is adding new sources of data to accountants' tables. The data are often derived from external sources, can be user-generated, and may come in many forms. Texts, images, and other types of non-transactional data are becoming the new normal. As the data are vast and often unstructured, risks arise for the providers and users of data-driven information. In addition, the literature stresses that the introduction of new technologies paves the way for reconfigured power relations. At the same time, the review shows that the extant literature is silent on how digitalization has influenced firms' financial performance. Researchers might find that the time is ripe for more research on this relationship. Moreover, our review indicates that little research has been conducted on the relationship between context variables, such as the external environment, and digitalization.

5. Conclusions and directions for future research

In this paper, we have reviewed the current work on digitalization in the accounting literature. The paper is timely and relevant, as this third phase of technological advancements is heavily influencing organizations. By forming and contrasting a comprehensive picture of the state-of-the-art literature on digitalization in accounting with extant literature on IIS in accounting, the paper develops knowledge by connecting the past with the future (Massaro et al., 2016). Thus, it provides researchers with a foundation for future research in the IT-accounting domain.

The paper initially asked: *How is digitalization influencing accounting practice and how do those effects compare to the effects of IIS on accounting practice? What are the most important avenues for future research on digitalization in accounting?*

With reference to the first research question, our findings suggest that digitalization influences accounting practice in many new ways, but we highlight three notable differences between the

effects of digitalization and IIS on accounting. First, we point to digitalization's impact on the *boundaries of accounting*. This finding emanates from the discussion of the move beyond a transactional focus (Bhimani and Willcocks, 2014) and how social media is driving changes in accounting (Agostino and Sidorova, 2017; Arnaboldi et al., 2017b). Second, we highlight how digitalization is *changing power relations*. This finding is related to the first in that the more elusive boundaries of accounting have implications for what accountants do, what they do not do, and what they are responsible for, which again affect their influence and power in organizations (Arnaboldi et al., 2017b; Kornberger et al., 2017; Scott and Orlikowski, 2012; Suddaby et al., 2015). Third, the review indicates that some scholars voice important questions regarding how digitalization affects the *production of knowledge for decision making* (Quattrone, 2016; Scott and Orlikowski, 2012).

Given the rapid proliferation of digital technologies and their impact on organizations and accounting, we argue that these and related issues deserve attention in future research. We therefore ask researchers to examine digitalization's impact on accounting from a number of perspectives. The need for more field studies is especially conspicuous, as the extant literature is still in a rather conceptual stage (see Appendix 4). In the following, we elaborate on how digitalization is influencing accounting practice and the concurrent avenues for future research.

5.1. Increasingly elusive boundaries of accounting

5.1.1. Concluding findings

First, digitalization is the impetus for *increasingly elusive boundaries of accounting*. This finding first and foremost applies to management accountants, whose role is more widely discussed in the reviewed literature. As digitalization enables a move beyond transactional tasks and significant alterations in information acquisition and use (Arnaboldi et al., 2017b), the boundaries of the accounting role and the accounting profession itself become more unclear than in the IIS era. Organizations now harness torrents of non-transactional data to capitalize on customers' digital traces, which denotes a shift in information acquisition that moves the boundaries of accounting. Furthermore, while data acquisition in the IIS era typically focused on structured data, the acquisition of non-structured data is becoming the new norm (Al-Htaybat and von Alberti-Alhtaybat, 2017; Warren et al., 2015). The harvesting of non-structured data is enabled by yet another technological advancement—the automatic collection of data from new sources, such as social media platforms (Viale et al., 2017). Such new data sources extend the

data ecosystem from which organizations may harvest data. In and of themselves, these developments may seem like nothing more than incremental technological developments. However, the joint emergence of these technologies, which we refer to as digitalization, represents a major technological shift that is making the boundaries of accounting ever more elusive.

In addition, other professional areas, such as IT and marketing, are utilizing digital technologies to leap into the accounting domain (Arnaboldi et al., 2017a). In other words, digitalization is bringing accounting into non-accounting functions. As such, hybridization fueled by digitalization is in part driving the increasing elusiveness of accounting's boundaries. This gives rise to questions about what accounting is and what the role of the accountant should be in the digital age.

5.1.2. Directions for future research

Future research on digitalization should investigate how the increasingly elusive boundaries of accounting are shaping the accounting profession. In this regard, there are several possible avenues for future research. The increasingly elusive boundaries of accounting and the accounting profession involve threats as well as opportunities. One opportunity lies in the adoption and implementation of digital technologies. Top management often drives the adoption of IIS (like ERP systems) because the implementation of these large and complex systems requires massive organizational effort and resources (Davenport, 1998). In the words of Bygstad (2015), ERP systems are heavyweight systems that are highly complex, require extensive resources, computational power, and expertise. The implementation process of these systems is typically formalized and involves a range of actors (Granlund and Malmi, 2002). In contrast, digitalization initiatives are often adopted by individuals or groups in the organization (see, e.g., Arnaboldi et al., 2017a). This represents a more endogenous and organic adoption of the technology, and the same actors might drive the implementation process (Suddaby et al., 2015). The lightweight nature of digital technologies (Bygstad, 2015) enables such organic adoption and implementation.

This kind of implementation process is rather informal, akin to vernacular accounting systems: systems that are “self-generated by managers and/or employees and not officially sanctioned in the organizational hierarchy” (Kilfoyle et al., 2013, p. 382). Thus, pro-active accountants can seize the opportunity arising from the more elusive boundaries of accounting to become key constituents in their organizations. They can do so by combining digital curiosity with business

insights. Future research should empirically investigate how accountants operate in the adoption and implementation processes of digital technologies, as their influence in these processes will shape the future boundaries of accounting. For example, researchers could investigate how accountants can utilize new data sources to maintain relevance in their organizations. Such studies are important for assessing the future role of accounting and (management) accountants. Echoing Bromwich and Bhimani (1989), Rom and Rohde (2007, p. 53) conclude that “the proactivity of management accountants is important if they want to define their future role themselves.” Based on our review, we argue that this observation still holds and that it is arguably even more relevant today. We suggest that accountants would be remiss if they failed to take charge of defining their own future.

5.2. *Changing power relations*

5.2.1. *Concluding findings*

Second, digitalization entails *changing power relations* both within and outside the organizational boundaries. Within the organization, IIS allowed for *vertical power shifts* through increased decentralization (Dechow and Mouritsen, 2005; Granlund and Mouritsen, 2003), as lower-level employees were given access to information that was previously in the custody of middle-level and higher-level managers. Today, accountants’ reluctance to take the lead in digital initiatives may lead to *horizontal power shifts* in organizations, as power seems to accrue in those professions that flaunt their digital know-how. The accounting profession’s apparent lack of digital savviness result in reduced legitimacy, which can lead to horizontal changes in power relations. Conversely, accountants may leverage their critical insights into business processes. Knowledge is power—by exploiting their financial prowess, accountants can play a pivotal part in reengineering business processes and business models.

The extant literature on digitalization in accounting has not devoted much attention to explicit discussions of horizontal power relations, but this issue becomes discernable through the concept of hybridization (Arnaboldi et al., 2017; Suddaby et al., 2015). Hybridization is driven, in part, by the mobility and transferability of tools and techniques (Caglio, 2003; Hopwood, 1992; Miller, 1998). In the IIS era, hybridization mainly occurred between related professional roles, such as between management accountants and financial accountants (Caglio, 2003). However, in the emerging digital era, hybridization is evident between more divergent professional roles, such as marketers and accountants (Arnaboldi et al., 2017a).

Moreover, digitalization leads to changes in power relations outside the organizational boundaries, thereby opening up for *extra-organizational power shifts* by placing more power in the hands of external stakeholders. The literature on IIS technologies mainly emphasized power shifts *within* organizations, but the digitalization literature opens up a wider discussion (Scott and Orlikowski, 2012; Suddaby et al., 2015). The ways in which digitalization allows for extra-organizational power shifts and the pace of those shifts represent uncharted waters for organizations. These shifts incur uncertainty and risks for organizations. Previously, the power of accountants was, in part, rooted in their capacity to reduce complexity to a single number (Miller, 2001). When the numbers by which organizations govern are increasingly generated externally (and not necessarily for business purposes), the information's veracity carry greater risk and imply the potential for reduced power for accountants. As online user reviews and evaluative infrastructures shift the dynamics in certain industries (Jeacle and Carter, 2011; Kornberger et al., 2017), customers are gaining more influence in organizations, while the power and accountability of accountants are at risk of becoming diluted.

5.2.2. Directions for future research

We see several interesting research opportunities tied to the discussion of changing power relations. To what extent will the apparent lack of digital know-how challenge accountants' influence within the organization? If accountants remain reluctant to engage in digital development, do they risk becoming obsolete? Will digitalization lead to increased centralization, which could benefit accountants? Some functionalistic studies have sought to compute the extent to which certain jobs are susceptible to technological developments (Frey and Osborne, 2017), but more empirical studies are needed to untangle the future of accountants' work. Moreover, additional research is needed to investigate how new digital tools and techniques are driving hybridization as well as the concurrent consequences. Do some digital technologies benefit or harm the power and influence of accountants more than others? How will the new digital relationship between organizations and their stakeholders (e.g., in digital ecosystems) lead to fluxes in power relations? Suddaby et al. (2015, p. 53) cite Hoskin and Macve (1994), who claim that prior research has focused on the accounting domain as being continually in flux and constantly extending in terms of both "power and scope." We call for more research into the potential oscillations of power inside and outside organizations resulting from digitalization.

5.3. Production of knowledge for decision making

5.3.1. Concluding findings

Third, digitalization raises new questions related to the *production of knowledge for decision making*. In their examination of the IIS literature, Rom and Rohde (2007) report that the implementation of new technologies, such as ERP systems, improved both the supply of data and the flexibility of information provision. Yet, it did not entail inclusion of new types of information. The accounting literature on digitalization, on the other hand, emphasizes how new types of information enter the organization and the fact that new decision-making practices will have consequences for knowledge production.

Digitalization allows new types of data and information to enter organizations, such as non-transactional data (Bhimani and Willcocks, 2014) and new KPIs based on social media (Agostino and Sidorova, 2017; Viale et al., 2017). Simultaneously, digital tools and techniques give rise to new practices of organizational decision making among employees at managerial levels. In this vein, Quattrone (2016) raises important questions about the future of accounting in the digital age. He points out that “the effects of the digital revolution on management accounting and decision-making are still unclear” (Quattrone, 2016, p. 1), and warns that a digital move in decision making results in less space for valuable human discussions and the exercise of judgement.

In such an environment, actions occur quickly after the acquisition of information. Scott and Orlikowski (2012, p. 39) ask how organizations should handle the production of user-generated “quasi-formalized knowledge.” Although the vast amounts of data entail a wealth of opportunities, organizations need to recognize the challenges of making quick decisions based on externally generated data. Those data are characterized, at least in part, by dubious veracity, as opposed the clean data acquired in the IIS era. The increasing reliance on data-driven decisions based on analytical “truths” raises plenty of new considerations for accountants with regard to decision-making processes. Organizations and accountants need to consider the degree to which algorithms should be trusted when making decisions. Relatedly, how opaque can an algorithm be before it becomes a problem for accountants and decision makers?

Furthermore, the discussion of the language of accounting illustrates that decision-making based not only on algorithms but also on “the wisdom of the crowd” might yield suboptimal outcomes. To some extent, this is due to the factual possibility of creating intentional results.

Real-time reporting adds another layer of complexity to today's decision-making processes, as it reduces the time allotted to discussion and reflection prior to decision making.

5.3.2. Directions for future research

Future research in this area could go in many directions. The extent to which data-driven decision making is used remains unclear. Surveys are needed to map the proliferation of these practices. In addition, there is a clear need for more qualitative studies that unravel how accountants and decision makers perceive data-driven decisions based on algorithms. For example, how does the increased use of visualizations shape managerial decision making? What are the major obstacles, potential pitfalls, and tensions associated with basing decisions on analytical truths? Such considerations are important, and likely to be fruitful avenues for future research. Will the reduced space for judgement not only lead to quick actions but also to a need for revised actions as a consequence of misjudgments? Poor judgments on issues like cybersecurity may have long-lasting and severe implications. Recent examples in the media, such as the Facebook case,¹⁵ demonstrate the negative effects that organizations may experience if personal data goes astray. Consequently, we argue that accounting scholars should delve into the organizational effects of digital moves in decision making.

5.4. Contributions, practical implications, and limitations

Our study makes three contributions to the accounting literature. First, we clarify the concept of digitalization and highlight the potential implications of this ubiquitous concept for accounting. Second, we synthesize the emerging literature on digitalization in accounting and contrast this stream of literature to the literature on IIS in accounting. By comparing the findings of our review with findings from the IIS literature, we are able to crystallize how digitalization influences accounting in new ways. Moreover, by presenting a comprehensive overview of the literature on digitalization in accounting, the paper offers a clear basis for future research on a number of issues. Third, we point to several novel research paths. Just as Chapman and Chua (2003, p. 91) addressed the need for more studies on ERP because of "their potential to radically alter the field of accounting," we make similar arguments for studies on digitalization in accounting. Given the widespread attention paid to digitalization in society, we expect that the

¹⁵ <https://www.ft.com/content/257d4598-2cb9-11e8-a34a-7e7563b0b0f4>.

topic of accounting and digitalization will increasingly attract interest among accounting scholars. Thus, we believe that this literature review can serve as a valuable starting point for future research on the topic. We urge accounting scholars to examine how digitalization affects the boundaries of accounting as well as intra- and extra-organizational power struggles, and to analyze the impact of new digital tools and techniques on the production of knowledge for decision making.

The conclusions in this paper also have several practical implications. Accountants are expected to deliver reliable, high-quality inputs for decision making. At the same time, they might be expected to include more externally generated data, which is associated with risks related to veracity and representativeness. This tension requires accountants to begin to analyze the trustworthiness of information. Moreover, new ethical dilemmas arise when accountants must exercise professional skepticism¹⁶ (IESBA, 2018) in their assessments of assumptions and the quality of inputs in digital processes. Such analytical and ethical dilemmas give rise to a need to exhibit high levels of digital proficiency, which accountants might not have the required training to undertake. At the same time, accountants may play a crucial role in the design process of technology implementations, as they are the primary holders of vital business knowledge.

We carefully considered our methodological approach when conducting this study, but limitations still exist. First, when conducting a systematic literature review, there is always a risk that relevant publications might be overlooked. For this paper, database issues might have clouded our overview of relevant published material. Scopus's coverage of the chosen journals was limited in a handful of cases. However, we addressed the concern about potentially overlooked relevant material by cross-checking our search in additional databases.¹⁷ Second, some readers might find the scope of the papers to be too narrow. Although we exceed the scope of Rom and Rohde's (2007) review by studying the accounting literature, we do not include publications focused on auditing, as the need to delineate the boundaries of our review resulted in a narrow focus on publications in management and financial accounting. Third, others researchers may not draw the same conclusions given the same material. However, we are confident that the study's conclusions reflect and expand the main issues discussed in the

¹⁶ According to the International Accounting Education Standards Board (IAESB), "professional skepticism" is not limited to auditing but applies to "the broader context of a role as a professional accountant" (IESBA, 2018, p. 13).

¹⁷ This exercise returned one article: "Do Auditor-Provided Tax Services Enhance or Impair the Value Relevance of Earnings?" published by Cook in the *Journal of the American Taxation Association* in 2013. This article was not included, as it subscribes to the auditing literature, which is beyond the scope of this study.

literature thus far.

Our review suggests that the literature on digitalization in accounting is still immature and that there are a number of possible avenues for future research. Importantly, more empirical research is required to understand the impact of digitalization on accounting.

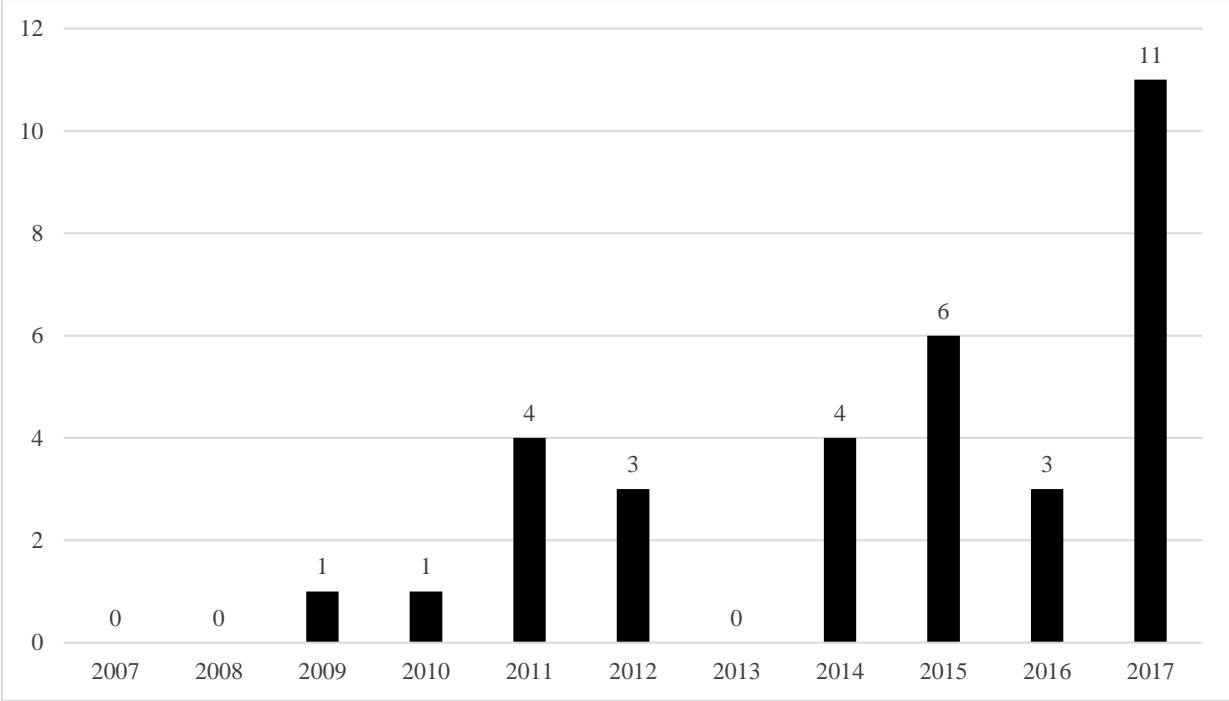
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Appendix 1: Number of publications per research outlet

| Research Outlet | Number of publications |
|---|-------------------------------|
| <i>Accounting, Auditing and Accountability Journal (AAAJ)</i> | 8 |
| <i>Accounting and Business Research (ABR)</i> | 4 |
| <i>Accounting Horizons (AH)</i> | 2 |
| <i>Accounting Review (AR)</i> | 2 |
| <i>Accounting, Organizations and Society (AOS)</i> | 3 |
| <i>Critical Perspectives on Accounting (CPA)</i> | 2 |
| <i>International Journal of Accounting Information Systems (IJ AIS)</i> | 6 |
| <i>Journal of Accounting Research (JAR)</i> | 2 |
| <i>Management Accounting Research (MAR)</i> | 2 |
| Other | 2 |
| Total | 33 |

Appendix 2: Number of publications per year, 2007-2017



Appendix 3: Query string from the online database Scopus

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TITLE-ABS-KEY (digitali?ation OR digital OR "big data" OR "analytics" OR "cloud" OR "cyber" OR "mobile" OR "social media" OR "roboti?ation" OR "automati?ation" OR "artificial intelligence" OR "blockchain" OR "platforms" OR "internet of things" ) AND PUBYEAR > 2006 AND PUBYEAR < 2018 AND ( LIMIT-TO ( EXACTSRCTITLE,"Accounting Auditing And Accountability Journal " ) OR LIMIT-TO ( EXACTSRCTITLE," Abacus " ) OR LIMIT-TO ( EXACTSRCTITLE," Accounting And Business Research " ) OR LIMIT-TO ( EXACTSRCTITLE," Accounting Forum " ) OR LIMIT-TO ( EXACTSRCTITLE," Accounting Horizons " ) OR LIMIT-TO ( EXACTSRCTITLE," Accounting Review " ) OR LIMIT-TO ( EXACTSRCTITLE," Accounting Organizations And Society " ) OR LIMIT-TO ( EXACTSRCTITLE," Auditing " ) OR LIMIT-TO ( EXACTSRCTITLE," Behavioral Research In Accounting " ) OR LIMIT-TO ( EXACTSRCTITLE," British Accounting Review " ) OR LIMIT-TO ( EXACTSRCTITLE," British Tax Review " ) OR LIMIT-TO ( EXACTSRCTITLE," Contemporary Accounting Research " ) OR LIMIT-TO ( EXACTSRCTITLE," Critical Perspectives On Accounting " ) OR LIMIT-TO ( EXACTSRCTITLE," European Accounting Review " ) OR LIMIT-TO ( EXACTSRCTITLE," Financial Accountability And Management " ) OR LIMIT-TO ( EXACTSRCTITLE," Foundations And Trends In Accounting " ) OR LIMIT-TO ( EXACTSRCTITLE," International Journal Of Accounting " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Accounting And Economics " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Accounting And Public Policy " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Accounting Literature " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Accounting Research " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Accounting Auditing And Finance " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of Business Finance And Accounting " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of International Accounting Auditing And Taxation " ) OR LIMIT-TO ( EXACTSRCTITLE," Journal Of The American Taxation Association " ) OR LIMIT-TO ( EXACTSRCTITLE," Management Accounting Research " ) OR LIMIT-TO ( EXACTSRCTITLE," Review Of Accounting Studies " ) OR LIMIT-TO ( EXACTSRCTITLE," International Journal Of Accounting Information Systems " ) )
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Appendix 4: List of articles sorted by publication year

| Article ID | Accounting area | Source | Title | Method | Year | Author(s) |
|------------|-----------------------|--|---|---------------|------|--|
| J1 | Financial accounting | <i>Accounting, Auditing and Accountability Journal</i> | Big Data and corporate reporting: impacts and paradoxes | Qualitative | 2017 | Al-Htaybat K., von Alberti-Alhtaybat L. |
| J2 | Financial accounting | <i>Journal of Accounting Research</i> | Wisdom of Crowds: Cross-Sectional Variation in the Informativeness of Third-Party-Generated Product Information on Twitter | Quantitative | 2017 | Tang V.W. |
| J3 | Financial accounting | <i>Accounting and Business Research</i> | Accounting narratives and impression management on social media | Quantitative | 2017 | Yang J.H., Liu S. |
| J4 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | How social media reshapes action on distant customers: some empirical evidence | Qualitative | 2017 | Agostino D., Sidorova Y. |
| J5 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | Governing social media: the emergence of hybridised boundary objects | Qualitative | 2017 | Arnaboldi M., Azzone G., Sidorova Y. |
| J6 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | Accounting, accountability, social media and big data: revolution or hype? | Conceptual | 2017 | Arnaboldi M., Busco C., Cuganesan S. |
| J7 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | Facebook as a tool for supporting dialogic accounting? Evidence from large philanthropic foundations in the United States | Mixed methods | 2017 | Bellucci M., Manetti G. |
| J8 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | Reinventing organizational control: Meaning contest surrounding reputational risk controllability in the social media arena | Qualitative | 2017 | Brivot M., Gendron Y., Guénin H. |
| J9 | Management accounting | <i>Accounting, Organizations and Society</i> | Evaluative infrastructures: Accounting for platform organization | Conceptual | 2017 | Kornberger M., Pflueger D., Mouritsen J. |
| J10 | Management accounting | <i>Accounting, Auditing and Accountability Journal</i> | From “mad men” to “math men”: The rise of expertise in digital measurement and the shaping of online consumer freedom | Qualitative | 2017 | Viale T., Gendron Y., Suddaby R. |

| | | | | | | |
|------------|-----------------------|--|---|---------------|------|--|
| J11 | Management accounting | <i>International Journal of Accounting Information Systems</i> | Impact of business analytics and enterprise systems on managerial accounting | Conceptual | 2017 | Appelbaum D., Kogan A., Vasarhelyi M., Yan Z. |
| J12 | Financial accounting | <i>Accounting, Auditing and Accountability Journal</i> | The use of social media for engaging stakeholders in sustainability reporting | Mixed methods | 2016 | Manetti G., Bellucci M. |
| J13 | Management accounting | <i>Management Accounting Research</i> | Management accounting goes digital: Will the move make it wiser? | Conceptual | 2016 | Quattrone P. |
| J14 | Management accounting | <i>Management Accounting Research</i> | Management accounting in context: Industry, regulation and informatics | Conceptual | 2016 | Van der Stede W.A. |
| J15 | Financial accounting | <i>Journal of Accounting Research</i> | The role of social media in the capital market: Evidence from consumer product recalls | Quantitative | 2015 | Lee L.F., Hutton A.P., Shu S. |
| J16 | Financial accounting | <i>Accounting, Organizations and Society</i> | Twittering change: The institutional work of domain change in accounting expertise | Mixed methods | 2015 | Suddaby R., Saxton G.D., Gunz S. |
| J17 | Financial accounting | <i>Accounting and Business Research</i> | Institutionalising XBRL for financial reporting: Resorting to regulation | Qualitative | 2015 | Troshani I., Parker L.D., Lymer A. |
| J18 | Financial accounting | <i>International Journal of Accounting Information Systems</i> | A note on an architecture for integrating cloud computing and enterprise systems using REA | Conceptual | 2015 | Geerts G.L., O'Leary D.E. |
| J19 | Management accounting | <i>Accounting Horizons</i> | Infer, predict, and assure: Accounting opportunities in data analytics | Conceptual | 2015 | Schneider G.P., Dai J., Janvrin D.J., Ajayi K., Raschke R.L. |
| J20 | Management accounting | <i>Accounting Horizons</i> | How big data will change accounting | Conceptual | 2015 | Warren, Jr. J.D., Moffitt K.C., Byrnes P. |
| J21 | Management accounting | <i>International Journal of Accounting Information Systems</i> | On governance structures for the cloud computing services and assessing their effectiveness | Quantitative | 2014 | Prasad A., Green P., Heales J. |
| J22 | Financial accounting | <i>Accounting Review</i> | The role of dissemination in market liquidity: Evidence from firms' use of Twitter™ | Quantitative | 2014 | Blankespoor E., Miller G.S., White H.D. |
| J23 | Management accounting | <i>Accounting and Business Research</i> | Digitisation, 'Big Data' and the transformation of accounting information | Conceptual | 2014 | Bhimani A., Willcocks L. |

| | | | | | | |
|------------|-----------------------|--|---|--------------|------|---|
| J24 | Management accounting | <i>Accounting and Business Research</i> | Discussion of 'Digitisation', 'Big Data' and the transformation of accounting information by Alnoor Bhimani and Leslie Willcocks (2014) | Conceptual | 2014 | Payne R. |
| J25 | Financial accounting | <i>Critical Perspectives on Accounting</i> | The SEC's retail investor 2.0: Interactive data and the rise of calculative accountability | Conceptual | 2012 | Lowe A., Locke J., Lymer A. |
| J26 | Financial accounting | <i>International Journal of Accounting Information Systems</i> | IFRS Taxonomy and financial reporting practices: The case of Italian listed companies | Quantitative | 2012 | Valentinetti D., Rea M.A. |
| J27 | Management accounting | <i>Accounting, Organizations and Society</i> | Reconfiguring relations of accountability: Materialization of social media in the travel sector | Qualitative | 2012 | Scott S.V., Orlikowski W.J. |
| J28 | Financial accounting | <i>British Accounting Review</i> | Functional fixation: Experimental evidence on the presentation of financial information through different digital formats | Quantitative | 2011 | Ghani, E.K., Laswad, F., Tooley, S. |
| J29 | Financial accounting | <i>European Accounting Review</i> | Artificial Intelligence Measurement of Disclosure (AIMD) | Quantitative | 2011 | Grüning, M. |
| J30 | Management accounting | <i>Accounting Review</i> | The role of organizational absorptive capacity in strategic use of business intelligence to support integrated management control systems | Quantitative | 2011 | Elbashir, M.Z., Collier, P.A., Sutton, S.G. |
| J31 | Management accounting | <i>Critical Perspectives on Accounting</i> | Beyond disciplinary enclosures: Management control in the society of control | Conceptual | 2011 | Martinez, D.E. |
| J32 | Financial accounting | <i>International Journal of Accounting Information Systems</i> | Environmental reporting on the internet by America's Toxic 100: Legitimacy and self-presentation | Quantitative | 2010 | Cho C.H., Roberts R.W. |
| J33 | Financial accounting | <i>International Journal of Accounting Information Systems</i> | Towards the global adoption of XBRL using International Financial Reporting Standards (IFRS) | Quantitative | 2009 | Bonsón E., Cortijo V., Escobar T. |

Appendix 5: Methodological overview

| Methods deployed in analyzed articles | |
|---|----------------|
| Method (freq. propor.) | Section |
| <i>Section 4.1: Accounting tasks and digitalization</i> | |
| Conceptual | 3 (38%) |
| Quantitative | 0 (0%) |
| Qualitative | 4 (50%) |
| Mixed methods | 1 (12%) |
| In total (section) | 8 (100%) |
| <i>Section 4.2: Accounting techniques and digitalization</i> | |
| Conceptual | 2 (33%) |
| Quantitative | 3 (50%) |
| Qualitative | 1 (17%) |
| Mixed methods | 0 (0%) |
| In total (section) | 6 (100%) |
| <i>Section 4.3: Organization of accounting and digitalization</i> | |
| Conceptual | 2 (33%) |
| Quantitative | 0 (0%) |
| Qualitative | 3 (50%) |
| Mixed methods | 1 (17%) |
| In total (section) | 6 (100%) |
| <i>Section 4.4: Behavior and use in relation to accounting and digitalization</i> | |
| Conceptual | 5 (41%) |
| Quantitative | 2 (17%) |
| Qualitative | 2 (17%) |
| Mixed methods | 3 (25%) |
| In total (section) | 12 (100%) |
| <i>Section 4.5: Performance and digitalization</i> | |
| Conceptual | 1 (100%) |
| Quantitative | 0 (0%) |
| Qualitative | 0 (0%) |
| Mixed methods | 0 (0%) |
| In total (section) | 1 (100%) |
| <i>Section 4.6: Power as a moderating or mediating variable</i> | |
| Conceptual | 1 (14%) |
| Quantitative | 0 (%) |
| Qualitative | 5 (72%) |
| Mixed methods | 1 (14%) |
| In total (section) | 7 (100%) |
| <i>Section 4.7: Contextual variables as moderating or mediating variables</i> | |
| Conceptual | 2 (67%) |
| Quantitative | 0 (0%) |
| Qualitative | 1 (33%) |
| Mixed methods | 0 (0%) |
| In total (section) | 3 (100%) |

References

- Abrahamson, E. (1996). Management Fashion. *The Academy of Management Review*, 21(1), 254–285.
- Agostino, D., & Sidorova, Y. (2017). How social media reshapes action on distant customers: some empirical evidence. *Accounting, Auditing and Accountability Journal*, 30(4), 777–794. <https://doi.org/10.1108/AAAJ-07-2015-2136>
- Al-Htaybat, K., & von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing & Accountability Journal*, 30(4), 850–873. <https://doi.org/10.1108/AAAJ-07-2015-2139>
- Appelbaum, D., Kogan, A., Vasarhelyi, M., & Yan, Z. (2017). Impact of business analytics and enterprise systems on managerial accounting. *International Journal of Accounting Information Systems*, 25, 29–44. <https://doi.org/10.1016/j.accinf.2017.03.003>
- Arnaboldi, M., Azzone, G., & Sidorova, Y. (2017a). Governing social media: the emergence of hybridised boundary objects. *Accounting, Auditing & Accountability Journal*, 30(4). <https://doi.org/10.1108/AAAJ-07-2015-2132>
- Arnaboldi, M., Busco, C., & Cuganesan, S. (2017b). Accounting, accountability, social media and big data: revolution or hype? *Accounting, Auditing and Accountability Journal*, 30(4), 762–776. <https://doi.org/10.1108/AAAJ-03-2017-2880>
- Bellucci, M., & Manetti, G. (2017). Facebook as a tool for supporting dialogic accounting? Evidence from large philanthropic foundations in the United States. *Accounting, Auditing & Accountability Journal*, 30(4). <https://doi.org/10.1108/AAAJ-07-2015-2122>
- Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, 37(2), 471–482. <https://doi.org/10.25300/MISQ/2013/37:2.3>
- Bhimani, A., & Willcocks, L. (2014). Digitisation, Big Data and the transformation of accounting information. *Accounting and Business Research*, 44(4), 469–490. <https://doi.org/10.1080/00014788.2014.910051>
- Blankespoor, E., Miller, G. S., & White, H. D. (2014). The role of dissemination in market liquidity: Evidence from firms' use of TwitterTM. *Accounting Review*, 89(1), 79–112.

<https://doi.org/10.2308/accr-50576>

- Booth, P., Matolcsy, Z., & Wieder, B. (2000). The Impacts of Enterprise Resource Planning Systems on Accounting Practice – the Australian Experience. *Australian Accounting Review*, 10(2), 4–18.
- Britten, N., Campbell, R., Pope, C., Donovan, J., Morgan, M., & Pill, R. (2002). Using meta ethnography to synthesise qualitative research: a worked example. *Journal of Health Services Research & Policy*, 7(4), 209–215.
- Brivot, M., Gendron, Y., & Guénin, H. (2017). Reinventing organizational control. *Accounting, Auditing & Accountability Journal*, 30(4), 795–820. <https://doi.org/10.1108/AAAJ-06-2015-2111>
- Bromwich, M. & Bhimani, A. (1989). *Management Accounting: Evolution Not Revolution*. Chartered Institute of Management Accountants.
- Bughin, J., LaBerge, L., & Mellbye, A. (2017). The case for digital reinvention. *McKinsey Quarterly*, (1), 26–41. Retrieved from <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/the-case-for-digital-reinvention>
- Burchell, S., Clubb, C., Hopwood, A., Hughes, J., & Nahapiet, J. (1980). The Roles of Accounting in Organizations and Society *. *Accounting, Organizations and Society*, 5(1), 5–21.
- Burns, J., & Scapens, R. W. (2000). Conceptualizing management accounting change: An institutional framework. *Management Accounting Research*, 11(1), 3–25. <https://doi.org/10.1006/mare.1999.0119>
- 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>
- Bygstad, B. (2015). The coming of lightweight IT. *Ecis, Paper* 22(2015), 1–16. <https://doi.org/10.1109/HICSS.2012.118>
- Caglio, A. (2003). *Enterprise Resource Planning systems and accountants: towards hybridization?* *European Accounting Review* (Vol. 12). <https://doi.org/10.1080/0963818031000087853>

- Chapman, C., & Chua, W. F. (2003). Technology-Driven Integration, Automation, and Standardization of Business Processes. In A. Bhimani (Ed.), *Management Accounting in the Digital Economy* (pp. 74–94). New York, US: Oxford University Press.
- Cuganesan, S., & Dumay, J. C. (2009). Reflecting on the production of intellectual capital visualisations. *Accounting, Auditing & Accountability Journal*, 22(8), 1161–1186. <https://doi.org/10.1108/09513570910999274>
- Davenport, T. H. (1998). Putting the Enterprise into the Enterprise System. *Harvard Business Review*, 1–12. <https://doi.org/Article>
- Dechow, N., & Mouritsen, J. (2005). Enterprise resource planning systems, management control and the quest for integration. *Accounting, Organizations and Society*, 30(7–8), 691–733. <https://doi.org/10.1016/j.aos.2004.11.004>
- den Hertog, F., & Wielinga, C. (1992). Control systems in dissonance: The computer as an ink blot. *Accounting, Organizations and Society*, 17(2), 103–127. [https://doi.org/10.1016/0361-3682\(92\)90006-E](https://doi.org/10.1016/0361-3682(92)90006-E)
- Dimaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited : Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, 48(2), 147–160.
- 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>
- Fahy, M., & Lynch, R. (1999). Enterprise Resource Planning (ERP) systems and strategic management accounting. Paper presented at the 22nd Annual Congress of the European Accounting Association, Bordeaux, France, May 5-7, 1999.
- Financial Times. (2018). Does China’s bet on big data for credit scoring work? Retrieved from <https://www.ft.com/content/ba163b00-fd4d-11e8-ac00-57a2a826423e>
- Fitzgerald, M., & Kruschwitz, N. (2013). Embracing digital technology: A new strategic imperative. *MIT Sloan*, 1–12. <https://doi.org/10.1057/palgrave.ejis.3000650>
- Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254–280. <https://doi.org/10.1016/j.techfore.2016.08.019>

- Giddens, A. (1976). *New rules of sociological method*. London, UK: Hutchinson.
- Granlund, M. (2011). Extending AIS research to management accounting and control issues: A research note. *International Journal of Accounting Information Systems*, 12(1), 3–19. <https://doi.org/10.1016/j.accinf.2010.11.001>
- Granlund, M., & Malmi, T. (2002). Moderate impact of ERPS on management accounting: A lag or permanent outcome? *Management Accounting Research*, 13(3), 299–321. <https://doi.org/10.1006/mare.2002.0189>
- Granlund, M., & Mouritsen, J. (2003). Special section on management control and new information technologies. *European Accounting Review*, 12(1), 77–83. <https://doi.org/10.1080/0963818031000087925>
- Guthrie, J., Ricceri, F., & Dumay, J. (2012). Reflections and projections: A decade of Intellectual Capital Accounting Research. *British Accounting Review*, 44(2), 68–82. <https://doi.org/10.1016/j.bar.2012.03.004>
- Hazgui, M., & Gendron, Y. (2015). Blurred roles and elusive boundaries: On contemporary forms of oversight surrounding professional work. *Accounting, Auditing and Accountability Journal*, 28(8), 1234–1262. <https://doi.org/10.1108/AAAJ-12-2014-1890>
- Heidegger, M. (1969). *Discourse on thinking*. Trans. by Anderson, J.M. & Freund, E.H. New York, US: Harper & Row
- Hopwood, A. G. (1992). Accounting calculation and the shifting sphere of the economic. *European Accounting Review*, 1(1), 125–143.
- Hoque, Z. (2014). 20 years of studies on the balanced scorecard: Trends, accomplishments, gaps and opportunities for future research. *British Accounting Review*, 46(1), 33–59. <https://doi.org/10.1016/j.bar.2013.10.003>
- Horlach, B., Drews, P., & Schirmer, I. (2016). Bimodal IT: Business-IT Alignment in the Age of Digital Transformation. *Proceedings of the Multikonferenz Wirtschaftsinformatik, Ilmenau*, (March), 1417–1428. <https://doi.org/10.1006/mpev.1999.0667>
- Horngren, C. T., Datar, S. M., & Rajan, M. V. (2015). *Cost Accounting: A Managerial Emphasis* (15th ed.). Essex, UK.: Pearson Education Limited.
- Hoskin, K., & Macve, R. (1994). Writing, examining, disciplining: The genesis of accounting's

- modern power'. In In A. G. Hopwood & P. Miller (Eds.), *Accounting as a social and institutional practice*. Cambridge University Press.
- Hylving, L., & Schultze, U. (2013). Evolving the modular layered architecture in digital innovation: The Case of the Car's Instrument Cluster. In *ICIS 2013 Proceedings*, 2(January), 1525–1541. <https://doi.org/10.1177/0160017604266026>
- IESBA. (2018). *Professional Skepticism – Meeting Public Expectations*. Retrieved from <http://www.ifac.org/system/files/publications/files/Professional-Skepticism-Meeting-Public-Expectations-Consultation-Paper.pdf>
- Ittner, C., & Larcker, D. F. (2009). Extending the Boundaries: Nonfinancial Performance Measures. *Handbook of Management Accounting Research*, 3, 1235–1251. [https://doi.org/10.1016/S1751-3243\(07\)03002-7](https://doi.org/10.1016/S1751-3243(07)03002-7)
- Jarvenpaa, S. L., & Lang, K. R. (2005). Managing the paradoxes of mobile technology. *Information Systems Management*, 22(4), 7–23. <https://doi.org/10.1201/1078.10580530/45520.22.4.20050901/90026.2>
- Jeacle, I., & Carter, C. (2011). In TripAdvisor we trust: Rankings, calculative regimes and abstract systems. *Accounting, Organizations and Society*, 36(4–5), 293–309. <https://doi.org/10.1016/j.aos.2011.04.002>
- Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry. *Journal of Management Information Systems*, 32(1), 39–81. <https://doi.org/10.1080/07421222.2015.1029380>
- Kilfoyle, E., Richardson, A. J., & Macdonald, L. D. (2013). Accounting , Organizations and Society Vernacular accountings: Bridging the cognitive and the social in the analysis of employee-generated accounting systems. *Accounting, Organizations and Society*, 38(5), 382–396. <https://doi.org/10.1016/j.aos.2013.08.001>
- Kitchenham, B. (2004). Procedures for performing systematic reviews. *Keele, UK, Keele University*, 33(TR/SE-0401), 28. <https://doi.org/10.1.1.122.3308>
- Kornberger, M., Pflueger, D., & Mouritsen, J. (2017). Evaluative infrastructures: Accounting for platform organization. *Accounting, Organizations and Society*, 60, 79–95. <https://doi.org/10.1016/j.aos.2017.05.002>
- Kure, N., Nørreklit, H., & Raffnsøe-Møller, M. (2017). Language Games of Management

- Accounting - Constructing Illusions or Realities? In H. Nørreklit (Ed.), *A Philosophy of Management Accounting* (pp. 211–224). New York, US: Routledge.
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA, USA: Harvard University Press.
- Lee, L. F., Hutton, A. P., & Shu, S. (2015). The role of social media in the capital market: Evidence from consumer product recalls. *Journal of Accounting Research*, 53(2), 367–404. <https://doi.org/10.1111/1475-679X.12074>
- Light, R. J., & Pillemer, D. B. (1984). *Summing Up*. Boston, MA: Harvard University Press.
- Malmi, T. (2001). Balanced scorecards in Finnish companies: A research note. *Management Accounting Research*, 12(November 2000), 207–220. <https://doi.org/10.1006/mare.2000.0154>
- Manetti, G., & Bellucci, M. (2016). The use of social media for engaging stakeholders in sustainability reporting. *Accounting, Auditing & Accountability Journal*, 29(6), 985–1011. <https://doi.org/10.1108/AAAJ-08-2014-1797>
- Massaro, M., Dumay, J., & Guthrie, J. (2016). On the shoulders of giants: undertaking a structured literature review in accounting. *Accounting, Auditing & Accountability Journal*, 29(5), 767–801.
- Mauldin, E. G., & Ruchala, L. V. (1999). Towards a meta-theory of accounting information systems. *Accounting, Organizations and Society*, 24, 317–331.
- Miller, G. S., & Skinner, D. J. (2015). The evolving disclosure landscape: How changes in technology, the media, and capital markets are affecting disclosure. *Journal of Accounting Research*, 53(2), 221–239. <https://doi.org/10.1111/1475-679X.12075>
- Miller, P. (1998). The margins of accounting. *European Accounting Review*, 7(4), 605–621. <https://doi.org/10.1080/096381898336213>
- Miller, P. (2001). Governing by Numbers: Why Calculative Practices Matter. *Social Research*, 68(2), 379–396. <https://doi.org/10.2307/40971463>
- Miller, P., & O’Leary, T. (1993). Accounting expertise and the politics of the product: Economic citizenship and modes of corporate governance. *Accounting, Organizations and Society*, 18(2–3), 187–206. [https://doi.org/10.1016/0361-3682\(93\)90033-3](https://doi.org/10.1016/0361-3682(93)90033-3)

- Nwankpa, J. K., & Roumani, Y. (2016). IT Capability and Digital Transformation : A Firm Performance Perspective. *International Conference on Information Systems*, 1–16.
- Okoli, C., & Schabram, K. (2010). A Guide to Conducting a Systematic Literature Review of Information Systems Research. *Sprouts: Working Papers on Information Systems*, 10(26), 1–51. <https://doi.org/10.2139/ssrn.1954824>
- Orlikowski, W.J., and Iacono, C.S. Research Commentary: Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact. *Information Systems Research*, 12(2), 121-134.
- Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: how to benefit from digitalization in practice. *International Journal of Information Systems and Project Management*, 5(1), 63–77. <https://doi.org/10.12821/ijispm050104>
- Payne, R. (2014). Discussion of Digitisation, Big Data and the transformation of accounting information by Alnoor Bhimani and Leslie Willcocks (2014). *Accounting and Business Research*, 44(4), 491–495. <https://doi.org/10.1080/00014788.2014.910053>
- Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming companies. *Harvard Business Review*, 92(November). <https://doi.org/10.1017/CBO9781107415324.004>
- Porter, T. M. (1995). *Trust in Numbers*. New Jersey: Princeton University Press.
- Poston, R., & Grabski, S. (2001). Financial impacts of enterprise resource planning implementations. *International Journal of Accounting Information Systems*, 2, 271–294.
- Prasad, A., & Green, P. (2015). Governing cloud computing services: Reconsideration of IT governance structures. *International Journal of Accounting Information Systems*, 19, 45–58. <https://doi.org/10.1016/j.accinf.2015.11.004>
- 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>
- Quattrone, P., & Hopper, T. (2005). A “time” space odyssey’: Management control systems in two multinational organisations. *Accounting, Organizations and Society*, 30(7–8), 735–764. <https://doi.org/10.1016/j.aos.2003.10.006>

- Roberts, J. (1991). The possibilities of accountability. *Accounting, Organizations and Society*, 16(4), 355–368.
- Rom, A., & Rohde, C. (2007). Management accounting and integrated information systems: A literature review. *International Journal of Accounting Information Systems*, 8(1), 40–68. <https://doi.org/10.1016/j.accinf.2006.12.003>
- Scapens, R. W., & Jazayeri, M. (2003). ERP systems and management accounting change: opportunities or impacts? A research note. *European Accounting Review*, 12(1), 201–233. <https://doi.org/10.1080/0963818031000087907>
- Sangster, A., Leech, S.A., & Grabski, S. (2009). ERP Implementations and Their Impact Upon Management Accountants. *Journal of Information Systems and Technology Management*, 6(2), 125–142.
- Schneider, G. P., Dai, J., Janvrin, D. J., Ajayi, K., & Raschke, R. L. (2015). Infer, predict, and assure: Accounting opportunities in data analytics. *Accounting Horizons*, 29(3), 719–742. <https://doi.org/10.2308/acch-51140>
- Scott, S. V., & Orlikowski, W. J. (2012). Reconfiguring relations of accountability: Materialization of social media in the travel sector. *Accounting, Organizations and Society*, 37(1), 26–40. <https://doi.org/10.1016/j.aos.2011.11.005>
- Silverman, D. (2013). *Doing Qualitative Research*. London, UK: SAGE Publications.
- Solomons, D. (1991). Accounting and Social Change: A Neutralist View. *Accounting, Organizations and Society*, 16(3), 287–295.
- Suddaby, R., Saxton, G. D., & Gunz, S. (2015). Twittering change: The institutional work of domain change in accounting expertise. *Accounting, Organizations and Society*, 45, 52–68. <https://doi.org/10.1016/j.aos.2015.07.002>
- Tang, V. W. (2017). Wisdom of Crowds: Cross-Sectional Variation in the Informativeness of Third-Party-Generated Product Information on Twitter. *Journal of Accounting Research*, 56(3), 989–1034. <https://doi.org/10.1111/1475-679X.12183>
- The Economist. (2015, October). Five-star fakes. Retrieved from <https://www.economist.com/business/2015/10/22/five-star-fakes>
- The Economist. (2019, August). What companies are for - big business, shareholders and

society.

- Thorseng, A. A., & Grisot, M. (2017). Digitalization as institutional work: a case of designing a tool for changing diabetes care. *Information Technology and People*, 30(1), 227–243. <https://doi.org/10.1108/ITP-07-2015-0155>
- Vasarhelyi, M. A., Kogan, A., & Tuttle, B. M. (2015). Big data in accounting: An overview. *Accounting Horizons*, 29(2), 381–396. <https://doi.org/10.2308/acch-51071>
- Viale, T., Gendron, Y., & Suddaby, R. (2017). From “mad men” to “math men”: The rise of expertise in digital measurement and the shaping of online consumer freedom. *Accounting, Auditing & Accountability Journal*, 30(2), 270-305. <https://doi.org/10.1108/AAAJ-12-2014-1887>
- Warren, J. D., 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>
- Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a literature Review. *MIS Quarterly*, 26(2), xiii–xxiii. <https://doi.org/10.2307/4132319>
- Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading Digital: Turning Technology Into Business Transformation*. Boston, MA: Harvard Business Review Press.
- Yang, J. H., & Liu, S. (2017). Accounting narratives and impression management on social media. *Accounting and Business Research*, 47(6), 673–694. <https://doi.org/10.1080/00014788.2017.1322936>
- Yoo, Y., Lyytinen, K., Boland, R., Berente, N., Gaskin, J., Schutz, D., & Srinivasan, N. (2010). The Next Wave of Digital Innovation: Opportunities and Challenges. *Report on the Research Workshop: “Digital Challenges in Innovation Research,”* 1–37. <https://doi.org/10.2139/ssrn.1622170>

CHAPTER II

Centers of Data Appropriation: Evidence From a Nordic Hotel Chain Competing With Online Travel Agencies

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Purpose – Research suggests that centers of calculation, empowered by accounting inscriptions, are similar to maps: they provide a useful, albeit simplified, version of reality. The purposes of this paper are to examine whether and how digital platforms change the nature of centers of calculation, and to improve our understanding of the relationship between digital platforms and accounting.

Design/methodology/approach – An in-depth, single case-study design is used to empirically investigate how a Nordic hotel chain competed with global online travel agencies (OTAs) in the quest for the “new oil”—customer data.

Findings – The paper demonstrates how the case organization created a local alternative to global digital platforms with the aim of acquiring customer data, thereby moving from a center of calculation (CoC) to what we label a “center of data appropriation” (CDA). While CoCs are guided by accounting inscriptions that enable “mapping”, CDAs are constructed around accounting inscriptions with other properties that enable digital “mirrors” of the economic domain. We find that this has two governing effects. First, multiple centers emerge that compete for access to the periphery. Second, future forms of competition can follow dynamic trajectories, where mutual dependence between CDAs may lead to cooptation.

Originality/value – Scholars have suggested that surveillance capitalism creates market-power imbalances. Our study indicates that the transformation of local organizations into CDAs enables them to challenge global digital-platform organizations. Therefore, we argue that local organizations may retain some market power by establishing local CDAs.

Keywords: Center of calculation, center of data appropriation, surveillance capitalism, inscription, digital platform, case study

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1. Introduction

Over the course of the last two decades, the emergence of a range of new and interconnected technologies has changed the nature of information, the economy, and business. Technologies such as digital platforms, mobile technologies, the Internet of Things, machine learning, and business analytics have enabled the production and use of more granular and personalized data (Al-Htaybat and von Alberti-Alhtaybat, 2017; Arnaboldi et al., 2017b; Bhimani and Willcocks, 2014; McAfee and Brynjolfsson, 2012; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015). In fact, the significance of data in the digital economy has given rise to the expression “data is the new oil” – a resource that must be found, extracted, refined, and processed before it can yield dividends (Al-Htaybat and von Alberti-Alhtaybat, 2017).

Fueled by this technological development, organizations of today work to capitalize on the existence of big data, and personalized data in particular. Several practitioners argue that big data accumulation is moving incredibly fast and companies that fail to take it into consideration risk losing power on the competitive market (MIT Technology Review, 2016). The competitive pressure for data has fostered an emergent logic of accumulation. This logic, and the actions this logic fuels, has been seen as new form of capitalism, referred to as surveillance capitalism (Zuboff, 2015, 2019) where the appropriation and accumulation of data is the core activity.

Contrary to conventional resources in traditional markets, data is an intangible, non-consumable resource that increases in value as it increases in scope. It is composed of a variety of scarce, often unique pieces of information and has created a new type of competition based on the asymmetrical distribution of power among actors (MIT Technology Review, 2016). The rise of surveillance capitalism is viewed as problematic because it enables an asymmetrical redistribution of power that is “weighted towards the actors who have access and the capability to make sense of data” (West, 2019, p. 20). Given the increasing production and centrality of big data, how actors deal with this asymmetrical redistribution of power in the competition for data resources is a subject of increasing interest.

Digital platforms arguably represent the most notable space in which this emergent logic of accumulation is materializing (Zuboff, 2015) given the asymmetrical redistribution of power between actors on these platforms (Kornberger et al. 2017). As data accumulation lies at the core of surveillance capitalism and digital platforms, management accounting is deeply involved in the facilitation of this emergent logic because the purpose of management accounting is to identify, accumulate, and analyze business-related information (Horngren et

al., 2005). Accounting scholars have previously discussed how the development of big data can supplement and enhance traditional accounting information (Warren et al., 2015). They have also debated how big data allows for improved inferences and predictions (Schneider et al., 2015) in order to enable better decision-making (Brown-Liburd et al., 2015).

Accounting scholars have also begun to investigate the role of accounting in the development of the digital-platform economy (Arnaboldi et al., 2017a; Begkos and Antonopoulou, 2020; Jeacle, 2017; Jeacle and Carter, 2011; Mcdaid et al., 2019; Scott and Orlikowski, 2012). In this stream of research, increasing emphasis has been placed on understanding how platform owners mobilize accounting to remain in power over (and sometimes in control of) platform users (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019). However, less is said about how digital platforms shape accounting practices inside digital-platform organizations. This issue warrants attention in the modern era of surveillance capitalism.

Theoretically, we are interested in critically examining how the burgeoning logic of data appropriation through digital platforms influences the use of accounting information. In particular, we aim to shed light on whether and how the use of digital platforms in the hotel industry has changed the nature of centers of calculation (CoCs) (Robson, 1992) and the role of accounting inscriptions (Agostino and Sidorova, 2017; Gullberg and Weinryb, 2021; Rose and Miller, 2010). While the emergence of CoCs played an important role in the rise of global neoliberal capitalism (Miller and Rose, 1990), we aim to develop our understanding of whether and how new modes of capitalism may shape the emergence and use of new accounting inscriptions and, consequently, new forms of CoCs. To that end, we rely on a framework consisting of the qualities of CoCs and inscriptions, namely quantification, visualization, and governance, used to analyze the data.

Empirically, we scrutinize how global digital platforms interact with local businesses and the consequences of those interactions over time. To do so, we conduct a qualitative and interpretative study in which we mobilize the theoretical discourse on accounting inscriptions and CoCs in the digital-platform setting, which provides us with a framework useful for understanding changes in accounting information and governance structures. Our main research question is: *Whether and how do digital platforms change the nature of centers of calculation?*

By addressing this research question, this study contributes to the debate about digital platforms and accounting in two ways. First, we contribute to the literature on accounting inscriptions and CoCs (Latour, 1987; Miller and Napier, 1993; Qu and Cooper, 2011; Robson, 1992; Rose and

Miller, 2010) by highlighting the influence of big data on the mobilization of data (by way of quantification) and by improving our understanding of the rationale behind this influence (through visualization). While we acknowledge the continued significance of CoCs, we also point to the rise of a new type of center, which we label “center of data appropriation” (CDA). Whereas CoCs are guided by accounting inscriptions that enable the “mapping” of the economic domain, CDAs are constructed around accounting inscriptions with other properties that enable digital “mirrors” of the economic domain. We claim that there is an emerging rationality at work for digital-platform organizations, which demonstrates how accounting “changes in both content and form over time” (Miller and Napier, 1993, p. 631). We suggest that the move from CoCs to CDAs represent a shift in how accounting inscriptions are gathered, transmitted, and assimilated. Second, our study contributes to the interdisciplinary discourse on the impact of surveillance capitalism on the trajectory of competitive forms in general (West, 2019; Zuboff, 2015) and to the debate on digital platforms in relation to accounting in particular (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019). We find two organizational governance effects emerging from the shift to CDAs.

One governance effect is the changing nature of the relationship between the center and the periphery. We argue that CDAs differ from CoCs owing to the emergence of multiple centers that compete for access to the periphery. This shift points to the previously unexplored notion in accounting literature that centers need to compete for the appropriation of data. The other governance effect is the rise of local CDAs, which creates new dynamics among centers and leads to a shift towards *coopetition* (Luo, 2007) – a situation of both competition and cooperation. This finding contradicts Zuboff’s (2015) assertion that the trajectory of new, competing forms is deterministic. We show that accounting is involved in the dynamics of the relationships among different digital platforms and that these dynamics play a role in the development of a less deterministic trajectory of surveillance capitalism.

The article is structured as follows. In section two, we introduce an overview of the shift from neoliberal capitalism towards surveillance capitalism and review the literature on digital platforms in accounting. In section three, we outline our theoretical lens based on the fundamental concepts of CoCs and accounting inscriptions. This is followed by an explanation of our method in section four and the presentation of our empirical findings in section five. Lastly, our concluding discussion and ideas for future research are offered in section six.

2. Surveillance capitalism and the role of accounting in digital platforms

2.1. From neo-liberal capitalism to surveillance capitalism

Globalization was a principal factor in the development of neoliberalism and it transformed industrial practices around the world. Neoliberalism is defined as “a theory of political economic practices which proposes that human well-being can be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets and free trade” (Harvey, 2005, p. 2). The influx of neoliberalism diluted the economic role of the state. In its place, a complex set of ideas and policies that ideologically underpin free trade and privatization arose (Free and Hecimovic, 2020).

Neoliberalism is seen as a stage in capitalism (Chiapello, 2017) that opened up for increased flows of trade, labor, capital, and technology, thereby giving rise to new types of business models. Among the most prominent business models arising from this development is that of digital platforms, whereby digital-platform owners rely on the appropriation of individual behavioral information. Although neoliberalism has been extensively debated in critical accounting research (see Chiapello, 2017, for an overview), subsequent stages of capitalism have not been sufficiently addressed. In light of the importance of novel technology-driven business models, Zuboff (2015) introduced the notion of surveillance capitalism – a new type of capitalism based on the appropriation and use of individual behavioral data.

In the traditional (and neoliberal) versions of capitalism, private individuals or businesses can own capital goods. Based on the seminal work of Smith (1976), the common belief has been that free markets are governed by an “invisible hand” that dictates what should be produced and how it should be priced. Competition is understood as the mechanism that creates an effective system with three pillars: the division of labor, the pricing mechanism, and the medium of exchange (i.e. money) (Smith, 1976).

Surveillance capitalism, on the other hand, is associated with a different mode of governmentality, as the “invisible hand” does not work as expected. It is governed by a new logic of accumulation with new politics and social relations that replace contracts, the rule of law, and social trust with the sovereignty of what Zuboff (2015) refers to as “Big Other”. Big Other is described as the “absence of legitimate authority and is largely free from detection or

sanction (...). Big Other may be described as an automated coup from above: not a *coup d'état*, but rather a *coup des gens*" (Zuboff, 2015, p. 83). In short, surveillance capitalism establishes a new form of power in which contracts and the rule of law are supplanted by the rewards and punishments of a new kind of invisible hand.

The emergence of surveillance capitalism warrants an examination of its theoretical and practical implications. As accounting represents the "technical lifeblood" (Guthrie et al., 1999, p. 211) of capitalism, it has been used to understand the functioning of neoliberalist economic regimes. Similarly, we argue that accounting scholars should study the role of accounting under surveillance capitalism, as we lack an understanding of the consequences of this changing economic regime. Based on its logic of accumulation (Zuboff, 2015), surveillance capitalism introduces important areas for accounting scholars, such as novel forms of information, changes in governance structures, and the emergence of other competitive forms.

2.2. The relationship between accounting and digital platforms

As the concept of surveillance capitalism was only recently introduced, our understanding of its implications for accounting is still incomplete. In fact, to the best of our knowledge, no published papers explicitly examine this relationship. However, Andon et al. (2003) discuss the influence of digital technologies on employee surveillance within post-industrial organizations. They mobilize Foucault's (1977) notion of the panopticon to discuss modern modes of surveillance, and their implications for governance and management control. Contrary to Zuboff (2015), who focuses on the societal level, these authors adopt an intra-organizational level of analysis. They observe that the digital transformation of accounting inscriptions is a feature that was absent from the pre-industrial contexts studied by Foucault (1977).

Andon et al. (2003) call for more research on the influence of digitally enabled surveillance. For example, they raise questions regarding the meaning of the "digitization of accounting inscriptions" (Andon et al., 2003, p. 138) for accounting and the nature of those inscriptions. The authors conclude that the "enigmas and tensions present in digitized forms of surveillance (...) constitute an interesting and challenging set of problems for future accounting research in a post-industrial context" (Andon et al., 2003, p. 148). More recently, an emerging body of literature has devoted attention to the characteristics of the digital economy in relation to accounting (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019).

Kornberger et al. (2017, p. 79) examine the role of accounting in digital platforms, which they define as “distributed and often switch-role producers (sellers) and consumer (buyers) interacting with each other, digitally mediated by third party, the platform owner”. In a quest to illuminate some of the mechanisms of digital platforms in contemporary capitalism (Kornberger et al., 2017), the authors unpack how platforms’ business models rest on their ability to ensure trust between buyers and sellers. This is achieved by creating a specific accounting regime known as an evaluative accounting infrastructure. Through evaluative infrastructures, digital platforms provide platform owners with privileged access to scads of consumer data (Kornberger et al., 2017; Srnicek, 2016). Kornberger et al. (2017) argue that platform users control the platform, while platform owners are in a position to analyze, mine, and sell the data and, hence, remain in power over the platform.

Similar to Andon et al. (2003), Leoni and Parker (2019) study how novel digital technologies influence governance and management control. In their examination of the use of accounting systems on digital platforms, they find that platform owners govern the digital platform from a central position of power, where they exert formal bureaucratic control over a large number of physically distant platform users. This aligns the users’ behaviors with the platform owner’s performance objectives. In theory, the distant platform users should enjoy high degrees of autonomy because they are not constrained by formal employment contracts. However, the platform owners exert considerable pressure on distant platform users owing to the increased opportunities to generate data, develop calculations (e.g. performance measurements), and introduce status-recognition controls. The authors therefore question the ability of the new (sharing) economy to deliver an alternative version of capitalism that can empower ordinary people.

Agostino and Sidorova (2017) explore the role of accounting in enabling action on distant customers and show that the adoption of social media (i.e. digital platforms) reconfigures CoCs. They conclude that social media facilitates action at a distance, and simultaneously blurs the lines between the center and the periphery. In this study, we engage with this stream of literature and advance the debate on the relationship between digital platforms and accounting by examining the implications of surveillance capitalism for accounting.

3. Theoretical framework: centers of calculation and accounting inscriptions

In order to analyze our empirical data, we mobilize the theoretical concepts of accounting inscriptions and CoCs – concepts that always have been an important part of technologies for governing at a distance (Latour, 1987; Miller and Rose, 1990; Rose and Miller, 1992). Latour (1987) introduced the CoC concept in his seminal work *Science in Action*, while Robson (1992) paved the way for the analytical application of the concept in accounting research.

When quantitative practices began playing a substantial role in a range of intellectual disciplines and in society at large, a sharp rise in the development of inscriptions and CoCs occurred. From the mid-1850s, a strong, positivistic orientation in society gave rise to a wave of quantitative practices (Hacking, 1981). In accounting and other disciplines, quantification now serves as the dominant form of information due, in part, to its reputed ability to provide “rigor” and “objectivity” (Robson, 1992).

When quantitative practices came to play a substantial role in a range of intellectual disciplines, including accounting, and in society at large, a sharp rise in the development of inscriptions occurred. Inscriptions can be understood “as the ‘material’ bases for the development of knowledge” (Robson, 1992, p. 689), most often in the form of numbers and quantification. In short, inscriptions refer to how we make an object or event known using such techniques as writing, recording, drawing, or tabulating (Robson, 1992). Since the mid-1850s, we have become increasingly used to understanding the world through inscriptions. In fact, according to Latour (1986, p. 13), we have become so accustomed to a world of prints and images that we are hardly able to understand knowledge “without indexes, bibliographies, dictionaries, papers with references, tables, columns, photographs, peaks, spots, [and] bands”. Therefore, a relevant question in modern society is whether there is any knowledge without inscriptions. Together, inscriptions become maps (Lowe and Koh, 2007) through which we orient ourselves and make sense of the world.

CoCs emerged along with the pervasive production of inscriptions. CoCs are certain entities or locales (i.e. a person, group, or organization) that accumulate information and knowledge by acquiring inscriptions (Agostino and Sidorova, 2017; Rose and Miller, 2010). By acquiring information and knowledge about the periphery, a CoC is able to “dominate [...] the periphery” (Latour, 1987, p. 232) and, thereby, to exert control over it. To Rose and Miller (2010, p. 238), the inscriptions that CoCs can accumulate about the periphery make them powerful because they are “in the know about that which they seek to govern”. This enables CoCs to take action

at a distance on something (i.e. the periphery) that is distant from the center (Agostino and Sidorova, 2017). Previous studies have shown that CoCs can govern at several distances, which may be temporal (Qu and Cooper, 2011; Quattrone and Hopper, 2005), geographical (Preston, 2006), or of another form (see, e.g., Ahrens and Chapman, 2007; Dambrin and Robson, 2011; Ezzamel and Willmott, 1998).

Even though previous research has thoroughly examined the roles of CoCs and accounting inscriptions in governance processes, few researchers have questioned the assumptions regarding the economic regime under which contemporary organizations operate (e.g. via the use of digital platforms). Under surveillance capitalism, we expect the transformation of, access to, and distribution of big data via digital platforms to change the nature of incoming and outgoing flows of information as an economic resource that can be mobilized in new types of accounting inscriptions and, therefore, change the nature of CoCs. Previous studies (Zuboff, 2015, 2019) assume that surveillance capitalism creates a change in the competitive situation by creating an asymmetrical distribution of power that favors the actors that have access to information and the ability to make sense of it. Thus, we expect new, economically relevant information to be produced and new types of accounting inscriptions to be mobilized to become competitive on the market.

Given this background, we ask *whether and how do digital platforms change the nature of centers of calculation?* We aim to answer this question by studying the use of digital platforms in the hotel industry. The broad and important changes discussed in this paper have not been driven by digital platforms alone but also by the rise of a number of interconnected digital technologies. However, we assert that digital platforms represent the most notable space in which the logic of accumulation materializes. Thus, we focus on this space. Furthermore, we examine how surveillance capitalism unfolds as well as its consequences. In order to do so, we draw on the accounting-inscriptions and CoC literature to highlight three important areas for our research, which are summarized in table I.

| Element | Qualities |
|-----------------------|---|
| Quantification | Knowledge development through the use of signs, texts, and numbers. What accounting numbers are measured and communicated? |
| Visualization | Inscriptions are imperfect representations of reality. What is the rationale behind the choice of the number and what are the intended implications of its visualization? |
| Governance | Inscriptions enable and condition actions at a distance. What are the governance effects of inscriptions? |

Table I: Qualities of CoCs and inscriptions

First, accounting inscriptions can be understood “as the ‘material’ bases for the development of knowledge” (Robson, 1992, p. 689), most often in the form of numbers and *quantification*. In short, inscriptions refer to how we make an object or event known using such techniques as writing, recording, drawing, or tabulating as well as categorizing, gathering, measuring, and aggregating (Robson, 1992). CoCs requires “infrastructures of codes” (Robson and Bottausci, 2018) that explain the subjects or objects to which the numbers refer. To bring remote contexts into a calculation by introducing new text or numbers, one must engage in a process of reduction of traces and reference – amplification of the reference to a form allows for greater compatibility and, therefore, results in the loss of some matter deemed inessential (Robson and Bottausci, 2018). As such, in order to answer our main research question, we need to first understand *the accounting inscriptions that are measured and communicated in the shift towards digital platforms*.

Second, inscriptions have *visualization* effects (Busco and Quattrone, 2015; Qu and Cooper, 2011; Quattrone, 2009). Inscriptions can be understood as intended “fact fabrication” and, therefore, constitute economic objects to be communicated and their importance to be visualized. Through visualization, inscriptions become objects for manipulation and governance. However, as the creation of an inscription involves selectivity, inscriptions are always imperfect representations of an underlying economic reality that the inscriptions are meant to visualize. This selectivity requires a rationale for representation and meaning that assign to such a representation, making the rhetoric behind the visualization important. Therefore, in order to answer our main research question, we also need to understand *the rationales behind and the meaning of the choice of new accounting numbers, and the intended implications of their visualization in the shift towards digital platforms*.

Third, inscriptions have *governance* effects and are expected to mobilize action across CoCs. Thus, accounting inscriptions are not neutral, as they create new spaces of representation and, therefore, new disciplinary and governance regimes that are expected to enable organizational change (Christensen et al., 2019) and work across distances. Inscriptions are meant to mobilize economic reality at a distance and, in this sense, facilitate action at a distance. Thus, inscriptions bring the outside world into the local world of interaction (Burfitt et al., 2020) and, therefore, change the nature of society and businesses by creating reciprocity between signs and actors, and “do things by making each other speak” (Fauré et al., 2019, p. 337). Therefore, in order to answer our main research question, we need to understand *the governance effects of new accounting inscriptions in the shift towards digital platforms*.

4. Methodology

Our empirical foundation is a single case study (Ahrens and Dent, 1998). In order to examine whether and how digital platforms change the nature of CoCs, we study how a large Nordic hotel chain evolved following the emergence of global digital platforms. The study is a theoretically informed interpretative case study, which “offers a way of examining the cumulative characteristics of organizational change and the changes in accounting processes that the organization has been subject to” (Bourmistrov and Kaarbøe, 2013, p. 199). The aim of our case study is to contribute to theoretical development by providing general insights (Flyvbjerg, 2006) or analytical generalizations (Parker and Northcott, 2016). Moreover, explorative case studies are well suited for uncovering questions for further exploration.

4.1 Company background and case selection

Our empirical setting is the travel industry. The case organization is a large Nordic hotel chain, which we call “CASE Hotel”. It is among the biggest players in the Nordic hotel industry with more than 200 hotels, 14,000 employees, and 8 million guests annually (pre-pandemic figures).

We chose CASE Hotel based on suggestions made by others in our research group who had previously conducted interviews with representatives of CASE Hotel and identified interesting areas for further enquiry. These existing relations eased our access to the organization. As such, this study was initially based on convenience sampling (Brewis, 2014). However, we conducted a more thorough assessment of the selected case organization before undertaking the study. In this process, we identified three rationales for the use of CASE Hotel as our empirical setting. First, the organization was located in the Nordic region, which is known for its digital maturity (Norwegian Ministry of Local Government and Modernisation, 2017). Second, the travel industry was a leader in collecting, collating, and capitalizing on individual customer data through the use of digital platforms (Bulgakov, 2018). Third, CASE Hotel had a certain level of market power in the Nordic countries, which provided it with the ability to invest in digital technologies in order to compete against the global digital players. These promising case characteristics convinced us that CASE Hotel represented a critical case that could provide interesting, general insights into the use of new forms of information collected through digital platforms and into a local player’s relationship to a global digital-platform owner.

4.2 Data collection

We collected our empirical data from various parallel sources (Corvellec et al., 2018) in two periods, as we adopted to an abductive research approach. Theory building in organizational studies requires disciplined imagination (Weick, 1989) and inspiration (Rivard, 2014), both of which often follow an evolutionary process. Consequently, an abductive approach was adequate.

An abductive approach involves an iterative process in which the researcher moves back and forth between empirical data collection and its theoretical interpretation (Lukka and Modell, 2010). This approach helped uncover how the process dynamics of an entity change or develop over time. In our study, we noted how the trajectory of the relationship between CASE Hotel and the online travel agencies (OTAs) developed dynamically over time. Such circular research processes (Flick, 2009) are seen as fruitful if the researcher aims to “discover new things” (Dubois and Gadde, 2002, p. 559), which was an aim of this study.

In total, we drew information from 32¹⁸ interviews conducted in two periods. In the first period, we read transcripts of interviews with several managers in CASE Hotel, some of whom were members of the top management team. These interviews were conducted from 2015 to 2018 by other researchers in our research group. A large portion of these interviews were characterized as open and explorative in nature. Four of these interviews were included in our study. The transcripts of these interviews provided us with an initial understanding of CASE Hotel’s relationship with the OTAs and some notion of the importance of customer data.

In the second period, which ran from 2019 to 2020, we conducted seven additional interviews with representatives from various organizational levels in CASE Hotel and one interview with an OTA representative. These interviews were more targeted in nature but semi-structured in form, thereby allowing for surprises to surface. Some interviews were conducted by phone due to time restrictions on the interviewees’ behalf. Relevant interviewees were identified by CASE Hotel representatives in a manner similar to a snowball sampling technique (Noy, 2008).

As one interview took place at the organization’s headquarters, the primary researcher was able to engage in participant observation for approximately two hours. During these two hours, the primary researcher was allowed to observe informal meetings of CASE Hotel’s management

¹⁸ We drew on a sample of 32 interviews, 24 of the which were conducted by others in our research group. From this population of 24 interviews, 4 were particularly relevant for our study. Thus, statements from these interviews are included here. We conducted an additional eight interviews. Consequently, the interview data in this study was gathered from 12 interviews conducted in two separate periods.

team, and to engage in informal conversations with those involved in strategic management about the role of OTAs and the importance of customer data. These were clearly issues that engaged CASE Hotel's management team, as the primary researcher was kept in the HQ lobby for continued discussions long after the agreed timeframe. Directly after these meetings, the researcher took hand-written notes in an effort to connect novel insights to existing ones. Moreover, the authors attended various events hosted by CASE Hotel with a total duration of four hours. During these events, C-level executives explained CASE Hotel's current and future strategic challenges, often highlighting the competition for and importance of individual data. The interviews and the participant observations served as our primary data sources.

In addition, we collected secondary data from several sources. We were granted access to detailed annual reports and performance reviews produced for internal use. Organizational documents may contain valuable empirical material because they are "elements of institutionalized practices" (Garfinkel, 1967, p. 197). As such, they provide a window into the organizational practices and procedures under which they were produced. By examining annual reports from 2014 to 2020, we were able to study CASE Hotel's reflections on and strategies concerning the increasing influence of OTAs in the hotel industry. These reports provided valuable information about the emergence of different accounting inscriptions over time and how those inscriptions were assigned different levels of importance at different stages in the process. In addition, the reports ensured that our conjectures of the organizational changes was accurate. Thus, the secondary data helped to mitigate any potential biases. The last source of data consisted of general information acquired from CASE Hotel's own website and mobile application as well as information and inscriptions from the two major OTAs' digital platforms. Appendix 1 details our empirical data collection.

The triangulation of the collected data (Denzin, 1978) highlighted three distinct empirical phases in CASE Hotel's relationship with the OTAs (see Figure 1). Several rounds of follow-up emails verified that our understanding was adequate. The first phase commenced when CASE Hotel joined the OTAs in the early 2000s and ended when it actively took a stance against the OTAs in 2012. The second phase started with CASE Hotel's withdrawal from the OTA platforms in 2012 and ended with the emergence of a reconfigured relationship between CASE Hotel and one of the OTAs in 2018. This reconfigured relationship represented the start of the third phase, which was characterized by cooptation.

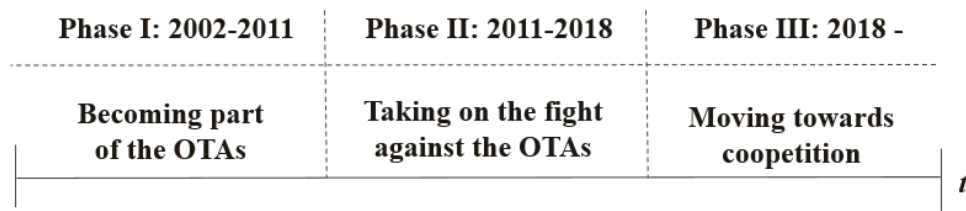


Figure 1: CASE Hotel's changing relationship with the OTAs

In order to present the changing dynamics in this case, we use temporal presentations of our findings, as they allow the researcher to reveal emerging themes, and to maintain the integrity and transparency of the findings (Reay et al., 2019).

5. Empirical findings: moving from CoCs to CDAs

CASE Hotel was founded in 1990. Until the end of the 1990s, the organization was managed in a highly traditional manner. For instance, the only customer-contact channels were phone or fax, and the hotel mainly operated with fixed prices, normally listed on a laminated A4 sheet kept behind the counter. At the time, the only customer data CASE Hotel recorded were names and phone numbers. In short, information acquired about customers was sparse, recorded manually, and of limited analytical interest. CASE Hotel traditionally used EBITDA to monitoring each hotel's performance, which was consolidated and discussed at the executive management and board levels.

5.1. *Becoming part of OTAs – a new actor takes charge in the hotel industry*

After the dot-com bubble burst in the initial years of the new millennium, equities entered a bear market. Investors and companies lacked both the confidence and the capital needed to make new IT-related investments. The terrorist attacks on September 11, 2001, aggravated market conditions, leaving the hotel industry in a state of crisis. This series of events made room for a new player in the hotel industry – OTAs. CASE Hotel's Vice President reflected on the market conditions in the early the 2000s:

[We joined the OTAs] shortly after they were established in Scandinavia. After 9/11, the whole industry was in a state of crisis and bookings of hotel rooms plummeted for everyone. This was when these actors [the OTAs] saw an opportunity to take charge of the industry – when everyone else was panicking.

Throughout the first decade of the 2000s, the influence and power of some OTAs grew significantly. Through a number of consolidations, two strong actors became the dominant

forces: Booking Holdings and Expedia Group. Notwithstanding the growing influence of these actors, CASE Hotel saw OTAs as a new and beneficial distribution channel it could exploit to reach new customers in previously uncharted territory. Hotel Manager 2 considered the emergence of OTAs:

It started as an advantageous distribution channel for our overseas markets. If we wanted to sell to Asian or American customers, we had no problem paying an “OK” commission for that.

However, by 2008, the OTAs had gained enough influence to leverage the increasingly asymmetrical power balance in a way that CASE Hotel found problematic:

In 2002/2003, we were not that conscious of the OTAs’ demands and they were not particularly influential. However, by 2008-2009, they had started to become strong. For us, the problem was that they made completely unrealistic demands regarding profit [commissions] and access to our rooms. (Distribution Key Accountant Manager)

Hotel Manager 2 had worked in the hotel industry throughout his career and had been with CASE Hotel since 1997. When asked about CASE Hotel’s relationship with the OTAs, he quickly replied:

I like to talk straight. To tell you the truth, it is a love-hate relationship. (...) For example, on issues regarding price-parity,¹⁹ we joined forces [with other hotel chains] in Scandinavia and got that sorted. We agreed to work together [against the OTAs] and said “enough is enough”.

The increasing influence and power of Booking Holdings and Expedia Group resulted in rising commission fees and, consequently, a negative perception of the OTAs:

We did take high commission rates, which did not create a good environment for further collaboration. (Market Manager, OTA)

The demands concerning commission rates and access to rooms were not the only issues CASE Hotel faced. Access to and ownership of customers and customer data also surfaced as a key issue. A corporate manager explained:

We did not receive any customer information from the OTAs. Even the guests’ contact information was unavailable to us. Therefore, we had to contact the respective OTA if we had a message for a customer.

Throughout the 2010s, digitalization became increasingly important in the hotel industry. Together with the rest of the corporate world, CASE Hotel started to realize the potential value

¹⁹ Price-parity clauses generally oblige hotels to provide rooms to OTAs on terms at least as favorable as those offered on other online and offline distribution channels.

of customer data. The harvesting of customer data and the treatment of it as a resource on its own became a chief priority for the organization. However, the OTAs were unwilling to share data with CASE Hotel:

If you book a room via [OTA 1], for example, an email address with a reservation number will be sent to the hotel, but that email address is only a temporary one that [OTA 1] creates for you. Then the OTA has to forward any mail from the hotel to the customer's real email address. The hotel never sees the customer's real email address. The OTAs do not want us to send marketing content to what they refer to as "their" customers. [Customer data] is alfa and omega. (Vice President)

This was a central part of the negotiations with OTA 1:

From [OTA 1], we receive the guests' first and last names. We do not get any other information or insights. That has been one of the main issues in our negotiations with [OTA 1], but...no (C-level Executive)

An OTA representative shared this understanding of the situation:

Market Manager, OTA: We create an alias for guests who book through our platform. We assign them a [temporary] email address, which is the email address the hotels receive, such that the communication between the hotel and the customer goes through us. We are not supposed to provide the real email address or home address.

Interviewer: Why is that?

Market Manager, OTA: That is something we have never done and something we are not going to do. A central question is "Who owns the customer?" In our view, we own the customer until he or she steps through the hotel's doors.

In sum, the costs of meeting the OTAs' demands became too high for CASE Hotel. Dissatisfaction with the OTAs' high commission rates was also evident among the other major hotel chains in the local market. In a joint effort to stifle the increasing influence of the OTAs, the hotel chains backed out of their agreements with the OTAs near the end of 2011. In this phase, CASE Hotel noted how the platform owners became stronger as a result of their centralized power (Kornberger et al., 2017). This power asymmetry resulted in even higher commission demands as well as a continued lack of direct access to customers and customer data, both of which CASE Hotel found increasingly problematic.

In terms of the use of accounting inscriptions during this period, CASE Hotel management was still using EBITDA to monitor its hotels' performance and it faced increasing competition from OTAs for access to customer data. It also introduced new accounting metrics focused on the cost of sharing customers with OTAs. These metrics, such as "revenue reduction due to

commission rates”, highlighted the rising dissatisfaction with OTAs’ exclusive access to customer data. Table II summarizes the development of accounting inscriptions in all three phases.

5.2. Taking on the fight against OTAs – realizing the importance of harvesting customer data

Shortly after CASE Hotel and the other major Norwegian hotel chains left the OTAs in 2011, they entered into new rounds of negotiations. After only three months, CASE Hotel rejoined the OTAs. The rationale for this quick U-turn was two-sided. On the one hand, CASE Hotel was able negotiate a better deal with the OTAs, which demonstrated that the hotels were still able to influence the OTAs. On the other hand, CASE Hotel had experienced a severe downturn in bookings after leaving the OTAs, especially bookings from the international market.

According to several managers, the most important issue for CASE Hotel was its increasing distance from customers, which inhibited data appropriation, although commission fees were still high on the agenda. Given its dissatisfaction with the lack of access to customer data and its general relationship with the OTAs, CASE Hotel decided to establish a new corporate entity dedicated to understanding and tackling the challenges brought about by digitalization. Among the main concerns of the new corporate entity was finding ways to harvest and analyze customer data. The establishment of the new entity also demonstrated CASE Hotel’s willingness to continue the fight against the OTAs with the explicit aim of appropriating customer-related information. Initially, the principal task of this corporate entity was to launch a new mobile application, which functioned as CASE Hotel’s own digital platform. Through the mobile application, CASE Hotel could meet its customers and appropriate data:

You might say our counterstrategies against the OTAs are the things we do in our own channels. For example, our current strategy is to stifle the influence of the OTAs. Therefore, we added the mobile application as part of what we offer. That is one of our countermoves against the OTAs; the app is clearly a part of that. (C-level Executive)

The importance of customer data was emphasized by the same C-level executive:

[The problem is] that we have become too distant from our customers—the platforms come in between. Part of the risk with [OTA] platforms relates to our margins, but data is arguably even more important. We do not get data about our customers [when the customers book a stay through third-party platforms].

When asked whether the need to reduce commission payments was the main reason for introducing the mobile application, a revenue manager responded:

It is not only commissions. What is really essential nowadays... is who owns the customer; customer data. (...). They [the OTAs] sit on a lot of data that is very valuable to us.

Figures 2, 3, and 4 are screenshots from CASE Hotel’s 2016 annual report. They highlight the somewhat hostile relationship between CASE Hotel and the OTAs as well as the importance of the mobile application in CASE Hotel’s efforts to appropriate customer data.

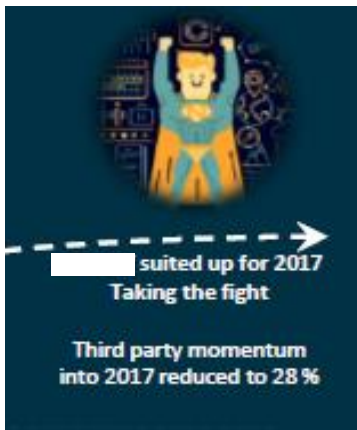


Figure 2: Screenshot from the 2016 Annual Report on CASE Hotel’s aim of challenging OTAs. “Third party” refers to the OTAs

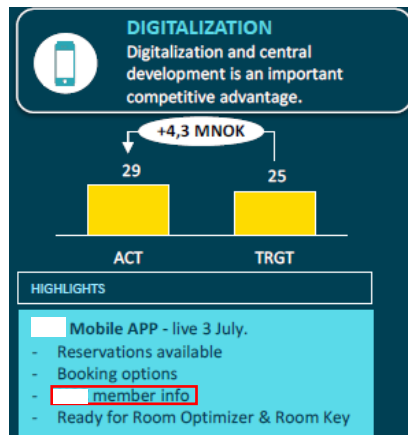


Figure 3: Screenshot from the 2016 Annual Report on CASE Hotel’s ambition to make digitalization a competitive advantage and to harvest member information.

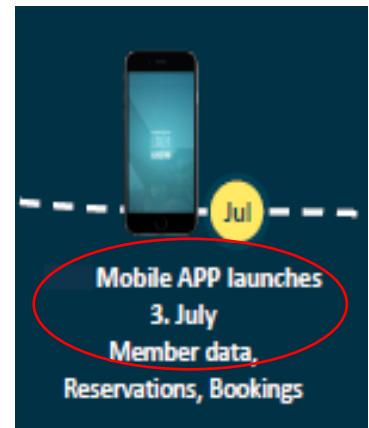


Figure 4: Screenshot from the 2016 Annual Report on the application’s launch.

Before the launch of the new digitalization initiatives in late 2015, the main sales channel was the call center, which did not systematically register customers’ preferences. After the launch of the mobile application on July 3, 2016, the hotel directed its customers to its online booking platforms (the application and the website) where customers could customize their stay according to their preferences:

[We have now enabled customers] to choose a specific room. We have even allowed them to design their hotel room – how it should look, feel, and smell. (C-level Executive)

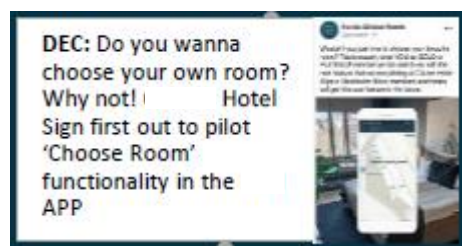


Figure 5: Screenshot from the 2018 Annual Report on the new application’s functionality.

These options gave customers a chance to tailor their hotel rooms to their preferences. This enabled CASE Hotel to appropriate customer data, including data on customers' sensory preferences. The launch of the app contributed to more appropriation of customer data for CASE Hotel. However, the OTAs also deployed strategies that reflected the competition for access to customers data. A Market Manager from one of the OTAs underlined how highly detailed information about customers gets collected and how new performance indicators have emerged as a result:

We keep track of “clicks” [on the digital platform] (...), such as information on the number of clicks compared to last year or the number of clicks compared to competitors. We pay attention to that information. In addition, we register conversion rates – the percentage of people who “click” and then actually book [a room].

Listing practices on OTA platforms was another reason CASE Hotel fought against the OTAs. Advanced data models determined which hotels appeared in which order when customers searched for hotels through, for example, the Google search engine:

The OTAs have very advanced data models that they use to rank hotels on their platforms. The fact that we sell rooms at a lower price on our own homepage than on the OTA platforms “kills” our ranking on the platforms. In other words, we appear farther down on the OTA page if you make a general search on an OTA platform for, for instance, “hotel Stockholm”. (Corporate Manager)

We asked a representative of OTA 2 about the determinants of hotel listings on its digital platform. Specifically, the interviewer asked : “What determines which hotels I see when I log onto [OTA 2]?” The representative replied:

We... Let me see...That is a question with a range of nice and correct answers. We have products for visibility. We have something called a “sponsored listing” [a paid listing service]. It is also about you as a person. For instance, do you delete your cookies? Your previous searches and “clicks” ... we gather information on those things. If you consistently book budget hotels without deleting your cookies, we will probably suggest a budget hotel. (Market Manager, OTA)

These measures increased the distance between potential customers and the hotels in which they would eventually stay. Consequently, informal practices emerged in CASE Hotel that aimed to reward customers booking directly through the hotel's own channels in a quest to appropriate data from the customers. One hotel manager stated that:

If you are a customer who books directly through one of our web services – especially if you are a potential or existing CASE Hotel member – then the odds that you will be offered an upgrade are far higher. Few will tell you this upfront, but it is true. This is because we will get more information

and we can get to know your preferences. We get so little of this kind of information from the third-party channels [the OTAs].

Similarly, a corporate manager indicated that:

The key is to get the customer's email address when they are standing at the counter. Chances are that customers can get up to a 20% discount on their next stay if they provide us with their email addresses.

In their efforts to access customer information, CASE Hotel also launched a new strategy in 2018 labelled the “Second-visit Strategy”. This strategy reflected CASE Hotel's acknowledgement that, despite its efforts to direct customers to its hotels through its own channels, most customers still booked hotels through OTAs. The Second-visit Strategy proclaimed that 80% of all returning customers should book their second (and nth) stay through CASE Hotel's own online channels (i.e. the website or the application). To incentivize returning customers to do so, CASE Hotel offered discounted rates (a minimum of 5%) and other member benefits. This strategy was important because – if successful – it would provide the organization with more and better customer data. At the same time, it would directly increase net profit. According to a corporate manager, the organization could not make a profit if all customers booked through the OTAs as long as the net profit of “OTA customers” was 15-25% below that of “direct customers”. The partial success of the Second-visit Strategy was used to explain how the company reached a “magical EBITDA” of approximately EUR 100 million in 2018. Purely economic rationales and access to data were the driving forces behind the strategy. Figure 6 presents an excerpt from the 2018 Annual Report highlighting the Second-visit Strategy.

2. VISIT STRATEGY

2nd Visit Strategy and initiatives have been launched both locally and centrally, and the strategy is starting to get traction - WEB/APP was our fastest growing channel in 2018!

Figure 6: Second-visit Strategy from the 2018 Annual Report

In 2015, directing customers through its own distribution channels (website/application) became a central priority for the organization. This gave rise to changes in focus concerning the KPIs in use and to numerous new KPIs, which were closely monitored. For instance, “revenue reduction related to commissions” was used to show how commission rates paid to OTAs flattened out. The KPI “share of room nights per distribution channel” appeared in 2017, through which the percentage of sales via OTAs was directly compared to the percentage of direct digital sales. In 2017, new measures such as “number of application downloads” and “number of new unique users” were introduced. By 2018, the use of the application was

becoming increasingly important and CASE Hotel started to rank its own hotels based on “number of customers using [the] application for check-in/check-out and using mobile key”.

A distribution key account manager agreed that customer data had become very important for the company, but she also shed light on the customers’ perspective. She explained that not only did customers accept that CASE Hotel appropriated data about them but they also *expected* it in exchange for a frictionless experience with the booking system:

Customer data has definitely become more important. [...]. For good or bad, I think we have reached a point where we expect the system to recognize us. In a way, it sounds horrible, but with all of the digitalization going on in all segments of society, that is what we do. Everyone who has a member card here only has to type in their phone number. Then [the system will say] “Oh hi, [name]! Is it you?”.

Hotel Director 2 envisioned how CASE Hotel could exploit appropriated customer data in new ways. He explained:

We have been successful in sending out information [to customers] one to two days before their stay. That is like the old-fashioned “mass mailing”, but the opportunity is there to tailor the information to the individual using the new technology. (...) When you land at the airport in, for instance, Oslo, I want your cell phone to automatically receive a message from us saying “Hi and welcome to Oslo! Press this link to book your stay with us”.

This hotel director also stated:

There are a few things we humans take for granted that we are rather critical about in reality, like temperature, scent, lighting – things that go through our senses. If we could [tailor] these elements to our customers, it would give us a huge advantage. You could, for instance, write in your CASE Hotel profile that you want the room temperature at 22 degrees Celsius, a certain level of humidity, and a particular scent – perhaps you could choose from five different scents – and you want a certain type of lighting. After you check in, our systems swing into action. Our system is set up to start the ventilation in your room and turn on the TV with your name on the screen the second you check in, [but] we still have a way to go. The challenge is to send different signals [in terms of scent, humidity level, etc.] to different rooms but that is just data input. The infrastructure is already there. The only thing left for us to do is to pair the system with our appropriated [individual] data. (Hotel Director 2)

The statements made by Hotel Director 2 demonstrate the importance of individual data for driving the changes and innovation CASE Hotel envisioned.

In summary, in the second phase, CASE Hotel did not remain a passive actor but instead took action and established a dedicated corporate entity with a mandate to develop an application

that would facilitate the appropriation of customer data – CASE Hotel’s own CDA. By mobilizing digital technologies, CASE Hotel could influence asymmetrical power balance between the OTAs and itself. The launch of the Second-visit Strategy accentuated CASE Hotel’s ambitions to regain a hold on its customers.

5.3. Towards cooperation

In 2018, CASE Hotel’s corporate management changed its discourse about the OTAs. It began to seek out more collaboration and partnership, especially with one of the OTAs:

A few years ago, [...] at our annual conference, [corporate management] talked a lot about the “fight against the OTAs”. Now this has changed completely and we view them as collaboration partners. (Hotel Manager)

[Our relationship] with one of the OTAs is changing. Now our best friend is [OTA 2]. We established a new contract last year and, hence, our working relationship has intensified. (Revenue Manager)

The Vice President explained that, in many cases, CASE Hotel sought out common ground with the OTAs. When that did not work, a more competitive attitude emerged. Thus, CASE Hotel’s relationship with the OTAs (especially OTA 2) was simultaneously characterized by a cooperative and a competitive nature:

You can have a collaboration in which you have coinciding interests. If we are unable to negotiate good deals, we start to bid against each other. What sets CASE Hotel apart from many other actors in this industry is that we managed to actively redirect volumes [customers] between actors [from “expensive” OTA 1 to “less expensive” OTA 2] and, thus, demonstrate that we can manage the channels through which the sales take place. When you have done that, it is easier to come to the negotiation table with them. (...) Then we seek win-win situations. (Vice President)

A relatively new feature for CASE Hotel was that it had customers who were loyal to CASE Hotel but still booked their stays through the OTAs:

What I like about [OTA 2] is that we have started to gain loyal customers through them. More people come back to the hotel time and time again. That is good because it reduces the distance between the customer and the hotel. (Hotel Manager)

This quote highlights the notion that customer-hotel distance is key. In this context, “distance” does not refer to spatial distance. Instead, it is used to describe the intimacy of the customer-hotel relationship. The level of intimacy in the relationship was also evident when a hotel manager described the “new normal” of working with OTA 2:

What is positive is that they also try to help us. It feels like that anyway. It is no longer a faceless relationship and [a unidirectional] emphasis on price.

OTA 2 also perceived the relationship as resurrected. A representative of OTA 2 reflected on the situation:

Interviewee: We now have a very good relationship with most hotel chains. I have to say that CASE Hotel was the one standing at the forefront of that development and we are very happy about that. (Market manager, OTA)

Interviewer: Is it correct to say that there was previously a bigger divide between you [the OTAs] and the hotels?

Interviewee: Absolutely. It was a clear “us against them” attitude. However, we have come extremely far. (...). We are working towards (...) more than – what should I say? – a fight against each other. (Market Manager, OTA)

In summary, we see that after joining the OTAs’ digital platforms in the early 2000s, CASE Hotel realized that the OTAs’ demands were unrealistic. Initially, the main issues were related to commissions and access to rooms. However, CASE Hotel soon recognized that access to customer data was bound to become highly important. According to a C-level executive, access to and ownership of customer data evolved into the main concern for CASE Hotel.

The OTAs were initially unwilling to enter into negotiations on this issue. At CASE Hotel, this resulted in the creation of an in-house “digitalization company” and the development of a mobile application aimed, in part, at appropriating customer data. In 2018, the character of CASE Hotel’s relationship with OTA 2 changed. Respondents from both OTA 2 and CASE Hotel alluded to a new situation of *coopetition* – an example of how new the “post-industrial economy is sustaining ‘new modes’ of inter- and intra-organizational functioning” (Andon et al., 2003, p. 135).

Table 2 summarizes our empirical findings for each of the three phases in relation to the elements of inscriptions: quantifying, visualizing, and governance. Our main observation is that accounting inscriptions of an economic nature, especially EBITDA, were used in all phases and acted as a relic from the initial phases of the organization’s history. However, other inscriptions also appeared that were characterized by weaker links to the economic domain, such as the “number of unique users (via application)” or the “share of rooms of rooms per distribution channel”. These inscriptions were more weighted towards the organization’s aim of appropriating data.

| Element | CASE Hotel becoming part of OTAs (2002–2011) | CASE Hotel versus OTAs: the fight for customer data (2011-2018) | CASE Hotel and OTAs: towards a new normal (since 2018) |
|---|---|---|---|
| Quantifying (What is inscribed?) | <p><i>CASE Hotel</i></p> <ul style="list-style-type: none"> • EBITDA decomposition for all hotels • Commission rates to OTAs (e.g., “revenue reduction due to commission rates”) <p><i>OTAs</i></p> <ul style="list-style-type: none"> • Price-parity agreements | <p><i>CASE Hotel</i></p> <ul style="list-style-type: none"> • EBITDA decomposition for all hotels • Commission rates to OTAs (e.g., “revenue reduction due to commission rates”) • Share of room nights per distribution channel (including OTAs versus website/application (digital direct sales)) • Number of application downloads • Number of unique users (via application) <p><i>OTAs</i></p> <ul style="list-style-type: none"> • Poor rankings of “rebel” hotels on the OTA search platforms • OTAs take over relevant hotel-related search words • KPIs related to customer clicks • Conversion rates | <p><i>CASE Hotel</i></p> <ul style="list-style-type: none"> • “Magical” EBITDA • “Revenue reduction due to commission rates” • Share of room nights per distribution channel • Number of application downloads • Number of unique users (via App) • Ranking of own hotels based on number of customers using application for check-in/check-out |
| Visualizing (Rationale for the inscription) | <ul style="list-style-type: none"> • All customers are OTAs’ customers (and not the hotel’s) • Temporary customer e-mail address assigned by OTA platforms | <ul style="list-style-type: none"> • Rewards for direct hotel bookings – aim for 80% bookings through CASE Hotel for second visits • Increased individuality through “choose-room functionality” in the application | <ul style="list-style-type: none"> • Intimacy in customer-hotel relationships |
| Governance (Effects of the inscriptions) | <ul style="list-style-type: none"> • OTAs created distance between CASE Hotel and its customers by “surveilling” communication • Emerging unhealthy environment for cooperation between OTAs and CASE Hotel | <ul style="list-style-type: none"> • Frictionless customer experience due to data access on the platform • Recognition of a mutual interdependence between OTAs and CASE Hotel • Attract customers by mobilizing individual information • Reward customers who provide personal information at the counter (increased likelihood of an upgrade) | <ul style="list-style-type: none"> • Partnership and cooperation between an OTA and CASE Hotel • Reduced distance between customers and CASE Hotel • Redirect customers from OTA 1 (“expensive OTA”) to OTA 2 (“less expensive OTA”) • Aim to mobilize more individual information to provide added customer value • Individualized advertisements |

Table II: Inscription development in CASE Hotel and OTAs

6. Concluding discussion

This paper aimed to improve our understanding of how digital platforms function from an accounting perspective (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019). In particular, we examined *whether and how digital platforms change the nature of COCs* in order to enhance our understanding of how the use of digital platforms may shape accounting practices and the nature of accounting information.

Based on our empirical study, we propose that by facilitating the enactment of data appropriation, digital platforms give rise to “centers of data appropriation” (CDAs), thereby moving beyond traditional CoCs. In this transition, accounting inscriptions take on a different meaning, as accounting information that supports this tradition is moving beyond the financial orientation to include a wider set of information without direct links to the economic domain.

Our theorization of how CDAs differ from CoCs constitutes our first contribution. In Table 3, we summarize the different properties of CoCs and CDAs. In sections 6.1 and 6.2, we discuss our first finding by elaborating on quantification and visualization, respectively. In section 6.3, we discuss our second finding by elaborating on the effects of CDA and governance. Section 6.4 details the study’s limitations and outlines suggestions for future research.

| Accounting inscriptions | CoCs | CDAs |
|--------------------------------|--------------------------------|---|
| Quantifying | Focus on financial performance | Focus on data-appropriation performance |
| Visualizing | Maps of reality | Mirrors of reality |
| Governance | Center dominates the periphery | Multiple centers compete (and/or cooperate) for access to the periphery |

Table III: CoCs versus CDAs

6.1. Digital platforms and the rise of CDAs – new quantifications and inscriptions

First, this study contributes to the literature on accounting inscriptions and CoCs (Latour, 1987; Miller and Napier, 1993; Qu and Cooper, 2011; Robson, 1992; Rose and Miller, 2010) by highlighting the influence of big data on what data is mobilized and the rationalization behind that mobilization. By examining the accounting inscriptions that are measured and

communicated in the shift towards digital platforms, we also show the evolution of CoCs into CDAs.

The extant literature on accounting inscriptions emphasizes that inscriptions contribute to knowledge development by making an object or event known through quantification and aggregation (Robson, 1992; Vaivio, 1999). We concur with the extant literature and find that traditional inscriptions still play a central role in CASE Hotel. For instance, EBITDA is the most prominent example of the continued existence – and importance – of traditional inscriptions. In fact, a pre-determined level of EBITDA was referred to as the “magical EBITDA” in several annual reports, signaling a continued focus on this inscription. The commission rate paid to OTAs was another financially oriented inscription that was present in all phases. Thus, the focus on financial performance was not abandoned or downplayed. As noted by Robson and Bottausci (2018), such traditional inscriptions are characterized by their aggregate and reductionist nature, which allows the power of the inscribed reference to be garnered.

However, in contrast to previous studies, we find that the introduction of digital technologies, and digital platforms with an emergent logic of accumulation fueled the rise of new types of inscriptions, as demonstrated in Table II. While previous studies in accounting (Chua, 1996; Robson, 1992) have demonstrated accounting inscriptions’ strong relations to the economic domain, our case is indicative of an influx of non-economic inscriptions that reflect the increasing use of and reliance on digital platforms.

These inscriptions are characterized by their lack of direct link to the economic domain. The “share of room nights per distribution channel (OTAs versus website/application)”, the “number of application downloads”, the “number of unique application users”, and several rankings surface as novel, highly prominent inscriptions in CASE Hotel. As such, we demonstrate the role of new inscriptions in prompting managerial innovation (Busco and Quattrone, 2018). These new forms of inscriptions (Ezzamel et al., 2004) are used to convey information about a new and increasingly digital reality, a reality in which data appropriation is not only an important competitive factor but also expected to be the fertile soil from which future economic benefits may be reaped. Notwithstanding the increasing credence given to these new inscriptions, they still co-exist with traditional inscriptions and function as increasingly important supplements. While the appearance and content of these new inscriptions are not surprising per se, the underlying logic of the new inscriptions epitomizes the shift towards a new economic rationality.

6.2 Digital platforms and the rise of CDAs – from maps to mirrors of reality

We further develop this finding by examining the rationales behind the choice of new accounting inscriptions and the implications of their visualization in the shift towards digital platforms.

The *modus operandi* of CoCs is calculative accounting practices aimed at reducing heterogeneity, complexity, and ambiguity (Cuganesan, 2008; Robson, 1992; Rose and Miller, 1992). As we have seen, CASE Hotel also relied on economic inscriptions, such as EBITDA calculations at the hotel-unit and brand levels. Such aggregated inscriptions create maps of reality (Lowe and Koh, 2007) that are imperfect representations of the world. Along these lines, the “purposeful quantification” (Vaivio, 1999, p. 690) orientation suggests a deductive approach to the acquisition of inscriptions. In other words, prior to data collection, CASE Hotel had a clear idea about what data should be collected and measured (e.g. financial performance of hotels) in order to facilitate comparisons and performance assessments. In CoCs, an inscription is always an imperfect representation of the underlying reality that the inscriptions are meant to visualize (Busco and Quattrone, 2015; Dambrin and Robson, 2011).

Our study indicates that there is a different, emerging rationality at work for digital-platform organizations and demonstrates how accounting “changes in both content and form over time” (Miller and Napier, 1993, p. 631). In the individual customer segment, detailed customer data are perceived as extremely important. CASE Hotel’s goal was to appropriate enough personal data about customers to enable the digitalized booking system to recognize every customer and their preferences. In this respect, we observe a fundamental shift away from combining and translating data into “higher-order and more aggregated degrees” (Cuganesan, 2008, p. 83) towards a state in which new accounting inscriptions motivate increasing data appropriation, where all data is assumed to have value on its own.

In other words, more data is always assumed to be better. This stands in contrast to CoCs, where inscriptions are given credence for the purpose of control (Lowe and Koh, 2007). While CoCs struggle to manage all of the data accumulated at the center (Cuganesan, 2008), CDAs both desire and manage to harvest and mobilize data by employing digital technologies. Consistent with Zuboff (2015), our empirical material suggests that no entity of data is too small or irrelevant to be appropriated. We suggest that the move from CoCs to CDAs represents a shift in how data is gathered, transmitted, and assimilated, and that new accounting inscriptions that support this transition also emerge.

The genesis of CDAs was primarily enabled by the massive increase in computing capacity and individuals' willingness to provide their personal data on digital platforms. These shifts enabled the OTAs and CASE Hotel to appropriate detailed data, sometimes in real time. While Lowe and Koh (2007) stress that inscriptions in CoCs are akin to maps because they provide an aggregated and simplified version of reality, we contend that the visualizing effects of accounting inscriptions in CDAs are more similar to mirrors because they provide a highly detailed version of reality, often in real time – creating a digital twin of a customer. While CoCs are characterized by the deductive approach to the acquisition of inscriptions, we argue that CDAs are driven by a more inductive approach. This is evident, for example, in CASE Hotel's ambition to acquire "member information". Although certain categories of member information were pre-determined, CASE Hotel's ambition was to acquire whatever information was available about present and future guests. This suggests a turn towards a more inductive approach in this respect.

The case material, which illustrates a clear focus on appropriating personal data, offers a unique window into how accounting inscriptions are moving from *homogenous, complexity-reducing pieces of information* (Cuganesan, 2008; Robson, 1992) to *heterogeneous, highly detailed pieces of individual information*. Several studies in accounting (Busco and Quattrone, 2015; Qu and Cooper, 2011; Quattrone, 2009) have stressed that visualization of inscriptions is about the construction of realities and rationales rather than the mere representation of financial rationales. As such, one implication of our advocated shift from maps of reality to mirrors of reality is the construction of a new economic regime characterized by strong assumptions about the future economic returns of data appropriation. By identifying and explaining this development, we also answer Ezzamel et al.'s (2004) call to shed light on the attributes and effects of new forms of accounting inscriptions.

6.3. Digital platforms and the rise of CDAs – governance effects

The second contribution relates to the interdisciplinary discourse on the impact of surveillance capitalism on the trajectory of competitive forms in general (West, 2019; Zuboff, 2015, 2019), and to the debate about the relationship between digital platforms and accounting in particular (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019). By analyzing the governance effects of new accounting inscriptions in the shift towards digital platforms, we find two governance effects for organizations: the changing nature of centers versus the periphery and the creation of new dynamics between centers in the form of a shift towards cooptation.

The extant literature that examines how digital platforms may change the relationship between CoCs and the periphery highlights intra-organizational controversies concerning the question of “Who is the customer?” (Agostino and Sidorova, 2017). In our case, the related but different question of “Who owns the customer?” was a central issue in discussions between CASE Hotel and the OTAs. In this situation, the hotel acted as a local CoC and the OTAs acted as a global CDA. Due to the asymmetrical power relationship, only the global CDA was able to appropriate valuable data about the customers, which motivated CASE Hotel to start its own digital platform and convert to a local CDA. In this regard, our study adds to the extant literature on digital platforms and accounting (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019) by recognizing that digital platforms open up a space for competition between local and global CDAs.

In CoCs, calculative practices are viewed as technologies of governance (Miller, 2001; Rose and Miller, 1992). The center has knowledge about the periphery and is, therefore, able to dominate it (Rose and Miller, 2010). However, our case study suggests that in CDAs, the digital platform enables one center (i.e. the global OTAs) to dominate another center (i.e. the local hotel chain). The central shift in governance effects in CDAs can be summarized as the emergence of multiple centers that compete for access to the periphery (e.g. customers). The consequence of this is a notion previously unexplored in the accounting literature – a situation in which multiple centers might need to compete in the collection of data.

Interesting notions also arise with regard to the role of the periphery. Under CoCs, the center is able to exert power and control over the periphery by acquiring information and knowledge about it (Latour, 1987; Rose and Miller, 2010). In the extant literature, the role of the periphery in this control relationship is not sufficiently problematized, but the implicit assumption is that the periphery must accept the center’s control over it. However, in CDAs, the center is not in a unilateral relationship with the periphery in which it can appropriate data without some form of customer consent. Rather, the development from CoCs to CDAs is fueled by the actors appropriating data (i.e. the OTAs) and by the periphery (i.e. the customers) donating data. Notably, most customers have come to not only accept data appropriation but also expect it. In exchange for their personal data, customers expect to be recognized, which ensures a frictionless meeting with the data systems.

In this respect, we argue that surveillance capitalism, enabled in large part by the rise of digital platforms, gives rise to a novel form of panopticon (Andon et al., 2003) in which the governed party not only (implicitly or explicitly) accepts but also expects to be governed in exchange for

convenience. This finding seems highly relevant for our understanding of how surveillance capitalism and digital platforms function from an accounting perspective (Agostino and Sidorova, 2017; Kornberger et al., 2017; Leoni and Parker, 2019) as well as our understanding of their role in shaping the new economy (Kornberger et al., 2018).

The second governance effect we highlight is the creation of new dynamics between centers owing to a shift towards *coopetition* (Luo, 2007). In contrast to existing views on surveillance capitalism, we do not envision the future trajectory of competing forms to be highly deterministic, as the extant literature contends (Zuboff, 2015; 2019). Instead, our empirical analysis suggests that the future of competing forms may well follow a dynamic trajectory. Our analysis shows that the dynamic trajectory of the relationship in our case was fueled by asymmetrical power relationships in terms of appropriating and controlling access to customer data. Initially, the global CDA could govern CASE Hotel by making it a hostage in its own business. It did so by catching CASE Hotel by surprise and, consequently, depriving it of access to detailed customer data. Therefore, OTAs as global CDAs exerted a kind of centralized control (Leoni and Parker, 2019) that forced CASE Hotel to follow the OTAs' policies. Remarkably, CASE Hotel's introduction of its own digital platform (a mobile application) reduced the asymmetry in the power relationship between the global OTAs and CASE Hotel.

In this respect, our paper adds interesting nuances to Kornberger et al.'s (2017) study. In contrast to that study, we show that access to customer data provides the platform owner with high levels of centralized power and control. When CASE Hotel realized that the OTAs completely controlled the data on customer bookings made through their platforms, it fought back against the OTAs in order to appropriate the customer data itself. Counteracting mechanisms contributed to the dynamic trajectory of this case, which may foreshadow a more nuanced version of surveillance capitalism.

As the two actors in our case were mutually dependent on each other, they were forced to find new ways to both compete and cooperate in their fight for loyal customers and customer data, leading to a situation of *coopetition*. As platform owners, OTAs control the global digital infrastructure and have access to international customers, but they still depend on the local services that the hotels provide to customers. The local hotels, in turn, provide services to customers but still need access to international customers.

6.4 Limitations and future research

Although this study brings novel and important theoretical and practical understandings of the role of accounting under surveillance capitalism to the fore, limitations still exist. First, our research draws on a single case study and can, therefore, only offer general insights. More research on this topic is warranted in order to nuance and advance the theoretical concept of CDAs, including their creation and maintenance. Do they exist in other digital-platform settings and industries? Second, our findings could be contingent on the particularities of the context. The rather liberal and democratic market environment in which CASE Hotel operated may have positively influenced its ability to act against the OTAs. Future studies should observe how local market conditions determine the future trajectory of power relationships in digital-platform settings. Important practical political discussions could emerge in the wake of such findings. Third, future studies should critically assess the consequences of moving towards a dependence on highly detailed, individual information. Qu and Cooper (2011) suggest that inscriptions are subject to negotiation and reinterpretation. What happens when data become detailed enough to exhaust all room for negotiation and reinterpretation? In terms of profitability, offering a large pool of customers tailor-made services is not necessarily more profitable. Rather, customer engagement should be matched by internal processes in a way that supports profitability.

Lastly, our conclusions build on the assumption that customers will continue to donate personal data. Although that trend is strong, customers might come to view the downsides of data donation as stronger than the benefits. What would happen if customers self-selected away from organizations dependent on the donation of personal data? Irrespective of the trajectory of such developments, more work is needed to understand accounting's role in the creation and maintenance of surveillance capitalism as well as its implications for individuals, organizations, and society.

Appendix 1: Data sources

| Data type | Quantity | Original data source | Data source classification |
|---|-------------------------------|---|-----------------------------------|
| Interviews from 2015-2018 | 4 (mean duration: 70 minutes) | Informants (Deputy CEO, Chief Digital Officer, Vice President Distribution, Head of Marketing Technology and Sales) | Primary |
| Interviews from 2019-2020 | 8 (mean duration: 60 minutes) | Informants (Vice President Distribution, Head of Business Performance x 2, Head Profit Cluster, Hotel Director 1, Hotel Director 2, OTA representative, Distribution Key Account Manager) | Primary |
| Participant observation (2019-2020) | 6 hours | Observation of informal meetings, discussions with various actors holding corporate positions at HQ and participants at seminar organized by CASE Hotel | Primary |
| Internal annual reports from 2014-2020 (not publicly available) | 7 | Annual reports from CASE Hotel Financial Services department | Secondary |
| Digital corporate platforms | 2 | General information acquired from the company's website and its application | Secondary |
| OTA platforms | 2 | Visits to the two major OTAs' platforms to assess rankings and other relevant information | Secondary |

References

- Agostino, D., and Sidorova, Y. (2017). How social media reshapes action on distant customers: some empirical evidence. *Accounting, Auditing and Accountability Journal*, *30*(4), 777–794. <https://doi.org/10.1108/AAAJ-07-2015-2136>
- Ahrens, T., and Chapman, C. S. (2007). Management accounting as practice. *Accounting, Organizations and Society*, *32*, 1–27. <https://doi.org/10.1016/j.aos.2006.09.013>
- Ahrens, T., and Dent, J. F. (1998). Accounting and organizations: Realizing the richness of field research. *Journal of Management Accounting Research*, *10*, 1–39. <https://doi.org/10.2139/ssrn.124433>
- Al-Htaybat, K., and von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing and Accountability Journal*, *30*(4), 850–873. <https://doi.org/10.1108/AAAJ-07-2015-2139>
- Andon, P., Baxter, J. A., and Chua, W. F. (2003). Management Accounting Inscriptions and the Post-Industrial Experience of Organizational Control. In A. Bhimani (Ed.), *Management Accounting in the Digital Economy* (pp. 131–151). Oxford: Oxford University Press.
- Arnaboldi, M., Azzone, G., and Sidorova, Y. (2017). Governing social media: the emergence of hybridised boundary objects. *Accounting, Auditing and Accountability Journal*, *30*(4), 821–849. <https://doi.org/10.1108/AAAJ-07-2015-2132>
- Arnaboldi, M., Busco, C., and Cuganesan, S. (2017). Accounting, accountability, social media and big data: revolution or hype? *Accounting, Auditing and Accountability Journal*, *30*(4), 762–776. <https://doi.org/10.1108/AAAJ-03-2017-2880>
- Begkos, C., and Antonopoulou, K. (2020). Measuring the unknown. Evaluative practices and performance indicators for digital platforms. *Accounting, Auditing and Accountability Journal*, *33*(3), 588–619. <https://doi.org/10.1108/AAAJ-04-2019-3977>
- Bhimani, Alnoor, and Willcocks, L. (2014). Digitisation, Big Data and the transformation of accounting information. *Accounting and Business Research*, *44*(4), 469–490. <https://doi.org/10.1080/00014788.2014.910051>
- Biernacki, P., and Waldorf, D. (1981). Snowball sampling: problems and techniques of chain

- referral sampling. *Sociological Methods and Research*, 10(2), 141–163.
- Bourmistrov, A., and Kaarbøe, K. (2013). From comfort to stretch zones: A field study of two multinational companies applying “beyond budgeting” ideas. *Management Accounting Research*, 24(3), 196–211. <https://doi.org/10.1016/j.mar.2013.04.001>
- Brewis, J. (2014). The Ethics of Researching Friends: On Convenience Sampling in Qualitative Management and Organization Studies. *British Journal of Management*, 25, 849–862. <https://doi.org/10.1111/1467-8551.12064>
- Brown-Liburd, H., Issa, H., and Lombardi, D. (2015). Behavioral implications of big data’s impact on audit judgment and decision making and future research directions. *Accounting Horizons*, 29(2), 451–468. <https://doi.org/10.2308/acch-51023>
- Bulgakov, A. L. (2018). *Financial and Economic Tools Used in the World Hospitality Industry*. (F. L. Gaol, F. Filimonova, and V. Maslennikov, Eds.). London, UK: Taylor and Francis Group.
- Burfitt, B. A., Baxter, J., and Mouritsen, J. (2020). Separating and integrating non-financial and financial measures: a case study of a sporting organization playing the value-in-kind (VIK) game. *Accounting, Auditing and Accountability Journal*, 33(8), 1871–1907. <https://doi.org/10.1108/AAAJ-06-2018-3543>
- Busco, C., and 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>
- Busco, C., and Quattrone, P. (2018). Performing business and social innovation through accounting inscriptions: An introduction. *Accounting, Organizations and Society*, 67, 15–19. <https://doi.org/10.1016/j.aos.2018.03.002>
- Chiapello, E. (2017). Critical accounting research and neoliberalism. *Critical Perspectives on Accounting*, 43, 47–64.
- Christensen, M., Skærbæk, P., and Tryggestad, K. (2019). Contested organizational change and accounting in trials of incompatibility. *Management Accounting Research*, 45(March), 100641. <https://doi.org/10.1016/j.mar.2019.03.001>
- Chua, W. F. (1996). Teaching and Learning Only The Language of Numbers - Monolingualism In a Multilingual World. *Critical Perspectives on Accounting*, 7, 129–

- Corvellec, H., Ek, R., Zapata, P., and Jos, M. (2018). Acting on distances: A topology of accounting inscriptions. *Accounting, Organizations and Society, Organizations and Society*, 67, 56–65. <https://doi.org/10.1016/j.aos.2016.02.005>
- Cuganesan, S. (2008). Calculating customer intimacy: Accounting numbers in a sales and marketing department. *Accounting, Auditing and Accountability Journal*, 21(1), 78–103. <https://doi.org/10.1108/09513570810842331>
- Dambrin, C., and Robson, K. (2011). Tracing performance in the pharmaceutical industry: Ambivalence, opacity and the performativity of flawed measures. *Accounting, Organizations and Society*, 36, 428–455. <https://doi.org/10.1016/j.aos.2011.07.006>
- Denzin, N. K. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods* (2nd ed.). New York, NY: McGraw-Hill.
- Dubois, A., and Gadde, L.-E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research*, 55(7), 553–560. [https://doi.org/10.1016/s0148-2963\(00\)00195-8](https://doi.org/10.1016/s0148-2963(00)00195-8)
- Ezzamel, M., Lilley, S., and Willmott, H. (2004). Accounting representation and the road to commercial salvation. *Accounting, Organizations and Society*, 29, 783–813. <https://doi.org/10.1016/j.aos.2003.10.004>
- Ezzamel, M., and Willmott, H. (1998). Accounting for Teamwork: A Critical Study of Group-Based Systems of Organizational Control. *Administrative Science Quarterly*, 43(2), 358–396.
- Fauré, B., Cooren, F., and Matte, F. (2019). To speak or not to speak the language of numbers: accounting as ventriloquism. *Accounting, Auditing and Accountability Journal*, 32(1), 337–361. <https://doi.org/10.1108/AAAJ-07-2017-3013>
- Flick, U. (2009). *An Introduction To Qualitative Research* (4th ed.). London: SAGE Publications Ltd.
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219–245.
- Foucault, M. (1977). *Discipline and Punish: The Birth of the Prison*. (P. Books, Ed.).

Middlesex.

- Free, C., and Hecimovic, A. (2020). Global supply chains after COVID-19: the end of the road for neoliberal globalisation? *Accounting, Auditing and Accountability Journal*, 34(1), 58–84. <https://doi.org/10.1108/AAAJ-06-2020-4634>
- Garfinkel, H. (1967). “Good” organizational reasons for “bad” clinic records. In *Studies in Ethnomethodology* (pp. 187–207). New Jersey: Prentice-Hall.
- Gullberg, C., and Weinryb, N. (2021). Inscriptions without boundaries: how action at a distance is enabled on social media. *Accounting, Auditing and Accountability Journal*, 34(9), 57–79. <https://doi.org/10.1108/AAAJ-07-2020-4663>
- Guthrie, J., Olsson, O., and Humphrey, C. (1999). Debating Developments In New Public Financial Management: The Limits of Global Theorising And Some New Ways Forward. *Financial Accountability and Management*, 15(3 and 4), 209–228.
- Hacking, I. (1981). How Should we do the History of Statistics? *I and C*, 15–26.
- Harvey, D. (2005). *A brief history of neoliberalism*. New York: Oxford University Press.
- Horngren, C. T., Bhimani, A., Datar, S. M., and Foster, G. (2005). *Management and Cost Accounting*. FT Prentice Hall.
- Jeacle, I. (2017). Constructing audit society in the virtual world: the case of the online reviewer. *Accounting, Auditing and Accountability Journal*, 30(1), 18–37. <https://doi.org/10.1108/AAAJ-12-2013-1540>
- Jeacle, I., and Carter, C. (2011). In TripAdvisor we trust: Rankings, calculative regimes and abstract systems. *Accounting, Organizations and Society*, 36(4–5), 293–309. <https://doi.org/10.1016/j.aos.2011.04.002>
- Kornberger, M., Leixnering, S., Meyer, R. E., and Höllerer, M. A. (2018). Rethinking the Sharing Economy: The Nature and Organizations of Sharing in the 2015 Refugee Crisis. *Academy of Management Discoveries*, 4(3), 314–335.
- Kornberger, M., Pflueger, D., and Mouritsen, J. (2017). Evaluative infrastructures: Accounting for platform organization. *Accounting, Organizations and Society*, 60, 79–95. <https://doi.org/10.1016/j.aos.2017.05.002>
- Latour, B. (1986). Visualization and Cognition: Drawing Things Together. In H. Kuklick

- (Ed.), *Knowledge and Society Studies in the Sociology of Culture Past and Present* (6th ed., pp. 1–40). JAI Press Limited.
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA, USA: Harvard University Press.
- Leoni, G., and Parker, L. D. (2019). Governance and control of sharing economy platforms: Hosting on Airbnb. *The British Accounting Review*, 51(6), 1–22.
<https://doi.org/10.1016/j.bar.2018.12.001>
- Lowe, A., and Koh, B. (2007). Inscribing the organization: Representations in dispute between accounting and production. *Critical Perspectives on Accounting*, 18, 952–974.
<https://doi.org/10.1016/j.cpa.2006.05.001>
- Lukka, K., and Modell, S. (2010). Validation in interpretive management accounting research. *Accounting, Organizations and Society*, 35(4), 462–477.
<https://doi.org/10.1016/j.aos.2009.10.004>
- Luo, Y. (2007). A coepitition perspective of global competition. *Journal of World Business*, 42, 129–144. <https://doi.org/10.1016/j.jwb.2006.08.007>
- McAfee, A., and Brynjolfsson, E. (2012). Big data: The Management Revolution. *Harvard Business Review*, 90(October).
- Mcdaid, E., Boedker, C., and Free, C. (2019). Close encounters and the illusion of accountability in the sharing economy. *Accounting, Auditing and Accountability Journal*, 32(5), 1437–1466. <https://doi.org/10.1108/AAAJ-09-2017-3156>
- Miller, P. (2001). Governing by Numbers: Why Calculative Practices Matter. *Social Research*, 68(2), 379–396.
- Miller, P., and Napier, C. (1993). Genealogies of Calculation. *Accounting, Organizations and Society*, 18(7), 631–647.
- Miller, P., and Rose, N. (1990). Governing Economic Life. *Economy and Society*, 19(1), 1–31.
- MIT Technology Review. (2016). The Rise of Data Capital. *MIT Technology Review Custom*.
- Moll, J., and Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping the work of accountants: New directions for accounting research. *The British Accounting*

Review, 51, 1–22. <https://doi.org/10.1016/j.bar.2019.04.002>

Norwegian Ministry of Local Government and Modernisation. (2017). *Digital North: Nordic Cooperation on Digitalization*. Oslo. Retrieved from <https://www.regjeringen.no/contentassets/5ed83530b83c4e4ba85338c29eb50c63/ministerial-declaration.pdf>

Noy, C. (2008). Sampling knowledge: the hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*, 11(4), 327–344. <https://doi.org/10.1080/13645570701401305>

Parker, L. D., and Northcott, D. (2016). Qualitative generalising in accounting research: concepts and strategies. *Accounting, Auditing and Accountability Journal*, 29(6), 1100–1131. <https://doi.org/10.1108/AAAJ-04-2015-2026>

Preston, A. M. (2006). Enabling, enacting and maintaining action at a distance: An historical case study of the role of accounts in the reduction of the Navajo herds. *Accounting, Organizations and Society*, 31, 559–578. <https://doi.org/10.1016/j.aos.2005.03.003>

Qu, S. Q., and 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. (2009). Books to be practiced: Memory, the power of the visual, and the success of accounting. *Accounting, Organizations and Society*, 34(1), 85–118. <https://doi.org/10.1016/j.aos.2008.03.001>

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>

Quattrone, P., and Hopper, T. (2005). A “time” space odyssey’: Management control systems in two multinational organisations. *Accounting, Organizations and Society*, 30(7–8), 735–764. <https://doi.org/10.1016/j.aos.2003.10.006>

Reay, T., Zafar, A., Monteiro, P., and Glaser, V. (2019). Presenting Findings From Qualitative Research: One Size Does Not Fit All! In T. Zilber, J. M. Amis, and J. Mair (Eds.), *The Production of Managerial Knowledge and Organizational Theory: New Approaches to Writing, Producing and Consuming Theory* (pp. 201–216). Bingley, UK:

- Emerald Publishing Limited. <https://doi.org/10.1108/S0733-558X20190000059011>
- Rivard, S. (2014). Editor's comments: The Ions of Theory Construction. *MIS Quarterly*, 38(2), iii–xiv.
- Robson, K. (1992). Accounting Numbers as “Inscription”: Action at a Distance And The Development of Accounting. *Accounting, Organizations and Society*, 17(7), 685–708.
- Robson, K., and Bottauschi, C. (2018). The sociology of translation and accounting inscriptions: Reflections on Latour and Accounting Research. *Critical Perspectives on Accounting*, 54, 60–75.
- Rose, N., and Miller, P. (1992). Political Power beyond the State: Problematics of Government. *The British Journal of Sociology*, 43(2), 173–205.
- Rose, N., and Miller, P. (2010). Political power beyond the State: problematics of government. *The British Journal of Sociology*, 61(1), 271–303.
<https://doi.org/10.1111/j.1468-4446.2009.01247.x>
- Schneider, G. P., Dai, J., Janvrin, D. J., Ajayi, K., and Raschke, R. L. (2015). Infer, predict, and assure: Accounting opportunities in data analytics. *Accounting Horizons*, 29(3), 719–742. <https://doi.org/10.2308/acch-51140>
- Scott, S. V., and Orlikowski, W. J. (2012). Reconfiguring relations of accountability: Materialization of social media in the travel sector. *Accounting, Organizations and Society*, 37(1), 26–40. <https://doi.org/10.1016/j.aos.2011.11.005>
- Smith, A. (1976). *An Inquiry Into the Nature and Causes of the Wealth of Nations*. (R. H. Campbell, A. S. Skinner, and W. B. Todd, Eds.). Oxford: Clarendon Press.
- Srnicek, N. (2016). *Platform Capitalism*. Cambridge: Polity Press.
- Vaivio, J. (1999). Examining “The Quantified Customer.” *Accounting, Organizations and Society*, 24, 698–715.
- Warren, J. D., Moffitt, K. C., and Byrnes, P. (2015). How big data will change accounting. *Accounting Horizons*, 29(2), 397–407. <https://doi.org/10.2308/acch-51069>
- Weick, K. E. (1989). Theory Construction as Disciplined Imagination. *The Academy of Management Review*, 14(4), 516–531.
- West, S. M. (2019). *Data Capitalism: Redefining the Logics of Surveillance and Privacy*.

Business and Society, 58(1), 20–41. <https://doi.org/10.1177/0007650317718185>

Zuboff, S. (2015). Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1), 75–89.
<https://doi.org/10.1057/jit.2015.5>

Zuboff, S. (2019). *The Age of Surveillance Capitalism* (1st ed.). New York: Public Affairs.

CHAPTER III

Weak Links but Strong Assumptions: A Case Study of The Production of Non-Financial Performance Measures in a Big Data Context

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Purpose—The purposes of this paper are to examine how reliance on big data might change the production of accounting information by focusing on the influence of non-financial performance measures (NFPMs) and to discuss the implications of new NFPMs for mobilizing action.

Design/methodology/approach—The study relies on field-based research and draws on a single case study in a large media conglomerate, called MediaCorp. On the basis of 25 semi-structured interviews undertaken across multiple organizational levels and units, we add empirical insights to the otherwise rather conceptual debate about big data’s influence on accounting.

Findings—We identify how NFPMs developed in a big data context differ from “traditional” NFPMs. Based on a theoretical foundation and empirical observations, we find three categories of NFPMs. Furthermore, we show that the NFPMs developed in a big data context do not necessarily provide local-level managers with information of perceived relevance. These measures may therefore fail to mobilize managerial action despite the high level of attention corporate management pays to them.

Originality/value—The study makes two contributions. First, we contribute by building a typology of NFPMs. Second, we extend the literature on big data and accounting by showing that while big data promises to add relevance through more detailed information, we advocate for rethinking the production of NFPMs in a big data context and the ability of NFPMs to mobilize action.

Keywords: Big data, big data context, non-financial performance measure, case study

1. Introduction

The rise of big data is reshaping the functioning of contemporary organizations. In the accounting literature, researchers have frequently suggested that big data will allow for the production of more relevant information and positively influence management accounting by providing access to externally generated, highly detailed data (Al-Htaybat and von Alberti-Alhtaybat, 2017; Arnaboldi et al., 2017a; Bhimani, 2020; Bhimani and Willcocks, 2014; Viale et al., 2017; Warren et al., 2015). In this study, we engage with this emerging stream of literature by examining how reliance on big data might change the production of accounting information. More specifically, we focus on big data's influence on performance measures (PMs).

While the influx of big data provides organizations with a range of opportunities, new complexities and entanglements in the production of information also arise (Quattrone, 2016), as big data typically lacks a verifiable link to financial transactions (Bhimani and Willcocks, 2014). Thus far, considerations on the relationship between big data and accounting have been mainly conceptual. Admittedly, Arnaboldi et al. (2017a) investigate the influence of social-media data on the construction of new indicators. Their study, which casts empirical light on how big data may influence the production of PMs, does so by focusing on the role of actors in the production process. However, this is still a nascent area of investigation, and a more qualified understanding of the relationship between big data and the role and nature of PMs is needed. Notably, this topic has received more attention outside the field of accounting (Arnaboldi et al., 2017b) despite the centrality of PMs in the accounting literature.

From the extant literature, we know that technologically driven organizational transitions may engender the development of new PMs (Catasús and Gröjer, 2006; Mouritsen, 1998; Vaivio, 1999a). Once produced, PMs provide maps of reality that contemporary organizations use to navigate (Kaplan and Norton, 1996). Given the material roles of PMs as guidance for the organization's direction and as a signal of desired action, surprisingly little attention has been devoted to understanding how the increased reliance on big data has shaped PMs and, thus, the direction of contemporary organizations. In line with calls in the extant research (Arnaboldi et al., 2017a; Viale et al., 2017), we argue that this issue warrants greater attention among accounting scholars in an era in which big data is becoming central to organizational functioning.

In this paper, we introduce the concept of a “big data context.” By providing access to new forms of data that are more voluminous, externally generated, and accessible in real time, big data represents a technological advancement that we expect to change accounting information. Moreover, the big data context encompasses broader organizational issues that can reconstitute organizational dependencies and affect important modes of organizational reality. Prior literature on big data in accounting has demonstrated that this context raises new questions related to issues such as the boundaries of accounting, the nature of the information produced, and the competencies needed (Appelbaum et al., 2017; Arnaboldi et al., 2017a; Arnaboldi et al., 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015). Given this background, it is theoretically important to extend our knowledge of how big data may change accounting information in contemporary organizations. Therefore, we ask:

How do performance measures change in a big data context and what are the implications for mobilizing action?

As we engage with the identified gap in the literature and seek to theoretically understand how big data influences accounting information, we focus on how big data changes the production of accounting information. In examining our research question, we subscribe to the “production of information” perspective that is gaining foothold in the literature on accounting information (Agostino et al., 2021; Graham, 2008; Knorr Cetina, 2010; Macintosh et al., 2000; Vollmer, 2007, 2019).

To examine how big data may change the production of accounting information and PMs, we undertake a case study in a large organization with roots in the media industry. A qualitative approach was well-suited for obtaining novel insights into this emerging area. By investigating the introduction of a new “data strategy” that entailed increased reliance on big data in the case organization, this paper seeks to help remedy the empirical deficit in studies on the relationship between big data and accounting.

The study makes two contributions. First, our findings contribute to the literature on non-financial performance measures (NFPMs) (Burfitt et al., 2020; Catasús and Gröjer, 2006; Catasús et al., 2007; Mouritsen, 1998, 2004; Vaivio, 1999a, 1999b, 2004, 2006) by introducing a typology of NFPMs that includes new categories that emerge in a big data context. We thereby

explain how NFPMs developed in a big data context differ from traditional NFPMs.²⁰ Specifically, we suggest that one particular category of these new measures is characterized by *weak links* to the financial domain but relies on *strong assumptions*.

Second, we contribute to the emerging literature on big data in management accounting (Appelbaum et al., 2017; Arnaboldi et al., 2017a, 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015) by problematizing the relationship between information produced in a big data context and control practices. Borrowing from studies within the critical big data literature (Bates et al., 2016; Iliadis and Russo, 2016; Saifer and Dacin, 2021; Schwarzkopf, 2020), we question some of the hopeful underpinnings surrounding the discourse on big data by critically discussing how accounting information produced in a big data context faces challenges in mobilizing action and in ensuring perceived relevance among local-level managers.

The remainder of the paper proceeds as follows. In section 2, we present our theoretical foundations. We first review the literature on big data in accounting and conceptualize a big data context. Thereafter, we describe the literature on NFPMs before we introduce our theoretical lens on the production of accounting information. In section 3, we outline our research methods. Section 4 provides an overview of our empirical findings in which we undertake an empirical analysis highlighting the production of accounting information in a big data context. Lastly, in section 5, we discuss our findings before we present our concluding remarks and suggestions for future research.

2. Theoretical foundation

Our in-depth case study of a company anonymized as MediaCorp aims to provide an understanding of how reliance on big data influences the production of accounting information. Specifically, we focus on the emergence of NFPMs. To account for these issues, we first review the key literature on big data in accounting to understand what a big data context is. We then consider the extant literature on NFPMs in order to crystallize important features of non-financial information. Finally, we present a “production of information” perspective as the theoretical lens for analyzing our findings.

²⁰ We use the term “traditional NFPMs” to refer to those NFPMs developed in the wake of the relevance lost debate that are now considered usual or typical. Examples of such NFPMs are customer satisfaction, defection rates, product and process innovation, and intellectual capital (DeBusk et al., 2003).

2.1. Big data context

The extant accounting literature has repeatedly demonstrated the need to understand the context in which accounting is produced in order to understand how it is used (Burchell et al., 1985; Flamholtz, 1983; Hopwood, 1983; Langfield-Smith, 1997). Rather than tacitly complying with the “black box” view of organizations, accounting scholars have emphasized the need to unpack and understand the contexts in which accounting operates. This shift has led to more nuanced accounts of how accounting information is produced and why accounting is used for different purposes. In short, the fact that accounting cannot stand in isolation from its context has been recognized (Hopwood, 1983; Walker, 2016). Through context-sensitive studies, technology has been shown to be among the most influential factors shaping the nature and boundaries of accounting (Hopwood, 1983).

In the accounting literature, a number of studies have emphasized the need to better understand the impact of big data on accounting practices (Appelbaum et al., 2017; Arnaboldi et al., 2017a, 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015). Big data is often understood as data that is more complex than traditional accounting data due to its volume, velocity, variety, and veracity (Gandomi and Haider, 2015). As highlighted by Bhimani (2020), big data typically differs from traditional accounting information because it lacks a direct link to verifiable economic impact. Consequently, managers must deal with both traditional accounting data (both financial and non-financial) and big data (new types of non-financial data), which may be created for non-business purposes (Al-Htaybat and von Alberti-Alhtaybat, 2017; Warren et al., 2015).

In this regard, Bhimani and Willcocks (2014, p. 475) proclaim that “what comprises relevant information [...] has to be reconsidered.” They argue that big data requires a cognitive shift in how accountants analyze and communicate the information it produces. In short, big data is expected to change accounting by offering access to assemblages of data that render an alleged possibility to produce more holistic and relevant frames of the future. Thus, when big data is “integrated in the organizational context” (Al-Htaybat and von Alberti-Alhtaybat, 2017, p. 851) with the aim of producing relevant accounting information, we refer to such a context as a “big data context.”

Here, it seems sensible to subscribe to a wide understanding of the term “accounting information,” as big data has broadened the traditional understanding of this type of information (Bhimani and Willcocks, 2014). In examining the use of accounting information in a big data

context, we concur with Knorr Cetina's (2010) view that the paradigmatic divide between "data" and "information" is useful in theory but appears inadequate in practice. As such, empirical attempts to delineate between the two are likely to prove futile.

2.2. Literature review: non-financial performance measures (NFPMs)

In the mid- to late-1980s, the role and nature of PMs received renewed attention. A range of accounting scholars argued for the failings and obsolescence of existing PMs (Eiler et al., 1982; Kaplan, 1983, 1985; Kaplan and Johnson, 1987; Simmonds, 1981). In particular, the work of Kaplan and Johnson (1987, p. 1) sparked the "relevance lost" debate by claiming that conventional²¹ accounting information was "too late, too aggregated and too distorted to be relevant for managers' planning and control decisions." Essentially, the criticism focused on the historical nature of financial measures and suggested that such measures are merely "economic shadow[s] of activities" (Jönsson, 1992, p. 113) that provide a compressed layout of organizational reality. In other words, financial measures were said to reveal a great deal about organizations' past actions but nothing about their future alertness (Nørreklit, 2000). In addition, scholars highlighted that management accounting remained distant from local organizational contexts (Granlund and Lukka, 1998).

In the wake of the relevance lost debate, management accounting evolved to encompass more strategic approaches to the production of managerial information (Ittner et al., 2003). Consequently, several management-accounting innovations emerged in a stream of rather normative research.²² In the early 1990s, the balanced scorecard (BSC) (Kaplan and Norton, 2001, 1992, 1993; Kaplan and Norton, 1996); activity-based costing (ABC) (Cooper and Kaplan, 1992, 1991), known in the French context as the *Tableau de Bord* (Lebas, 1994, 1996); and total quality management (TQM) (Akao, 1991) were prominent innovations that were widely disseminated.

A common feature of these management-accounting innovations was the aim of aligning operational activities with long-term strategic goals (Chenhall, 2003; Ferreira and Otley, 2009; Kaplan and Norton, 1996; Langfield-Smith, 1997). To remedy the disconnect between day-to-day operations and strategic goals, many organizations adopted "forward-looking" NFPMs

²¹ In line with Moers (2006), we understand conventional accounting information as aggregate financial measures, such as the return on assets (ROA) and net income.

²² In the wake of these studies, a range of functionalistic studies followed that sought to quantify the relationship between NFPMs and financial performance (see Ittner and Larcker, 2009, for an overview).

based on the assumption that such measures pay more attention to causes than effects (Wiersma, 2008). Examples of NFPMs include measures of customer satisfaction, defection rates, product and process innovation, and intellectual capital (DeBusk et al., 2003). Rather than focusing sharply on short-term financial outcomes, measures like customer satisfaction or customer loyalty were assumed to have effects in the medium to long term (e.g., a three-month time lag; see Nørreklit, 2000).

The shift towards NFPMs was, in part, enabled by the introduction of more complex technological systems with enhanced processing capabilities²³ (Catasús and Gröjer, 2006), as they allowed for new levels of integrated PM. Similarly, we conjecture that the reliance on big data and digital technologies may support the production of new forms of NFPMs. In a big data context, challenges might arise in relating non-financial dimensions of performance to financial dimensions due to unclear connections between what is measured and its relevance for financial performance.

The extant literature on NFPMs also points to such challenges. In a research trilogy, Vaivio (1999b, 1999a, 2004) notes that there is no one way to couple non-financial information to financial information. Still, NFPMs tend to serve as complements to financial measures by making things visible that were previously not considered important. In the first of his three studies of LI-UK, a chemicals company, Vaivio (1999b) found that management's interest in producing measures offering more penetrating visibility into critical functions was a central motivator of the change in the company. Similarly, in a big data context, we might expect the production of new NFPMs that seek to bring details and nuances to the surface that were previously convoluted. Furthermore, Vaivio (1999b, p. 410) noted that NFPMs can “include more tangible dimensions of performance,” which can give rise to a “focus potential”—highly focused measures with strategic significance that probe operational mechanisms, and can connect managers and stimulate interactive processes.

Although significant technological process has been made, little attention has been devoted to understanding how reliance on big data may influence NFPMs and what these measures may represent in a digital age. Furthermore, Vaivio (2006) examines meetings as a “fluid” calculable space. His study shows how spaces that previously had escaped the accounting eye are made knowable. In more general terms, the findings illustrate how a rational mentality permeates the

²³ Although processing capabilities were enhanced, the data input was still based on small data sets relative to the data sets of today. In 2013, it was believed that 90% of the world's data had been generated only since 2010 (Al-Htaybat and von Alberti-Alhtaybat, 2017).

inner workings of contemporary organizations, as exemplified by the emergence of ad hoc NFPMs.

Vaivio (2006, p. 736) suggests that the introduction of ad hoc measures can be understood as an attempt “to govern even the minutiae of operational behavior” and, consequently, how “new forms of accounting seep into the detail of organizational life.” This echoes his finding from the third study in the LI-UK trilogy, in which he argues that NFPMs can “trace the very substance of [internal] everyday life” (Vaivio, 2004, p. 40), thereby creating space for grassroots insights to emerge. In our research setting of a big data context, these observations may gain renewed relevance, as digital technologies allow for recordings of customer behavior at highly granular levels. As such, we might expect information on the minutiae behavior of external actors to enter new forms of accounting in contemporary organizations. When new forms of information enter organizations, questions arise as to how organizations can integrate and account for that information.

Other studies have focused on NFPMs’ ability to mobilize action in organizations. Mouritsen (1998) compares financial PMs with non-financial PMs by contrasting the measure of Economic Value Added (EVA™) with measures of intellectual capital (IC) in order to capture how organizations encourage growth. For the purpose of our paper, the IC measure is more relevant due to its non-financial nature. Mouritsen’s (1998, p. 461) observation concerning the IC measure is that, in capacity of being a loosely coupled non-financial measure, it becomes strong “via stories and metaphors about the post-modern firm in the post-modern world.” The assumption underlying IC is that, in the post-modern world, wealth and growth come from applying internal information and knowledge. In this endeavor, strategy must be rooted in “hopes for a better future” (Mouritsen, 1998, p. 480). This insight seems relevant for studies of big data, as the discourse surrounding big data is filled with hopes and promises (Fourcade and Healy, 2017). Like Mouritsen’s (1998, 2004) comparison of financial and non-financial PMs, we aim to improve our understanding of how reliance on big data might change the production of NFPMs and how such NFPMs might differ from traditional NFPMs.

Catasús and Gröjer (2006) and Catasús et al. (2007) contribute to our understanding of how performance measures may (or may not) mobilize action. Catasús and Gröjer (2006) follow the production and subsequent evolution of IC indicators. Their findings advance our understanding of the ambitions of non-financial indicators. When the ambition is to mobilize action, they find that indicators should express something new out of the old. In that case, indicators benefit from being part of a broader political agenda. Catasús et al. (2007) critically

scrutinize the relationship between measures and managerial action by questioning the well-known adage “what gets measured gets managed.” Their study thus takes an interest in how “the age of measurability” (Catasús et al., 2007, p. 506) shapes organizational reality. Based on data from a survey of 109 managers, the authors argue that acts of producing measurements are not sufficient to fuel organizational action. Rather, measurements activate managerial action on existing organizational issues, especially if they are supported by a coherent story.

Lastly, the extant literature on NFPMs highlights the central role of actors and their forms of expertise. In the LI-UK study, Vaivio (1999a) traces how the organization creates a new calculable space by quantifying “The Customer.” This is an example of new economic citizenship (Miller and O’Leary, 1993), which motivates organizational changes that account for an increasingly individualized customer. In this process, Vaivio (1999a) observes how new technologies are mobilized in an attempt to account for “The Customer” within organizations. He suggests that an organization should be recognized as a “turbulent arena in which different knowledges are embedded” (Vaivio, 1999a, p. 690). His study finds that The Customer’s penetration into organizations consolidates professional expertise and that collisions often occur between rival areas of professional expertise.

In summarizing the extant literature on traditional NFPMs, we observe that these measures initially emerged in response to the relevance lost debate. Managers at tactical and strategic levels created new measures that were assumed to be relevant owing to their (loose) causal links to financial measures, which were expected to materialize in financial gains on a medium- to long-term basis. The new measures had both tangible (e.g., defection rates) and abstract²⁴ (e.g., IC) dimensions. Lastly, the emergence of new measures also built on the ambition of mobilizing managerial action.

2.3. Theoretical lens: a “production of information” perspective

This paper subscribes to the school of thought that understands accounting as a social and institutional practice (Hopwood and Miller, 1994). According to this view, accounting research should be attentive to the ways in which accounting influences and is influenced by the multiplicity of agents, institutions, and processes. Within these lines of inquiry, a “production—consumption” perspective is gaining a foothold in the literature on accounting information

²⁴ We use the term “abstract” to refer to measures that relate to something that is not a specific object, something that is disassociated from any tangible material, or something that may be difficult to understand. Arguably, measures of things or events in the digital realm are more “abstract” in this sense, as they are disassociated from the tangible.

(Agostino et al., 2021; Graaf and Johed, 2020; Graham, 2008; Knorr Cetina, 2010; Macintosh et al., 2000; Vollmer, 2007, 2019). In this paper, we seek to understand how PMs changes in a big data context. In the following, we present excerpts from the extent literature on production of information. Moreover, we highlight two important features of information production that aid in our analysis of how big data influences the production of PMs.

The first feature relates to the *nature of accounting information and measures*. Macintosh et al. (2000) report that notions of production (and consumption) of information were early adopted by Baudrillard (see Macintosh et al., 2000, for an overview). Macintosh et al. (2000) embrace the “production” view of accounting information and argue that this perspective has the potential to generate new accounting insights beyond those stemming from extant studies on information. Their central argument is that, in postmodern societies, accounting information has ceased to represent real (i.e., tangible) objects and events (e.g., the stock of oxen or the number of cars produced). The corollary of this point is that subjective inferences and actors’ embeddedness play important roles in the production of accounting information.

The second feature highlighted here concerns *framing*. Vollmer (2019) provides insights into the production of information by addressing the importance of framing. He notes that accounting information is not just “passed on” (akin to the “provision” of information) by an actor. Rather, an inevitable process of information framing is involved. In this process, the framing depends on the context in which the information is produced. As this process consists of producing information that might be interpreted differently by the consumer than intended by the producer, Vollmer (2007) notes that organizations would be well-advised to develop disciplinary architectures of information production. This means assuring organizational actors of the quality, relevance, and meaning of the circulated information.

In this paper, we are interested in how big data influences the production of information. Knorr Cetina (2010) argues that the notion of the “production” of accounting information reflects the fact that choices are made when information is “manufactured” rather than discovered and, subsequently, transferred from one actor (and context) to another. Vollmer (2019) notes that the mode of production of accounting information is contingent on the role of organizational members’ expertise, as the framing and interpretation of information is structured by such elements as institutional mechanisms and expertise (Graham, 2008; Vollmer, 2019). Moreover, postmodernist forms of information are often laden with background theory and assumptions.

Knorr Cetina (2010) demonstrates this point by analyzing “The Dow,”²⁵ an example of a measure that contains information with high levels of inherent complexity.

We thus highlight the nature of measures and framing as central features in the emerging “production of information” perspective. We endorse this perspective, which supports our analysis of the empirical material. By viewing the extant literature on non-financial information through the “production of information” perspective, we conceptualize the features of traditional NFPMs as shown in Table I.

| Traditional NFPMs (e.g., customer satisfaction) | |
|--|--|
| Nature of measure | |
| <i>Representation</i> | • Tangible/abstract |
| <i>Data input</i> | • Small data sets |
| <i>Time horizon</i> | • Medium- to long-term horizon |
| Framing | |
| <i>Actors</i> | • Tactical and strategic management |
| <i>Assumption</i> | • “Loose” cause-effect relations to financial outcomes ²⁶ |

Table I: Features of traditional NFPMs

²⁵ The Dow Jones Industrial Average is “a sum of component prices, those of thirty companies during a standard trading session, divided by a divisor, which adjusts so as to generate a consistent value for the index” (Knorr Cetina, 2010, p. 172).

²⁶ In actuality, some cause-effect relations are tighter (e.g., relations between “revenue mix” and “revenue”), while other cause-effects relations are looser (e.g., relations between “innovation level” and “revenue”) (see Nørreklit, 2000).

3. Methodology

3.1. Research design and case selection

We decided to use a case-study method to account for how big data might change the production of PMs. As this study involves processual and contextual understandings of real-life events, a case-study approach seemed well-suited for providing new insights (Yin, 2009). This methodological approach allowed us to record how various actors in the organization discussed increased reliance on big data and how that influenced the production of information in the organization.

In this case study, we chose a company anonymized as MediaCorp as our empirical setting. This decision was driven by three factors. First, the media industry has been undergoing a significant digital transformation throughout the last decade. The depth and the pace of this transition have been immense, as customers have fled from printed media to digital media (Hess and Constantiou, 2018). In this regard, the media industry attracted our attention as we studied changing accounting practices in the shift towards the digital sphere. Second, within this industry, MediaCorp has been a digital forerunner. This also seemed to be the case in relation to its reliance on data. In its 2019 annual report, which was titled “Building on the value of data and sustainability,” MediaCorp declared that “data [is] a core building block of our business model” (MediaCorp, 2019). As such, the organization spearheaded the shift towards increased reliance on data within its industry. MediaCorp can thus be understood as a critical case (Flyvbjerg, 2006) insofar as “judgements of [its] typicality can be justifiably made” (Giddens, 1984, p. 328). Third, we were interested in how reliance on customer data (rather than, e.g., sensor data) shaped the production of PMs. Although this type of data is expected to affect new PMs, research on this issue is mainly found outside the accounting literature (Arnaboldi et al., 2017b). Given our purposes, MediaCorp stood out owing to its ongoing processes of mobilizing insights from customer data.

3.2. Data collection

We gathered our primary empirical data by conducting semi-structured interviews. As the study includes exploratory elements, semi-structured interviews were appropriate because they allowed us to probe the answers of our interviewees. In other words, the interviewees were given the opportunity to “think aloud,” thus allowing for unexpected themes and rich explanations to emerge (Saunders et al., 2016).

In total, we conducted 25 interviews with 20 interviewees (see Appendix 1 for details). The interviews lasted an average of 50 minutes. Given the strict rules following the emergence of the Covid 19-pandemic, most interviews were conducted using the Microsoft Teams videoconferencing platform. The respondents were mainly identified through a snowball sampling procedure (Noy, 2008), although some were identified through personal contacts and direct inquiries on LinkedIn, a social networking site for business professionals. Our aim was to ensure breadth among interviewees in terms of background (i.e., in business or technology) and organizational level (i.e., global-level and local-level managers) because we expected professionals with both technical and business backgrounds to be involved in the production of accounting information in a big data context. Of the 25 interviews, 20 were audio recorded and subsequently manually transcribed. Careful notetaking took place during the five non-recorded interviews. Three of the non-recorded interviews focused on identifying new, potential interviewees. The remaining 22 interviews provided us with fruitful empirical material. In the initial interviews, we asked questions about organizational development, key roles, and whether the increased reliance on digital technologies and big data had contributed to the production of new forms of information in the preceding three to five years. After obtaining a rather coherent view of the organization, we narrowed our focus in the remaining interviews and probed issues like the rationales, assumptions, and consequences of new NFPMs.

In addition to our primary data, we analyzed annual reports from 2010 to 2020. Internal records can provide researchers with insights into issues of organizational significance and their prioritization (Garfinkel, 1967). By gathering information on key elements of organizational stories over a full decade, we obtained a valuable overview of the organization's development with regard to reliance on digital technologies and data. Moreover, we gained access to written, internal material, such as the "Data Strategy v.2" and "Beyond Budgeting in [MediaCorp]." The Data Strategy v.2 was a strategy report that explained the data strategy to MediaCorp's employees. It covered how the organization envisioned enabling "value creation from data in different parts of [MediaCorp]." Both researchers reflexively analyzed and discussed the primary and secondary data (Patton, 1980; Strauss and Corbin, 1998). We followed an abductive research approach (Lukka and Modell, 2010), which allowed us to iteratively move between empirical data collection and our theoretical foundations.

3.3. Data analysis

The presentation of our empirical material is structured by following a narrative approach (Czarniawska, 1999), which affords us to convey the richness of our findings from the 25 interviews. Critics of this approach may raise questions regarding the study's transferability, as they may view the narrative approach as mere storytelling (Jørgensen and Messner, 2010). However, "once a narrative is understood as a template it is potentially transferable across contexts and can be reinterpreted to become relevant to other settings" (Llewellyn, 1999, p. 225). As stressed by Flyvbjerg (2001) and Messner and Jørgensen (2010), general insights emerging from this study's narrative can only be transferable to comparable contexts if the empirical findings are profoundly theorized. In order to theorize our empirical data, we mobilize the literature on production of information, and the set of mechanisms highlighted in that literature.

Our data analysis is not free from limitations. The fact that we conducted our interviews via digital platforms (mainly Microsoft Teams) represents a limitation in relation to our analysis of the collected empirical material. In-person interviews are likely to yield richer data than digital conversations because the physical setting allows the researcher to read more non-verbal signs. In addition, in-person interviews often provide the researcher with an opportunity to obtain a better understanding of the case through off-record conversations, which is not the case with digital interviews. However, due to restrictions related to the Covid-19 pandemic, in-person interviews were not an option (with the exception of interview #2). Thus, within the pandemic context, digital interviews represented the best available option.

4. Empirical findings

In this section, we present our empirical findings. First, in section 4.1, we provide background information on our empirical setting (i.e., MediaCorp) and we trace how the increasing reliance on big data influenced the organization's development. In section 4.2, we present our findings on the role of big data in the production of accounting information. We focus specifically on the production of NFPMs developed in a big data context.

4.1. Background: From a print past to a digital future

Our empirical setting was MediaCorp, a large organization with roots in the newspaper industry. MediaCorp was founded in 1839 as a publishing house, but it later gained an

increasing presence in the newspaper industry. The company was family owned until 1992, when it was converted into a listed player on the stock exchange. In 1995, the company undertook its first investments in the Internet and new emerging technologies. In light of changes in the market driven by the emergence of new technologies, MediaCorp soon adopted a long-term, technology-oriented strategy.

In 2000, the organization launched its first online-classified media outlet.²⁷ This strategic decision represented a major shift for the organization and marked the initiation of a new phase in the organization's history. In 2018 and 2019, the organization introduced what it referred to as the "data strategy." According to the organization's 2019 annual report, MediaCorp viewed data as "the fundamental driver of growth, product development and value creation." It simply stated that its future success depended on its ability to collect, catalogue, and capitalize on data. In line with the new data strategy, MediaCorp was organized into three main divisions, each consisting of several brands. The current organization was tailored to the aim of enabling lateral data sharing across organizational units.

At the time of our study, MediaCorp was a diverse organization that employed more than 5,000 people in nine countries. It consisted of three main divisions: Market Places (MP), News Media (NM), and Next (N). Each division encompassed several brands, some of which had strong legacies and, concurrently, a strong standing within the organization. MP was the division in which online classifieds brands were located. Online classifieds brands are primarily online marketplaces in which private and professional actors can buy and sell products and services. NM hosted the various newspaper brands, while Next consisted of a portfolio of diverse online start-ups acquired by MediaCorp. The purpose of Next was both to diversify the organization's overall portfolio, and to ensure access to more and new types of customer data. In 2018, MediaCorp's international online marketplaces were spun off into a separate, listed company in which MediaCorp held the majority share. Lastly, a data-steering committee was established to facilitate and manage the implementation of the data strategy. Figure 1 covers MediaCorp's organizational structure. The arrows represent how MediaCorp aimed to mobilize lateral data sharing across organizational units.

²⁷ eBay is probably the best know example of an online marketplace. It is not a part of MediaCorp.

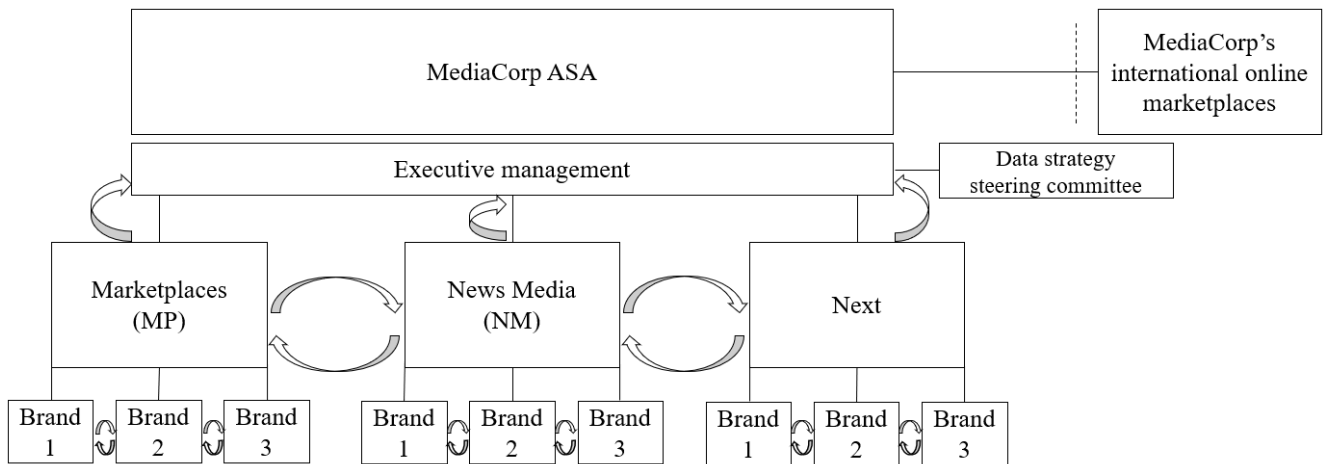


Figure 1: MediaCorp's organizational structure

Note: The arrows illustrate MediaCorp's aim of creating synergies through lateral data sharing across organizational levels.

In terms of financial PMs at the corporate level, MediaCorp traditionally relied on two main measures: year-on-year (YoY) revenue growth and the EBITDA margin. One respondent highlighted that, as MediaCorp was a listed player on the stock exchange, these two measures continued to attract executive management's attention. At the divisional level, there were differences between divisions. As the newspaper industry had been in a state of decline for some time, the EBITDA margin was more important than YoY revenue growth in NM. Conversely, YoY revenue growth was given more credence in MP, as MediaCorp still saw growth potential in this area. At the brand and division level, one business controller noted that, generally, there was a declining focus on costs. He explained that following a gradual shift towards the digital sphere, cost forecasts were simple because 90% of the costs were related to people (i.e., salaries).

In short, MediaCorp had developed from a print-based past to a digital future—a future in which big data was seen as a central factor in achieving continued growth. To that end, the organization introduced a data strategy with the aim of enabling data sharing across organizational units to produce new information and insights.

4.2. Production of PM in MediaCorp

4.2.1 Strategic NFPMs developed in a big data context: login rate and MBBs

In investigating the production of information in a big data context in MediaCorp, our starting point was the data strategy introduced in 2019. As noted above, the strategy aimed to enable data-based value creation in different parts of the organization. A data-strategy steering committee was appointed to lead the data strategy (see Figure 1). In this process, four new NFPMs were produced. However, in all interviews concerning those NFPMs, the interviewees consistently elaborated on only two of them: the “login rate” and the “percentage of brands with full MBB (mandatory building blocks) implementation completed” (see Figure 2). In the following, we elaborate on these two NFPMs.

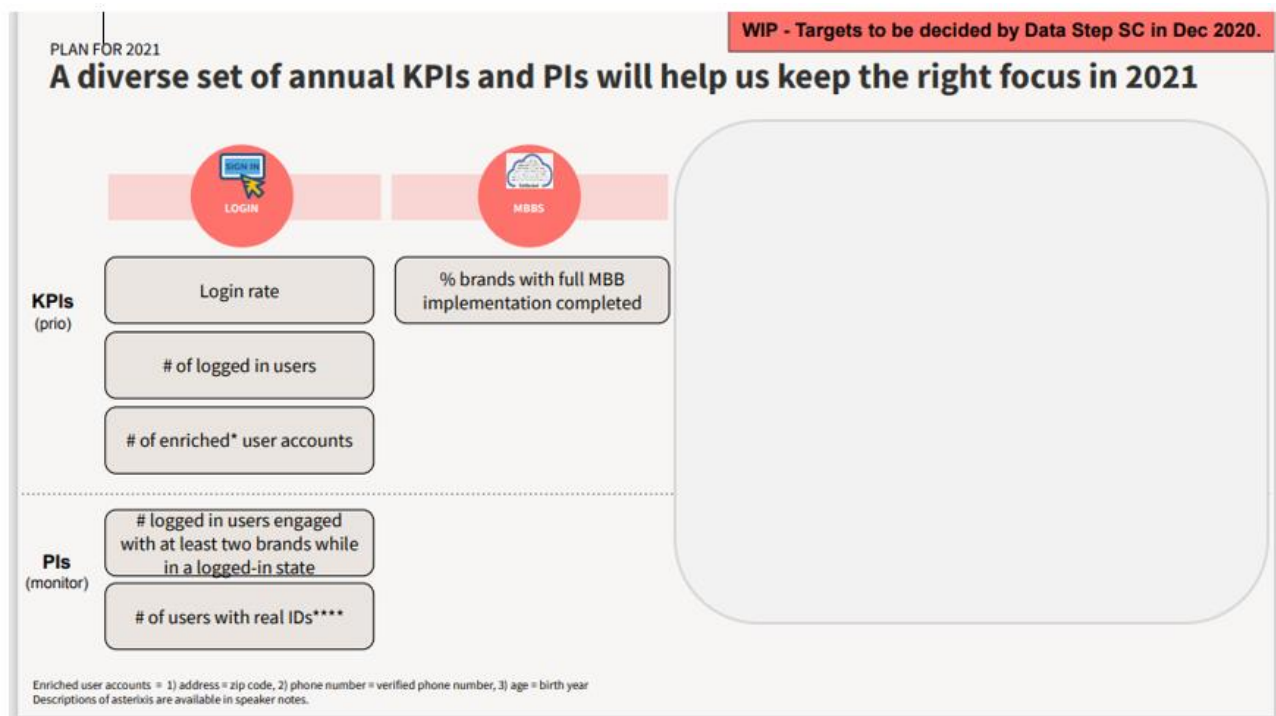


Figure 2: MediaCorp’s two most important PM for becoming data-driven: ‘Login rate’ and ‘Mandatory building blocks’ (MBBs). Excerpt from the Data Strategy v.2 document.

Login rate

The first NFPM MediaCorp produced owing to its reliance on big data was *login rate*. This NFPM was mentioned by a large proportion of our respondents as the most important strategic NFPM for MediaCorp in the big data context. “Login rate” referred to the share of users on MediaCorp’s various digital platforms who logged in with user credentials when using a MediaCorp service. Examples of users ranged from newspapers subscribers to users of the online classifieds brands in the MP division. In addition to login rate (i.e., the share of users logged in), MediaCorp tracked the absolute number of logged in users as well the number of “enriched user accounts.” The latter referred to logged-in users who had provided MediaCorp with detailed personal information, such as address, zip code, phone number, and age.

Initially, the main rationale for introducing the login rate as an NFPM was the emerging competition from global platform organizations, primarily Facebook and Google. In 2014 and 2015, the corporate management group decided to intensify the organization’s technological focus. One product manager explained:

We were too small on product and tech—we were not good enough. So we hired some great people, especially from Google and Facebook, and we thought “what is important now is data, it’s login, it’s platforms”. (#5—Product Manager, NM)

A product director further explained that logged-in users were essential for harvesting “sustainable data” because customer data gathered without consent would be of little value in the future:

We are moving in a direction where Google, Apple, and others are starting to make it harder to handle data. (...) In relation to sharing data with us, the customers’ trust will be essential. The first step towards sustainable data in the future is to get people to log in and provide consent. Five years ago, big data was about cookies. In a few years, I think cookies will be worthless. For example, Safari [the browser] deletes cookies after 24 hours. Therefore, I think user data without consent will be practically worthless in the future. (#14—Product Director 1, MP)

The director of analytics also referred to competition from Apple and Facebook in conjunction with changing privacy regulations as a rationale for introducing the login rate:

The technologically fierce competition in data collection is important. You have the “intelligent tracking prevention” [ITP] initiative from both Apple and Google, which limits other actors’ opportunities to advertise, all under the banner of privacy. Thus, we need to create our own ecosystem [in which people log in]. Google is not worried that cookies will become obsolete because it has its own ecosystem in which all users log in anyway. (#25—Director of Analytics, Corporate)

MediaCorp's changing business landscape created a novel reality amid the emergence of new competitors and fluxing regulations. Although it had primarily been a player in the newspaper industry (albeit with some prominent technology brands), MediaCorp increasingly came to view global tech companies like Facebook and Google as important competitors. As the quotes above suggest, these changes created a perceived pressure to hire a growing number of "technologists," such as data scientists and data analysts, trained to produce insights from big data. Higher login rates emerged as fundamental for providing technologists with quality input.

The development of the login rate NFPM and the MBBs NFPM was the result of a complex and laborious process involving many actors. The most central unit in this process was the steering committee for the new data strategy. The committee consisted of representatives from each of the three main divisions (see Figure 1), who were selected by the divisional CEOs. In addition, the data and tech unit had several representatives on the committee. The chief data and privacy officer and the corporate CTO completed the group. In short, a range of actors, primarily from strategic management, were involved in the production of the new NFPMs. The chief data and privacy officer explained that the new NFPMs initially failed to attract sufficient attention from divisional top managers. Consequently, the steering committee implemented an incentive scheme to underscore the importance of the new NFPMs, and the login rate in particular:

We realized that getting our users to log in was so important that we targeted that [NFPM] as the one on which to focus. Therefore, we have an SDI [Strategic Development Incentive]—an incentive scheme for divisional top managers in MediaCorp which ties data-related targets and the login rate to all leaders' [responsibilities]. Those who represent a brand have specific login targets for their brand as a part of their SDIs. Those who are not connected to a particular brand are tied to the overall MediaCorp target for login rate because we want to incentivize cooperation across the organization. (#22—Chief Data and Privacy Officer)

The implementation of the login rate demonstrates how the data strategy led MediaCorp to focus on new NFPMs, even at the top-management level. In practice, the login rate was monitored by corporate management using Tableau dashboards, which signaled the perceived importance of the login rate from corporate management's perspective. However, as the quote above demonstrates, the introduction of the login rate did not automatically mobilize managerial action at the divisional and brand levels. Consequently, corporate management tied incentives to this NFPM to ensure that all corporate units worked towards a common goal. However, there were signs of conflicting views about the importance of the login rate. When

asked about the rationale for developing and controlling the login rate, a director of insights responded:

I ask myself that question too. It is not something we work on in [brand name]. I think it [i.e., the brand-level login rate] has been on the same level—about 75%—for a while. We have no specific priorities to increase it. I have been a part of the product-management group for four years, and I cannot recall that we ever discussed the need to increase the login rate. (#24—Director of Insights, MP)

Top management expected its strong focus on increasing login rates and the introduction of incentive schemes linked to this NFPM to mobilize managerial action. However, in certain areas, the attention paid to the login rate remained virtually unchanged. Thus, even the introduction of monetary incentives tied to the login rate failed to mobilize action throughout the organization. Although corporate management put a lot of effort into and emphasis on the login rate, understanding the ways in which data and increased login rates would yield financial gains remained a challenge. The chief data and privacy officer stated that even though discussions of this issue had taken place, corporate management was certain that the value of data would materialize in indirect ways on a long-term basis:

What we see is that there are other dimensions [than the financial dimension] where data are important for us to succeed. Let me give you a specific example. One of our priorities is to work more effectively with subscribers. (...) We believe that using data to obtain insights about our users across our services - is completely necessary for us to succeed. In this example of using data in relation to subscribers, we cannot assign an exact financial value to the data as such. It is more *indirect* and derived from whether we succeed with subscribers. However, this has been an eternal discussion—the issue of assigning value to data. We ended up pausing that discussion, and we now say that we might see the value of data in dollars and cents in some cases. (...) If you look at the time dimension [of these new NFPMs], short term versus long term, it is not like we have a burning platform here and now. It is about preparing for the *years to come*. (#13—Chief Data and Privacy Officer)

This quote seems to suggest that the login rate and other data-related strategic NFPMs were characterized by relatively *weak links* to the financial realm. They appear to be characterized by an underlying belief that more (granular) data would result in increased profits. Moreover, this new NFPM was clearly a lead indicator given the assumption that the login rate was connected to profitability in a *long-term* perspective. In a follow-up interview, the primary researcher probed into the assumptions associated with the login rate. In this regard, the chief data and privacy officer was asked about the seemingly strong assumptions built into the login-rate measure and other new NFPMs:

Interviewer: These new KPIs seem to rest on quite a few assumptions, such as the assumption that a higher login rate in the long will somehow lead to higher profitability. Do you [MediaCorp] have a hypothesis that a given increase in login rate yields a given increase in profitability?

Interviewee: That's a good question. We have tried to calculate it, because it is a highly relevant question. However, what we see is that ... we get the number we want, so to speak. It is practically impossible to calculate it—it will always be a speculation about the future. I think the most accurate thing we can say is that, in our type of business, having data is a sort of “to be or not be.” It is so fundamental that there is no point in trying to make accurate calculations because you are simply not in the game without this kind of data. (#22—Chief Data and Privacy Officer)

Here, the interviewee stressed the belief that access to data, especially login data, was a “to be or not be” for MediaCorp. Hence, login data was assumed to represent an essential condition—a *sine qua non*—for MediaCorp’s future competitiveness. Moreover, the quote supports the notion that the NFPMs developed in a big data context are characterized by weak links to the financial realm, as the interviewee claimed that “it is practically impossible to calculate” the relationship between higher login rates and financial gains. In short, the NFPMs developed in a big data context seemed to build on *weak links but strong assumptions*. These strong assumptions might also have reflected the complexity of the login rate, which was associated with how an increase in login rate related to changes in financial terms. MediaCorp’s belief seemed to be grounded in correlational patterns and its approach to the production of NFPMs evidently did not rely on causal relationships.

A talent-acquisition partner responsible for targeting and hiring new talent for MediaCorp noted that hiring product developers and product managers was among the key concerns for the talent-acquisition group. Although this interview did not revolve around big data as such, the conversation pointed to some of the challenges highlighted in other interviews, including the challenge of moving from possible value creation to real value creation. This interviewee suggested that the move towards a digital business strategy carried an expectation of many opportunities, but that how MediaCorp would capitalize on those opportunities was still somewhat unclear. She reflected:

Interviewee: Our legacy is the newspaper business, but we have increasingly been moving towards Internet-based businesses and new types of revenue streams. We need people who can help us figure out how we can capitalize on that. (...). In terms of competence, we are looking for a range of product developers and product managers—people who can figure out how we can make money from [brand name]. We have more of those roles now.

Interviewer: When you say that you have more product developers now, does that have something to do with MediaCorp seeing the *possibilities* of new forms of revenue streams, while it does not know how to make money from them? Is that a fair assessment?

Interviewer: Yes, that is it. (#12— Talent Acquisition Manager)

Furthermore, we found tensions related to the deductive, top-down-driven production of new strategic NFPMs in general and the login rate in particular. A business controller reflected on the (lack) of relevance of the top-down-driven NFPMs for the local brands:

What you first and foremost need to know is “What are our key growth drivers?”/ That is the single most important thing you need to know. When we have this [deductive] approach, which starts from the top, then our unit is somewhat unable to steer the KPI production. Consequently, we have KPIs that ... I am not going to say that they are bad, because they are really not “bad.” (...) I mean that the login rate, customer engagement—those kinds of things – they’re very important. However, often, when you analyze things (...), you only see those KPIs and maybe not in combination with (...) other metrics that are more related to actual revenues. (#18—Business Controller, MP)

The sentiments highlighted above seem to suggest that the information produced needed to be better attuned to local needs. The login rate was an example of information production that catered to the needs of corporate management. As indicated in these quotes, local units seemed less concerned with increasing the login rate. As such, there was a discrepancy between corporate management’s view (the global view) and the brand- and divisional-level view (the local view). While traditional NFPMs were often produced with the aim of empowering decentralized managers through information flows (Mouritsen, 1999), the new NFPMs in MediaCorp seemed to supplant local issues and promote global ones through the adoption of a centralized focus. These issues were also apparent in relation to other strategic NFPMs, especially the NFPM known as “MBBs.”

MBBs

The MBBs NFPM referred to the *percentage of brands under the MediaCorp umbrella with full MBB implementation*. MBBs were “mandatory building blocks”—four data processes that corporate management wanted to standardize throughout the organization. First, MediaCorp was to be the controller of data in order to ensure that it had the legal right to use that data across the organization (referred to as “MediaCorp controller”). Second, the same identifier for a given user was to be used across brands and devices over time (“MediaCorp account”). Third, user behavior was to be consistently tracked within and across brands using a technical tool called “Pulse” (“common tracking”). Fourth, “common data warehouse” was to be used to provide a

foundation for accessing commonly defined data, which was to be user centric, relevant, and trustable.

The Data Strategy v. 2.0 document detailed that, from the perspective of corporate management and the steering committee, the aim of the MBBs was to “create the basic prerequisites to collect and enable use cases across the ecosystem in compliance with GDPR. The MBBs will also allow us to get to know our users better than the brands can do on their own - by establishing the prerequisites for one single customer view.” According to the data-collaboration manager, the process of adhering to the MBBs was enforced in all brands and divisions, regardless of the local managers’ opinions on the matter:

Some issues need to be forced through. In terms of the mandatory building blocks, MediaCorp [corporate management] said that “this is so important for MediaCorp as a whole” that it will force every brand across the organization to adhere to the MBBs, whether they want to or not. (#19—Data-collaboration Manager)

This quote demonstrates that MediaCorp forced through changes that it expected to serve the organization as whole. Technically, the MBBs concerned intra-organizational processes of standardization. In short, the data strategy was about generating enhanced customer insights by connecting data from the various brands across all three divisions. The corporate head of insights explained why the MBBs were important for producing information:

When you are talking about data for management-control purposes, the data needs to be robust. We all have to agree [on what the data says]. If no one trusts the numbers, nothing works. We first need to agree that “this is an apple and this is what an apple looks like” so that when people ask for an apple, they will get an apple. In other words, you need to harmonize a lot of processes. Does the way a page view looks in [brand Y] mean anything for [brand X]? No. Does it mean anything for MediaCorp as a whole? Yes, because these are the foundational building blocks. (...). Therefore, we need good technical solutions in order for data engineers and data analytics to do things. (#20—Head of Insights)

As this quote demonstrates, corporate management and the steering committee were aware that the introduction of MBBs could spark some tension at the local level. This proved to be a correct assessment. On the local level, the approach of introducing a “one size fits all” solution was not welcomed by all. One director of analytics did not share the belief that comparing apples to apples would provide value in its own right. He reflected:

I previously worked at the corporate level, where there is an overarching belief that as long as you can compare data across brands, then “voilà.” ... I do not have much faith in that. (...) For us [at the brand level], data availability is not the most important thing. For us, two other components are

far more important than the availability of data: ability and motivation. (#24—Director of Insights, MP)

In this quote, the director of insights provided technical arguments for why broad implementation of the MBBs would not necessarily create synergies. The assumption that collecting and standardizing data should provide synergies was also contested from a business perspective. Two business controllers reflected on this issue:

Many of our initiatives [such as the MBBs] go across the organization with the purpose of generating a kind of overall information ... standardizing how we collect and structure data. However, to interpret that information is something else, as there are not necessarily a lot of synergies to be gained from merging data from the subscription business with data from the advertisement business, and then making sense of that. (#10—Business Controller, NM)

The main challenge I guess, is that we all think that “we have all this data and we have KPIs in place.” That information goes through a long trail—from raw data to data to data sources to reports—before it ultimately becomes a constituent in a KPI. At the end [of that process], we need to (...) look at this holistically [in order to make sense of it locally]. That can be a real challenge in my opinion. (#18—Business Controller, MP)

The aim of the data strategy was to create synergies by constructing a “single customer view” or, in other words, a “true” representation of a given customer by collecting information about customer behavior across the whole organization (as illustrated in Figure 1). The business controllers quoted above seemed to question the relevance of such standardized information for local brands.

The complexity of the implementation process of MBBs was aggravated by MediaCorp’s organizational roots. Historically, MediaCorp had remained rather passive and anonymous in its role as a parent company. However, some of the local brands were highly visible and enjoyed strong legacies. As a consequence, employees’ identities were situated at the local brand level rather than at the global corporate level. A finance director explained the discrepancy between the global corporate perspective and the local brand perspective:

Previously, all of the data harvested by [brand X] was only available to that brand, all of the data harvested by [brand Y] was only available to [brand Y], and so on. The fact that the data was not aggregated was disastrous [for MediaCorp] – mildly put (...). However, [brand Y] might feel like they have been assigned a big burden [of standardizing data capture]. What they see is that “now we must take on this burden, but we might only get a small payback.” (...) You can imagine the dynamics. You are supposed to be loyal to these legacy politics and, at the same adhere to numerous other policies. (#2—Finance Director, NM)

In our general conversation with the finance director in NM, we had the impression that it was not only the local-global issue that made the process of implementing new NFPs both complex and laborious. When we probed into the production of information at the brand level contradictory modes of professional expertise seemed to drive accountants (in a wide sense) and technologists to perceive things differently. In essence, the accountants were frustrated because technologists sometimes lacked an understanding of what was needed to realize real value creation:

In terms of the technological side, I feel the technologists need to increase their understanding of business: What are our goals? Why do we do what we do? What easily can happen is that our technologists (...) often only see issues in isolation and they may lack an understanding of the direction in which we are heading. (#15—Product Director 2, MP)

A product manager questioned whether the technologists in his department understood how he brought value to the organization. In other words, he questioned the existence of a reciprocal understanding between the business domain and the technical domain.

The two product directors ascribed the lack of understanding between the technological domain and the business domain to insufficient mutual domain knowledge and communication issues. The latter took the form of speaking different professional languages, framing issues in conflicting ways, and having different approaches to valuing certain aspects. In a big data context, where the physical world is increasingly being replaced with digital representations of objects and events, the production of relevant accounting information was a challenge in MediaCorp. As seen above, unclear connections between the information produced and the financial realm created some tensions and uncertainty. Differences in professional expertise seemed to aggravate perceived differences in settings characterized by unclear connections. For example, while technical skills were a prerequisite for extracting information from complex data sets, a director of insights reflected on how traditional business acumen was missing among technologists in relation to producing value-adding information:

I think there is a lot of focus on business analysts with extreme technical skills ... but analysts often lack good old business judgement. In my experience, such business judgement—or at least having an interest in the business side of things—is important. The skills needed to connect databases are completely different. ... I think we have a slight overweight of such skills here. [The technical experts] are more introverted. They find their passion in solving the issue at hand. They are not too concerned with earning money or [producing information to] make good decisions. (#9—Director of Insights, MP)

Reflections from the two product managers and the director of insights and analytics seem to give credence to the view that the production of information entailed a framing process (Vollmer, 2019). Thus, when we summarize the production and implementation of the login rate and MBBs, certain complexities arose due not only due to organizational factors, such as local-global level tensions, but also factors related to the measures themselves. These new, non-financial strategic measures were, arguably, more abstract than traditional measures (i.e., a step further away from the tangible world and intuitive interpretations) and their assumptions regarding value creation seemed vague. Therefore, the extent to which organizational actors viewed these new NFPMs as important varied across organizational levels and types of professional expertise. In addition, how these measures should be enacted in the organization and, thereby, mobilize managerial action was somewhat unclear.

4.2.2 Operational NFPMs developed in a big data context

The login rate and the MBBs were non-financial, strategic PMs introduced to control the development of the data strategy, which revolved around becoming more reliant on data. In other words, MediaCorp managed big data through “small data” PMs. That is, the strategic PMs did not feed on big data input sources. However, while this data-driven approach materialized through the production of strategic-level NFPMs, new NFPMs also emerged at the operational level. MediaCorp introduced a range of new, big-data-related NFPMs, of which we present two examples: “conversion rate” and a specific “effect indicator.” There were a number of conversion rates, but one specific conversion rate was the “share of advertisements published that convert into transactions.” Figure 3 provides examples of conversion rates in one area of a local brand. For example, the conversion rate in week 43 was 0.6%, as 32 of 5,245 published advertisements converted into transactions.

| Week | Ads published | Acquisition (target = 40%) | | Funnel completion (target = 25%) | | p2p ads with SB (target = 10%) | |
|------|---------------|-------------------------------|-----------------|-------------------------------------|-----------------|-----------------------------------|--------------|
| | Number of ads | Contracts created | Aquisition rate | Completed funnel | Completion rate | Number of ads | Share of ads |
| 43 | 5,245 | 453 | 9% | 32 | 7% | 32 | 0.6% |
| 42 | 5,093 | 829 | 16% | 63 | 12% | 99 | 1.9% |
| 41 | 5,509 | 1053 | 19% | 83 | 11% | 120 | 2.2% |
| 40 | 5,097 | 1032 | 20% | 106 | 14% | 146 | 2.9% |
| 39 | 5,286 | 1199 | 23% | 131 | 15% | 176 | 3.3% |

Figure 3: Examples of advertisements to transactions conversion rate. Figure provided by MediaCorp.

As noted by a director of insights, these numbers were not necessarily big data in themselves. However, MediaCorp drew on highly granular customer behavior data to understand changes in the numbers in Figure 3. Therefore, we refer to this category of as “operational big data NFPMs.” When asked about examples of operational big data NFPMs, the director of analytics responded:

When you are in the business of product development, you have huge numbers of such measures because you are doing experiments. How many [customers] received treatment A or B [i.e., A/B testing, where group A is given a different treatment than control group B], and how did those treatments change the “conversion rate”? (...). We have detailed data on everything from user level to user behavior on a specific page view. (...). Another KPI is the “share of adverts posted within the last week that has generated seller-buyer interactions” [referred to as an “effect indicator”]. All effect indicators are small signals but in very large volumes. We have millions of ads and a range of such effect indicators, and there is traffic from millions of users every day on these ads. Hence, this is solid big data. (#25—Director of Analytics)

As shown in this quote, the operational NFPMs relied on vast amounts of granular customer data. In contrast, the data input for the strategic NFPMs was based on (relatively speaking) medium-sized data sets. However, the vast amounts of data that MediaCorp needed to handle in a big data context did not represent any major issues in itself. Another contrast with the new NFPMs was the time horizon. While, for example, the login rate was characterized by a long time horizon (i.e., years), the operational big data NFPMs was characterized by a much shorter time horizon (i.e., weeks). When discussing the role of managers at different organizational levels, the director of analytics commented:

Big data has been a part of our world for quite some time. What we need to work on and focus on is becoming more target oriented—getting every level to become target oriented. It is no longer only corporate management that should translate its plans and targets into KPIs—everyone should do that. I think this is a bigger challenge for us than merely coping with all the data. (#25—Director of Analytics)

This statement seems to suggest that the director of analytics considered the relationship between big data and measures (target oriented) was a more challenging and important issue than the technical aspect of coping with big data. Similarly, the director of insights also touched upon the notion of connecting the information produced through operational NFPMs to higher-level issues. He wanted his unit, which consisted of technologists, to produce more than descriptive analyses about a development at the operational or tactical level. In his view, there

was a need to lift the perspective and include analyses that aimed to not only describe but also explain the patterns and trends observed at the operational level. He reflected:

From my point of view, I think “How can we lift the perspective?” so that we do not just provide managers (...) with data and say “This is what the development looks like [e.g., in terms of conversion rates]” because, often, that is like ... so what? What does that tell [the strategic managers]? What can [they] do with that information? (#9—Director of Insights)

The impression we had from this conversation, which the director of insights also brought up in later interviews, was that although the aim was to drive locally produced information up to a centralized level, the insights got stuck on the (digital) operational floor. The director of insights also shared some thoughts on what he viewed as problematic as well as a potential remedy:

I do not believe in only looking at the data. There are those who believe in that approach—that if we only have the data in place, we can assign a data scientist to the task and he will produce gold from it. That is not the reality in my experience. You need to closely tie it to real business issues. That means you need to know the business issues and you need to know which data you have—or do not have—or can acquire. (...) I think that is essential. (#9—Director of Insights)

Mainly (technically proficient) operational managers and heads of analysis were involved in the production of operational big data NFPMs. However, as seen in the quote above, the production of rather descriptive information could be seen as futile in its own right. The information produced from big data needs to be closely tied to business issues, which requires the involvement of a broader range of actors—including those with business acumen, such as management accountants. A brand-level COO reported that technologists could wait for “the perfect data” to appear. However, he concluded that such an approach would not work in practice because data will, to some degree, always be subject to flaws:

You can say that you want enough quality to make data-driven decisions, but it is important that you do not become paralyzed. You need to make decisions all of the time. I think that is an important aspect. (...) It is important for the organization that this does not become a break but instead becomes a safety factor—something that gives you confidence in the decision. Do not let the [technologists’ drive towards optimization] get in the way of quickly making decisions. I actually think that is a very, very important aspect. (#16—Brand COO, MP).

The key notion highlighted by the director of insights and the brand COO was the need to involve a broader range of actors in the production of information based on big data at the operational level, especially actors with an understanding of how to connect insights with real business issues.

The implicit assumptions related to the big data NFPMs represent a stark contrast to the strategic-level NFPMs. While the strategic-level NFPMs were mainly driven by a belief that access to (login) data would determine future competitiveness, the impact of the operational-level NFPMs was measured statistically. By mobilizing big data, MediaCorp could test statistical significance through “A/B testing,” as alluded to by the director of analytics. In this statistical approach, the time horizon from a change in a variable to a potential change in the measure is significantly shorter for operational-level NFPMs than for strategic-level NFPMs. A brand COO added:

In terms of [measures] for product development and A/B testing, we can say that we may get answers from the statistics. We can see that “alternative A was, in fact, better than alternative B.” (#16—Brand COO, MP)

In this section, we have detailed the role of big data in the production of new accounting information in the form of two new NFPMs. At the strategic level, MediaCorp produced two measures—the login rate and MBB implementation. These measures were arguably more abstract than traditional PMs, as they moved away from tangible dimensions and they reflected the assumption that future value creation would materialize in highly indirect ways. The measures relied on aggregated data input from (relatively) small data sets. A range of actors were involved in the production of these measures, including the steering committee for the data strategy—a group consisting of several actors. Unlike traditional PMs, these NFPMs were not based on clear cause-effect relationships but rather on a belief in long-term effects in the direction they were produced to support. As such, these measures may be characterized by *weak links* to the financial domain *but strong assumptions*.

At the operational level, a range of new NFPMs was produced, exemplified by the conversion rate and the effect indicator. We demonstrated that these NFPMs could also be characterized by their abstract nature. However, the operational-level NFPMs drew on data from big data sets. They were mainly produced and controlled by operational managers and heads of analysis. Yet, there were voices in the organization that called for a closer relationship between insights produced through these measures and more strategic, business-oriented issues. In contrast to the strategic-level NFPMs, the new operational-level NFPMs were not characterized by belief and strong assumptions, but rather by statistically significant cause-effect relationships with short time horizons.

Table II summarizes our empirical findings and presents a typology with three categories of NFPMs based on their main features. The labels (“nature of measure” and “framing”) are informed by our theoretical lens.

| | Category 1 | Category 2 | Category 3 |
|---------------------------------------|---|---|--|
| | Traditional NFPMs: <i>a priori</i> links (e.g., customer satisfaction) | Strategic big data NFPMs: <i>a posteriori</i> links (e.g., login rate) | Operational big data NFPMs: <i>a posteriori</i> links (e.g., conversion rate) |
| Nature of measure²⁸ | | | |
| <i>Representation</i> | • Tangible/abstract | • Abstract | • Abstract |
| <i>Data input</i> | • Small sample size data sets | • Medium sample size data sets | • Big sample size data sets |
| <i>Time horizon</i> | • Medium time horizon (months) | • Long time horizon (years) | • Short time horizon (weeks) |
| Framing | | | |
| <i>Actors</i> | • Tactical and strategic management | • A range of actors, primarily from strategic management | • Operational management/heads of analysis |
| <i>Assumption</i> | • “Loose” cause-effect relations to financial outcomes | • Assumed to measure <i>sine qua non</i> conditions | • Statistically significant cause-effect relationships (e.g., through A/B testing) |

Table II: NFPMs typology

²⁸ The nature of measures is stated in relative terms. For example, in terms of the time horizon, even though some category 1 measures may have a 12-18 month (i.e., more than one year) time horizon, they are still characterized by a medium time horizon relative to category 2 measures. The same is true for the for data input sample sizes.

5. Concluding discussion

The MediaCorp case traces how reliance on big data has played a role in the production of new accounting information. Specifically, our empirical inquiry has focused on understanding how PMs change in a big data context and the related implications for mobilizing action. Based on our understanding of the big data context and NFPMs, our empirical analysis has identified new categories of NFPMs (see Table II). Furthermore, our findings respond to calls for more studies that consider how emerging non-financial measurements become embedded in management processes (Burfitt et al., 2020; Vaivio, 1999b).

Thus, this study makes two contributions. First, we develop a typology of NFPMs that systematically maps the various features of traditional NFPMs on the one hand and NFPMs developed in a big data context on the other. Hence, we extend the extant literature on NFPMs (Burfitt et al., 2020; Catasús and Gröjer, 2006; Catasús et al., 2007; Mouritsen, 1998, 2004; Vaivio, 1999b, 1999a, 2004, 2006) by developing an understanding of the anatomy of different categories of NFPMs and the role of big data in the development of new categories of measures.

Second, we contribute to the emerging literature on accounting and big data (Appelbaum et al., 2017; Arnaboldi et al., 2017a, 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015) by problematizing the relationship between accounting information in the form of NFPMs and the role of NFPMs in mobilizing action in a big data context. We show that when measures rely on weak links but strong assumptions, managers need to be aware that their attention to those measures might not be sufficient for mobilizing organizational action.

The conclusions drawn here, which are based on our interpretations of empirical events, are subject to the inherent limitations of a single, contextually situated study. Nevertheless, we strongly believe that the study is illustrative of the tendency of contemporary organizations to rely on the promises of big data. In the remainder of this section, we discuss and contrast the nature and framing of the three categories of NFPMs. We then link our findings to a critical discussion of how these measures may influence management-control practices.

5.1. NFPMs developed in a big data context—weak links but strong assumptions

Anchored in our empirical investigation of the production of accounting information in MediaCorp, this study provides a detailed account of how NFPMs can become embedded in management processes (Burfitt et al., 2020; Vaivio, 1999b) in a big data context. Based on the

identified differences between traditional NFPMs and the new categories of NFPMs that emerge in a big data context, we develop a typology of NFPMs.

The main difference between traditional NFPMs (category 1) and big data NFPMs (category 2 and 3) lies in the ideas underpinning the measures. Traditional NFPMs (category 1) are built on managerial preconceptions about how a measure is linked to strategy and, thereby, value creation and, ultimately, cash flow. In other word, the perceived links between the measure and a strategy leading to financial value creation are established *a priori*.

Using customer satisfaction as an example, this measure assumes that there is a rather direct relationship between customer satisfaction and profitability. To collect “relevant” information, managers must have an idea of the link between the measure and financial value creation before creating an indicator. As discussed in the extant literature on NFPMs, these links may be loose or strong (Kaplan and Norton, 1996; Nørreklit, 2000; Wiersma, 2008), but the point here is that managers must nevertheless establish their preconceptions about how a certain measure is linked to financial value creation before producing an indicator.

Moreover, as traditional NFPMs are typically assessed frequently, managers able to trace the relationship between the development in the NFPMs and the development in the relevant financial indicator. As such, any clear mismatch in the preconceived links between the NFPMs and financial value creation would presumably be discovered. In addition, there is an understanding that NFPMs are merely indicators and not perfect, objective measures. Therefore, they are continually reevaluated in order to attain NFPMs that align the strategy with operational activities in the best way possible.

In contrast, strategic NFPMs developed in a big data context (category 2) are built on another set of ideas and are, therefore, supportive of the argument that big data changes accounting (Warren et al., 2015). Such measures are not limited to managers’ preconceptions about the links between certain measures and financial value creation. Rather, strategic big data NFPMs are a different category of measures. In the MediaCorp case, strategic-level managers seemed convinced that having data was a *sine qua non*—data was believed to epitomize an essential condition of “to be or not to be.” However, the empirical material showed that top managers in MediaCorp did not have clear preconceptions about the link between the login rate and financial value creation. The login rate was important only in the sense that a higher login rate would provide MediaCorp with more detailed customer data. The links to financial value creation were expected to materialize *a posteriori* in uncertain ways. In other words, the strategy was simply

to collect data because there was an expectation that appropriating data in its own right would be the most important strategic action of today. These assumptions built on the belief that the data would eventually support future cash flows. Consequently, MediaCorp invested in gaining access to new competencies (e.g., more product developers and technologists) in order to find significant links between data and future cash flows.

A complicating factor in this regard is that such measures are based on very long time horizons, which constrains the analysis of the extent to which there is a relationship between an NFPMs and financial value creation. In short, strategic big data NFPMs are built on weak links but strong assumptions—the links between the measures and future cash flow are uncertain and are expected to materialize through a number of steps. For instance, when customers log in, they leave more detailed data about their current actions and preferences, which then provides MediaCorp with a more detailed (and possibly more relevant) picture of future preferences. Product developers, together with technically proficient professionals, are expected to analyze that data to determine which future products and services should be offered to yield an economic profit. In strategic NFPMs, a set of strong assumptions is related to the described process.

Finally, operational NFPMs developed in a big data context (category 3) differ from both category 1 and category 2 NFPMs. This category is not used for aligning strategy with operational activities today, although MediaCorp's operative managers argued that such an alignment would be preferable. In MediaCorp, this type of measure (e.g., conversion rate) was the only category built on big sample size data sets. What sets these measures apart from the other categories is the assumption inherent in them. Our empirical material showed that MediaCorp carried out statistical testing to assess how small changes to, for example, a web page layout might influence customer behavior that would affect a certain measure, such as the conversion rate. The category 3 measures were analyzed on a regular (weekly) basis, which enabled frequent analysis of the links between the measure and financial value creation. As such, this type of measure is the closest we can come to the scientific approach promised by big data (Iliadis and Russo, 2016), as it involves using statistical experiments to collect data about actual customer behavior.

5.2. The perceived relevance of NFPMs and the mobilization of managerial action

One of the main purposes of NFPMs is to mobilize action. Studies have shown that managerial action is more likely to be mobilized when NFPMs are tied to strategic/political agendas (Mouritsen, 2004) or when they are supported by a coherent story (Catasús et al., 2007). We

suggest that in a big data context, tying NFPMs to a certain agenda is not sufficient for mobilizing managerial action. In MediaCorp, the login rate was produced as part of the aim of becoming data driven. As such, it served corporate management's interest in generating penetrating visibility (Vaivio, 1999b) into what it saw as critical functions in a post-modern organizational reality. MediaCorp's corporate management thus built a coherent rationale and a powerful story for the implementation of the login rate.

There was a strong belief in MediaCorp that the organization's future competitiveness was completely dependent on data. The strategic agenda was geared towards keeping up with global technological giants like Facebook and Google, which perceived login data as the cornerstone of producing customer insights. Notwithstanding this coherent rationale, which most organizational actors seemed to accept, the introduction of the login rate PM initially failed to mobilize managerial action. The findings revealed that corporate management needed to tie login-rate performance to a monetary incentive scheme to mobilize action among divisional and brand managers. Why did the login rate fail to mobilize managerial action, when it was seemingly built on a coherent rationale and strategic agenda in which the employees believed?

In line with Vaivio (1999b, p. 410), the introduction of traditional NFPMs can "include more tangible dimensions of performance," which provide a "focus potential." However, instead of creating a focus potential as in Vaivio (1999b), this study proposes that the abstract nature and the weak links of the strategic NFPMs may create ambivalence and hesitancy. In another study of the production of accounting information, Jørgensen and Messner (2010, p. 202) show that "attention to accounting information is likely to be important in uncertain and ambiguous settings."

We further these insights by claiming that in a rather new and, therefore, uncertain context like the big data context, paying attention to accounting information (in the form of NFPMs) does not seem to be enough. In terms of mobilizing action, our study suggests that the ways in which accounting information is linked to financial value creation are just as important as paying attention to certain measures. For example, one business controller stated that the strategic NFPMs (category 2) did not contribute to an understanding of the "real key drivers of growth" and, thus, failed to provide a sense of relevance. Furthermore, the chief data and privacy officer noted that the strategic NFPMs were based on a belief in the overall strategic direction rather than factual links to financial performance.

We identified the same tendencies in relation to the MBBs. The aspiration was to connect local worlds through standardization and to enable a single customer view, thereby “making things work together, [...] traversing space and overcoming [heterogeneity]” (Mennicken, 2008, p. 384). This initiative was driven by a range of actors, although most of them were at the strategic-management level. Actors at the local level did not see how lateral data sharing could yield more relevant information or improve value creation because local issues needed local answers. At the local brand level, the implementation of the standards enforced through the MBBs meant incurring costs, while the financial upside potential was uncertain. In other words, the links between the measure and the financial domain were weak. Hence, this finding empirically demonstrates what Arnaboldi et al. (2017b, p. 767) view as the dark side of abstraction processes—“the move away from the local and particular that might be relevant for organizational action.” In the MediaCorp case, we suggest that the weak links but strong assumptions of the strategic NFPMs failed to provide a focus potential (Vaivio, 1999b) and, consequently, failed to mobilize managerial action. This finding indicates a strong belief in big data and what can be achieved by sticking to it.

In summary, our findings showed a strong belief in big data, which caused tensions between the local and the global levels related to whether the new NFPMs were viewed as relevant. More specifically, we found that managers at local levels did not discuss how they could increase the login rate and did not understand how it could be relevant for them. This indicates that global-level managers’ beliefs in evidence-based decisions in a big data context are based more on the belief that a measure is relevant and will signify value creation than on an objective truth. In fact, it can be argued that, in the MediaCorp case, the drive to eliminate vertical silos unintentionally contributed to the creation of horizontal ones. In other words, the aim of achieving lateral data sharing resulted in a partial disconnect between global-level and local-level managers.

The empirical material and our analysis allow for reflection on how big data can be used to create relevant management-accounting information. Schwarzkopf (2020, p. 198) argues that big data can lead to ignorance, which is related to both “knowledge not known” and “know[ing] too much” (i.e., the presence of many uncertain links makes it difficult to determine which data is relevant). Based on the findings in this study, we question whether NFPMs developed in a big data context have the propensity to generate relevance by collecting detailed big data about customer behavior or if following the dream of big data, in effect, produces too much information to generate the relevance and insights that contemporary organizations seek.

This study contributes to the stream of literature on big data and accounting (Appelbaum et al., 2017; Arnaboldi et al., 2017a, 2017b; Bhimani, 2020; Bhimani and Willcocks, 2014; Knudsen, 2020; Moll and Yigitbasioglu, 2019; Quattrone, 2016; Warren et al., 2015) by providing evidence that when NFPMs are introduced in a big data context, the relationship between what is represented and what is relevant is complicated. This seems like an important insight added to the extant literature, which follows a rationale that big data is a powerful and necessary vehicle for producing relevant information.

This rationale creates difficulties in terms of determining how the information produced should be interpreted and how it is relevant for business purposes. The new categories of NFPMs aim to create links between today's customer behavior and potential customers' future behavior. However, the weak links to financial value creation seem to contribute to a lack of managerial action. Consequently, we highlight the need to strike a balance in the production of NFPMs in a big data context. On the one hand, measures must be sufficiently linked to financial value creation in order to be perceived as relevant and, thus, mobilize action. On the other hand, they should not be built on a belief that they convey objective truths. Instead, they should leave sufficient room for debate to arise. For management-control practices, the number of a NFPM is not what is important. As Quattrone (2021, p. 4) contends, PMs are not oracles—instead, the numbers should help us ask the right questions and create doubt rather than certainty, as “doubt, not prophecies, creates the space for scrutiny.”

Future research may explore future trajectories of production and consumption of accounting information in organizations and critically discuss the consequences of conflicting trajectories. This study has emphasized the tensions between global- and local-level managers in the production of accounting information, and the related implications for mobilizing action. However, more knowledge is needed about actual decision-making processes in big data contexts. Therefore, accounting scholars could investigate not only what accounting information is produced but also what kind of information is consumed among top-level executives in actual decision-making settings. What is the role of NFPMs in such settings? Lastly, future studies could engage with the role of accountants in ensuring relevant filters in the production of information. Will the role of accountants be pushed into unfamiliar local arrangements that require an extension of their professional roles and expertise? We still have much to learn about how big data will affect accounting and accountants in contemporary organizations.

Appendix 1: List of respondents

| # | Title | Unit | Duration | Date | Recruitment method |
|------------------------|---------------------------------|----------------|---------------|----------|--------------------|
| #1 | Corporate executive | Corporate | 60 | 24.09.20 | Personal contact |
| #2 | Finance director | NM | 80 | 30.10.20 | Personal contact |
| #3 | Project manager | NM | 60 | 12.11.20 | Snowballing |
| #4 | Director of insights | MP | 60 | 26.11.20 | Snowballing |
| #5 | Product manager | NM | 55 | 30.11.20 | LinkedIn |
| #6 | Corporate executive | Corporate | 20 | 02.12.20 | Personal contact |
| #7 | Brand CFO (1) | MP | 40 | 04.12.20 | Snowballing |
| #8 | Finance manager | Corporate | 60 | 07.12.20 | LinkedIn |
| #9 | Director of insights | MP | 60 | 16.12.20 | Snowballing |
| #10 | Business controller | NM | 60 | 18.12.20 | LinkedIn |
| #11 | Brand CFO (2) | MP | 20 | 18.12.20 | Snowballing |
| #12 | Talent acquisition manager | Corporate | 50 | 21.12.20 | LinkedIn |
| #13 | Chief data and privacy officer | Corporate | 60 | 07.01.21 | Snowballing |
| #14 | Product director (1) | MP | 55 | 11.01.21 | Snowballing |
| #15 | Product director (2) | MP | 60 | 14.01.21 | Snowballing |
| #16 | Brand COO | MP | 45 | 15.01.21 | Snowballing |
| #17 | Business director | MP | 60 | 21.01.21 | Snowballing |
| #18 | Business controller | MP | 55 | 22.01.21 | Snowballing |
| #19 | Data-collaboration manager | Corporate | 70 | 27.01.21 | Snowballing |
| #20 | Head of insights | Corporate | 45 | 21.06.21 | Snowballing |
| #21 | Manager, enterprise performance | Corporate | 60 | 22.06.21 | Snowballing |
| #22 | CDO | Corporate | 25 | 22.06.21 | Snowballing |
| #23 | Corporate executive | Corporate | 25 | 24.06.21 | Personal contact |
| #24 | Director of insights | MP | 35 | 01.11.21 | Snowballing |
| #25 | Director of analytics | Corporate | 35 | 03.11.21 | Snowballing |
| | | | Avg.: | | |
| 20 interviewees | | 3 units | 50 min | | |

References

- Agostino, D., Saliterer, I., & Steccolini, I. (2021). Digitalization , accounting and accountability : A literature review and reflections on future research in public services. *Financial Accountability and Management*, (August 2020), 1–25.
<https://doi.org/10.1111/faam.12301>
- Akao, Y. (1991). *Hoshin Kanri: policy deployment for successful TQM*. Portland, OR: Productivity Press.
- Al-Htaybat, K., & von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing and Accountability Journal*, 30(4), 850–873. <https://doi.org/10.1108/AAAJ-07-2015-2139>
- Appelbaum, D., Kogan, A., Vasarhelyi, M., & Yan, Z. (2017). Impact of business analytics and enterprise systems on managerial accounting. *International Journal of Accounting Information Systems*, 25(March), 29–44. <https://doi.org/10.1016/j.accinf.2017.03.003>
- Arnaboldi, M., Azzone, G., & Sidorova, Y. (2017a). Governing social media: the emergence of hybridised boundary objects. *Accounting, Auditing and Accountability Journal*, 30(4), 821–849. <https://doi.org/10.1108/AAAJ-07-2015-2132>
- Arnaboldi, M., Busco, C., & Cuganesan, S. (2017b). Accounting, accountability, social media and big data: revolution or hype? *Accounting, Auditing and Accountability Journal*, 30(4), 762–776. <https://doi.org/10.1108/AAAJ-03-2017-2880>
- Bates, J., Lin, Y., & Goodale, P. (2016). Data journeys: Capturing the socio-material constitution of data objects and flows. *Big Data & Society*, (July-December), 1–12.
<https://doi.org/10.1177/2053951716654502>
- Bhimani, A. (2020). Digital data and management accounting : why we need to rethink research methods. *Journal of Management Control*, 31(1), 9–23.
<https://doi.org/10.1007/s00187-020-00295-z>
- Bhimani, A., & Willcocks, L. (2014). Digitisation, Big Data and the transformation of accounting information. *Accounting and Business Research*, 44(4), 469–490.
<https://doi.org/10.1080/00014788.2014.910051>
- Burchell, S., Hopwood, A. G., & Clubb, C. (1985). Accounting in its social context: Towards

- a history of value added in the United Kingdom. *Accounting, Organizations and Society*, 10(4), 381–413.
- Burfitt, B. A., Baxter, J., & Mouritsen, J. (2020). Separating and integrating non-financial and financial measures: a case study of a sporting organization playing the value-in-kind (VIK) game. *Accounting, Auditing and Accountability Journal*, 33(8), 1871–1907. <https://doi.org/10.1108/AAAJ-06-2018-3543>
- Catasús, B., & Gröjer, J.-E. (2006). Indicators: on visualizing, classifying and dramatizing. *Journal of Intellectual Capital*, 7(2), 187–203. <https://doi.org/10.1108/14691930610661854>
- Catasús, B. J., Ersson, S., Gröjer, J.-E., & Wallentin, F. Y. (2007). What gets measured gets. *Accounting, Auditing and Accountability Journal*, 20(4), 505–521. <https://doi.org/10.1108/09513570710762566>
- Chenhall, R. H. (2003). Management control systems design within its organizational context : findings from contingency-based research and directions for the future. *Accounting , Organizations and Society*, 28, 127–168.
- Cooper, R., & Kaplan, R. S. (1992). Activity-Based Systems : Measuring the Costs of Resource Usage. *Accounting Horizons*, (Sept), 1–13.
- Cooper, Robin, & Kaplan, R. S. (1991). Profit priorities from activity-based costing. *Harvard Business Review*, (May-June), 130–135.
- Czarniawska, B. (1999). *Writing Management: Organization Theory as a Literary Genre*. Oxford: Oxford University Press.
- DeBusk, G. K., Brown, R. M., & Killough, L. N. (2003). Components and relative weights in utilization of dashboard measurement systems like the Balanced Scorecard. *British Accounting Review*, 35, 215–231. [https://doi.org/10.1016/S0890-8389\(03\)00026-X](https://doi.org/10.1016/S0890-8389(03)00026-X)
- Eiler, R. G., Goletz, W. K., & Keegan, D. P. (1982). Is your cost accounting up to date? *Harvard*, (July-Aug), 131–140.
- Ferreira, A., & Otley, D. (2009). The design and use of performance management systems: An extended framework for analysis. *Management Accounting Research*, 20, 263–282. <https://doi.org/10.1016/j.mar.2009.07.003>

- Flamholtz, E. G. (1983). Accounting, budgeting and control systems in their organizational context: Theoretical and empirical perspectives. *Accounting, Organizations and Society*, 8(2/3), 153–169.
- Flyvbjerg, B. (2001). *Making Social Science Matter*. Cambridge, UK: Cambridge University Press.
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research, 219–245.
- Fourcade, M., & Healy, K. (2017). Seeing like a market. *Socio-Economic Review*, 15(1), 9–29. <https://doi.org/10.1093/ser/mww033>
- Gandomi, A., & Haider, M. (2015). International Journal of Information Management Beyond the hype : Big data concepts , methods , and analytics. *International Journal of Information Management*, 35(2), 137–144. <https://doi.org/10.1016/j.ijinfomgt.2014.10.007>
- Garfinkel, H. (1967). “Good” organizational reasons for “bad” clinic records. In *Studies in Ethnomethodology* (pp. 187–207). New Jersey: Prentice-Hall.
- Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Cambridge, UK: Polity Press.
- Graaf, J., & Johed, G. (2020). “Reverse brokering” and the consumption of accounting : A broker desk ethnography of an investment case*. *Accounting, Organizations and Society*, 85(Article 101154). <https://doi.org/10.1016/j.aos.2020.101154>
- Graham, C. (2008). Fearful asymmetry : The consumption of accounting signs in the Algoma Steel pension bailout. *AOS*, 33(7–8), 756–782. <https://doi.org/10.1016/j.aos.2008.01.001>
- Granlund, M., & Lukka, K. (1998). Towards increasing business orientation: Finnish management accountants in a changing cultural context. *Management Accounting Research*, (9), 185–211.
- Hess, T., & Constantiou, I. (2018). Introduction to the special issue on “Digitalization and the Media Industry.” *Electronic Markets*, 28(1), 77–78. <https://doi.org/10.1007/s12525-017-0282-1>
- Hopwood, A. (1983). On trying to study accounting in the contexts in which it operates. *Accounting, Organizations and Society*, 8(2/3), 287–305.

- Hopwood, A., & Miller, P. (1994). *Accounting as a social and institutional practice*. (A. Hopwood & P. Miller, Eds.). Cambridge: Cambridge University Press.
- Iliadis, A., & Russo, F. (2016). Critical data studies: An introduction. *Big Data & Society*, (July-December), 1–7. <https://doi.org/10.1177/2053951716674238>
- Ittner, C. D., Larcker, D. F., & Randall, T. (2003). Performance implications of strategic performance measurement in financial services firms. *Accounting, Organizations and Society*, 28, 715–741. [https://doi.org/10.1016/S0361-3682\(03\)00033-3](https://doi.org/10.1016/S0361-3682(03)00033-3)
- Ittner, C., & Larcker, D. F. (2009). Extending the Boundaries: Nonfinancial Performance Measures. *Handbook of Management Accounting Research*, 3, 1235–1251. [https://doi.org/10.1016/S1751-3243\(07\)03002-7](https://doi.org/10.1016/S1751-3243(07)03002-7)
- Jönsson, S. (1992). Action accounting for improvement: Research on local management. *Accounting, Management and Information Technologies*, 2(2), 99–115.
- Jørgensen, B., & Messner, M. (2010). Accounting and strategising : A case study from new product development. *Accounting, Organizations and Society*, 35(2), 184–204. <https://doi.org/10.1016/j.aos.2009.04.001>
- Kaplan, R.S., & Norton, D. . (2001). *The Strategic Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment*. Boston: Harvard Business School Press.
- Kaplan, Robert S. (1983). Measuring Manufacturing Performance : A New Challenge for Managerial Accounting Research. *The Accounting Review*, 58(4), 686–705.
- Kaplan, Robert S. (1985). Accounting lag: the obsolescence of cost accounting systems. In K. Clark, R. Hayes, & C. Lorenz (Eds.), *The Uneasy alliance: Managing the Productivity-Technology Dilemma* (pp. 195–226). Harvard Business School Press.
- Kaplan, Robert S., & Johnson, T. H. (1987). *Relevance Lost: The Rise and Fall of Management Accounting*. Boston, MA: Harvard Business School Press.
- Kaplan, Robert S., & Norton, D. P. (1992). The balanced scorecard—measures that drive performance. *Harvard Business Review*, (January-February), 71–79.
- Kaplan, Robert S., & Norton, D. P. (1993). Putting the Balanced Scorecard to Work. *Harvard*, 315–324. <https://doi.org/10.1016/B978-0-7506-7009-8.50023-9>

- Kaplan, Robert S, & Norton, D. P. (1996). Using the Balanced Scorecard as a Strategic Management System. *Harvard*, 74(1), 75–85.
- Knorr-Cetina, K. (2010). The Epistemics of Information: A consumption model. *Journal of Consumer Culture*, 10(2), 171–201. <https://doi.org/10.1177/1469540510366641>
- 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. <https://doi.org/10.1016/j.accinf.2019.100441>
- Langfield-smith, K. (1997). Management Control Systems and Strategy: A Critical Review. *Accounting, Organizations and Society*, 22(2), 207–232.
- Lebas, M. (1994). Managerial accounting in France Overview of past tradition and current practice. *European Accounting Review*, 3(3), 471–487. <https://doi.org/10.1080/09638189400000032>
- Lebas, M. (1996). Management accounting practice in France. In A. Bhimani (Ed.), *Management accounting, European perspectives* (pp. 74–99). Oxford: Oxford University Press.
- Llewellyn, S. (1999). Narratives in accounting and management research. *Accounting, Auditing and Accountability Journal*, 12(2), 220–236.
- Lukka, K., & Modell, S. (2010). Validation in interpretive management accounting research. *Accounting, Organizations and Society*, 35(4), 462–477. <https://doi.org/10.1016/j.aos.2009.10.004>
- Macintosh, N. B., Shearer, T., Thornton, D. B., & Welker, M. (2000). Accounting as simulacrum and hyperreality : perspectives on income and capital. *Accounting , Organizations and Society*, 25, 13–50.
- MediaCorp. (2019). *2019 annual report*.
- Mennicken, A. (2008). Connecting worlds : The translation of international auditing standards into post-Soviet audit practice. *Accounting , Organizations and Society*, 33, 384–414. <https://doi.org/10.1016/j.aos.2007.06.001>
- Miller, P., & O’Leary, T. (1993). Accounting expertise and the politics of the product: Economic citizenship and modes of corporate governance. *Accounting, Organizations*

- and Society*, 18(2–3), 187–206. [https://doi.org/10.1016/0361-3682\(93\)90033-3](https://doi.org/10.1016/0361-3682(93)90033-3)
- Moers, F. (2006). Performance Measure Properties and Delegation. *The Accounting Review*, 81(4), 897–924.
- Moll, J., & Yigitbasioglu, O. (2019). The role of internet-related technologies in shaping the work of accountants : New directions for accounting research. *The British Accounting Review*, 51, 1–22. <https://doi.org/10.1016/j.bar.2019.04.002>
- Mouritsen, J. (1998). Driving Growth: Economic Value Added Versus Intellectual Capital. *Management Accounting Research*, 9, 461–482. <https://doi.org/10.1006/mare.1998.0090>
- Mouritsen, J. (1999). The flexible firm: strategies for a subcontractor’s management control. *Accounting, Organizations and Society*, 24, 31–55.
- Mouritsen, J. (2004). Measuring and intervening : how do we theorise intellectual capital management ? *Journal of Intellectual Capital*, 5(2), 257–267. <https://doi.org/10.1108/14691930410533687>
- Nørreklit, H. (2000). The balance on the balanced scorecard — a critical analysis of some of its assumptions. *Management Accounting Research*, 11, 65–88.
- Noy, C. (2008). Sampling knowledge : the hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*, 11(4), 327–344. <https://doi.org/10.1080/13645570701401305>
- Patton, M. . (1980). *Qualitative Evaluation Methods*. Thousand Oaks, CA: SAGE Publications.
- 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>
- Quattrone, P. (2021). Seeking transparency makes one blind: how to rethink disclosure, account for nature and make corporations sustainable. *Accounting, Auditing and Accountability Journal*. <https://doi.org/10.1108/AAAJ-04-2021-5233>
- Saifer, A., & Dacin, M. T. (2021). Data and Organization Studies: Aesthetics, emotions, discourse and our everyday encounters with data. *Organization Studies*, 1–14. <https://doi.org/10.1177/01708406211006250>

- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research Methods for Business Students* (7th ed.). Harlow, England: Pearson Education Limited.
- Schwarzkopf, S. (2020). Sacred Exces : Organizational Ignorance in an Age of Toxic Data. *Organization Studies*, *41*(2), 197–217. <https://doi.org/10.1177/0170840618815527>
- Simmonds, K. (1981). Strategic management accounting. *Management Accounting*, *59*(4), 26–30.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage.
- Vaivio, J. (1999a). Examining “The Quantified Customer.” *Accounting, Organizations and Society*, *24*, 698–715.
- Vaivio, J. (1999b). Exploring a “non-financial” management accounting change. *Management Accounting Research*, *10*, 409–437.
- Vaivio, J. (2004). Mobilizing local knowledge with “Provocative” non-financial measures. *European Accounting Review*, *13*(1), 39–71. <https://doi.org/10.1080/0963818032000102971>
- Vaivio, J. (2006). The accounting of “The Meeting”: Examining calculability within a “Fluid” local space. *Accounting , Organizations and Society*, *31*, 735–762. <https://doi.org/10.1016/j.aos.2005.12.007>
- Viale, T., Gendron, Y., & Suddaby, R. (2017). From “mad men” to “math men.” *Accounting, Auditing & Accountability Journal* (Vol. 30). <https://doi.org/10.1108/AAAJ-12-2014-1887>
- Vollmer, H. (2007). How to do more with numbers* Elementary stakes, framing, keying, and the three-dimensional character of numerical signs. *Accounting , Organizations and Society*, *32*, 577–600. <https://doi.org/10.1016/j.aos.2006.10.001>
- Vollmer, H. (2019). Accounting for tacit coordination : The passing of accounts and the broader case for accounting theory. *Accounting, Organizations and Society*, *73*, 15–34. <https://doi.org/10.1016/j.aos.2018.06.003>
- Walker, S. P. (2016). Accounting , Organizations and Society Revisiting the roles of accounting in society. *Accounting, Organizations and Society*, *49*, 41–50.

<https://doi.org/10.1016/j.aos.2015.11.007>

Warren, J. D., 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>

Wiersma, E. (2008). An exploratory study of relative and incremental information content of two non-financial performance measures : Field study evidence on absence frequency and on-time delivery. *Accounting , Organizations and Society*, 33, 249–265. <https://doi.org/10.1016/j.aos.2006.12.004>

Yin, R. (2009). *Case Study Research: Design and Methods* (4th ed.). Thousand Oaks: SAGE Publications.