Forthcoming in: Martin Quinn and Erik Strauß (Eds.): The Routledge Companion to Accounting Information Systems, Routledge, 2018.

Chapter 13 Issues with Big Data

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Introduction

Digitalization and the comprehensive expansion and use of the internet cause exponential data growth, with total data volume, according to estimates, growing to approximately 100 zettabytes by 2022 (Brands, 2014; Fox and Do, 2013). Therefore, targeted use of appropriate technologies and methods will be necessary to gather, store and process this large amount of data, technologies and methods that are often termed Big Data (Davenport, 2014; Gänßlen and Losbichler, 2014). Both Manyika et al. (2011) and McAfee and Brynjolfsson (2012; Provost and Fawcett, 2013) describe Big Data as a kind of management revolution. With Big Data technologies, enterprises may be able to manage a large amount of data, provide more accurate forecasts and make better decisions (McAfee and Brynjolsson, 2012). Special features of Big Data include not only the real-time handling of immense, rapidly growing databases but also the processing of any data formats and different data structures that previously had to be collected and analysed separately (Brands, 2014; Gandomi and Haider, 2015).

Hence, Big Data may offer firms and other organizations various opportunities (Hashem et al., 2015). Especially in marketing, new analysis options arise when, for example, considering consumer behaviour and interacting with customers. Not only structured but also unstructured data (e.g., image, audio and text files) can be included in such analyses (Bhimani and Willcocks, 2014). In addition, analytics tools included in Big Data solutions enable firms to analyse data in real-time while in contact with customers. Thus, based on Big Data, firms are increasingly able to influence customer decisions during customer interactions (Gandomi and Haider, 2015). Besides the analysis of user data for marketing purposes, Big Data could also provide valuable information for other business functions. Among these, the usage of Big Data is also currently being discussed for management accounting, especially due to the generally close connection between information systems (IS) and management accounting. The close links between IS and management accounting are exemplified, for instance, by the frequent usage of ERP systems for management-accounting purposes and the crucial role played by management accountants as key users in the implementation and use of such systems (Granlund and Mouritsen, 2003; Gärtner and Duller, 2015). Not least for this reason, management accountants often have extensive experience handling large datasets. Just as from ERP systems, important information for management accountants can also be gained from Big Data. Accordingly, due to the ever-increasing amounts of data available, an almost inevitable

necessity arises to deal intensively with Big Data in management accounting, as in many aspects of enterprises more broadly (Chen et al., 2012).

Besides some opportunities, different challenges surrounding Big Data have also been explored in the literature. Davenport (2014), for example, argues that although the new and extended options for analysis may be innovative, challenges may also present themselves, such as the automation of management-accounting tasks (Frey and Osborne, 2013; Wimmes et al., 2015). Furthermore, the use of Big Data may not have solely positive effects on the determination and provision of management-accounting information; larger quantities of data do not necessarily lead to better decision making. In other words, the risk arises that the most relevant or correct information fails to be retrieved from existing data. Management accountants may thus pass on inferior information to top management (Quattrone, 2016). Since providing top management with information represents one of the main tasks of management accounting, Big Data currently poses one of the greatest challenges for management accounting.

This chapter therefore aims to discuss opportunities and challenges which arise through the use of Big Data for management accounting. The rest of this chapter is organized as follows. First, our underlying understanding of Big Data and management accounting will be clarified. The following section then focuses on opportunities for management accounting due to Big Data, after which possible challenges will be examined. The chapter concludes with a summary of the most important findings and potential avenues for further research on Big Data in management accounting.

Terminology

Big Data

Currently, the term Big Data is frequently used in corporate practice, as well as in scientific research. Nonetheless, the term is often interpreted quite differently. To date, the literature presents no uniformly recognized definition of Big Data. In fact, many different approaches to the description of the term Big Data may be found (Davenport, 2014; Ward and Barker, 2013).

At the same time, there seems to be some agreement in the literature that Big Data refers to a process featuring certain characteristics (Ward and Barker, 2013). When the term “Big Data” first emerged, Big Data meant both information management and information processing. Now, both of these processes are characterized by a growing volume of data, growing variety of data and increasing velocity of data generation (Fox and Do, 2013; Lin, 2014), what the Gartner Group calls the three Vs of Big Data (Lin, 2014):

- **Volume** is one of the most immediate challenges of Big Data. According to *McAfee and* Brynjolfsson (2012), more data crosses the internet every second than the total amount of data stored online 20 years ago. Thus, the volume of available data has increased and continues to increase exponentially, creating the need to provide sufficient storage for such huge amounts of data.

- **Velocity** refers to the speed of generating, processing and analysing data. According to IBM, an enormous 2.5 million terabytes of data are created daily. Therefore, firms have a growing need for real-time analytics in order to act agilely and stay competitive (Brands, 2014; Gandomi and Haider, 2015; Hashem et al., 2015; Lin, 2014).
- **Variety** concerns the heterogeneity of data type (Gandomi and Haider, 2015; Bendler et al., 2014; Hashem et al., 2015) that stems from the wide range of Big Data sources, such as sensors, the internet, mobile transactions, social media and global positioning system (GPS) signals. Those sources include various types of structured, semi-structured, unstructured (i.e., no defined format) and multi-structured data (Gandomi and Haider, 2015; Ishwarappa and Anuradha, 2015; Moffitt and Vasarhelyi; 2013). Only an estimated 5% of all existing data are stored in a structured format (Gandomi and Haider, 2015).

In addition to these three Vs, two additional Vs have recently been suggested as important aspects of Big Data (e.g., Ishwarappa and Anuradha, 2015), resulting in a description of Big Data through five Vs that comprise the abovementioned three plus "veracity" and "value":

- **Veracity** is another aspect of data that companies dealing with Big Data may encounter. Data accuracy depends on source, but data are rarely 100% correct. Data quality can suffer as a result of inconsistencies, incompleteness and ambiguities (Brands, 2014; Gandomi and Haider, 2015; Hashem et al., 2014; Ishwarappa and Anuradha, 2015). Thus, when dealing with Big Data, it is necessary to assess data veracity.
- **Value** is, for some authors, the most important aspect of Big Data (Hashem et al., 2015; Ishwarappa and Anuradha, 2015). In this regard, "value" refers to the process of discovering something useful from large datasets. Generally, since data may have high potential for usefulness, access to massive amounts of data may also seem helpful, but it can be challenging to distill valuable information from large datasets (Brands, 2014; Hashem et al., 2015; Ishwarappa and Anuradha, 2015).

Besides these five Vs, discussions have added additional dimensions to Big Data (Brands, 2014; Gandomi and Haider, 2015), such as variability, validity, venue or vocabulary. Notwithstanding the diversity of this theme, there seems to be broad agreement that the initially presented three Vs—volume, velocity and variety—are the core characteristics of Big Data. Moreover, it seems that the additional two Vs—value and veracity—have also been well established as characteristics that help decisively define Big Data. We will therefore use the following *definition of Big Data* for the remainder of this chapter, which combines Ward and Baker's (2013) survey of Big Data definitions with the above discussion of the five Vs:

> *Big Data refers to the generation, storage, processing, verification and analysis of large, highly versatile and quickly growing volumes of data with the objective of creating valuable information.*

Management accounting

Like the term "Big Data", the current literature presents no consistent definition of the term "management accounting" (Malmi and Brown, 2008). One similarity of many definitions, however, is that they centre around supporting managers' decision making by supplying information regarding corporate tasks, such as planning and controlling targets or evaluating performance (Edwards and Emmanuel, 1990). Management accounting thereby not only addresses internal target groups, such as managers, but also partially external target groups, such as banks or other stakeholders (Lavia Lopez and Hiebl, 2015).

According to Chenhall (2003), the terms "management accounting", "management-accounting systems", "managerial accounting", "management-control systems" and "organizational controls" are sometimes used synonymously. Malmi and Brown (2008), however, clarify that "management accounting" and "management control" can be distinguished based on their usage of underlying accounting information. While management control, they suggest, refers to "systems, rules, practices, values and other activities management put in place in order to direct employee behaviour" (Malmi and Brown, 2008, p. 290), they postulate that those accounting systems that "leave the use of those systems unmonitored" should be called not management control, but management accounting (Malmi and Brown, 2008, p. 290). In their view, therefore, management accounting refers to accounting systems that focus on supporting organizational decision making.

Similarly, other authors, such as Burns et al. (2013), also view the support of decision making as central to management accounting. In line with the above-discussed notions of management accounting (Edwards and Emmanuel, 1990), Burns et al. (2013) add that the provision of information is pivotal for management accounting to support decision making. For the rest of the paper, we use their definition, which suggests that *management accounting "is a professional practice that seeks to provide information to assist organizational managers in their decision making"* (Burns et al., 2013, p. 4). In our view, this definition covers the most important aspects of management accounting described in the literature (Edwards and Emmanuel, 1990), while at the same time not being so specific as to exclude many practices that are sometimes viewed as being part of management accounting.

Given the centrality of information to this definition of management accounting, the connections to Big Data are readily apparent: the provision of valuable information through Big Data seems paramount to management accounting. As supplying information for managerial decision-making is a vital feature of management accounting (Malmi and Brown, 2008; Burns et al., 2013), using Big Data for such purposes may also be valuable and—in today's business environment—even necessary.

Given these considerations, the coordination of exponentially growing data flows as well as the corresponding structuring of data can be understood as essential tasks in management accounting. In this connection, Big Data technologies can help management accountants to generate appropriate and usable information to support decision-making. Since both Big Data and management accounting aim for efficient data collection and analysis, the

opportunities and challenges surrounding the use of Big Data for management accounting will be discussed in more detail in the following sections.

Opportunities with Big Data for management accounting

We discuss the opportunities and challenges of Big Data for management accounting along three broad phases, following our definitions of both. The first two phases are *(1) data generation and storage* and *(2) data processing, verification and analysis*, in line with our definition of Big Data. Eventually, such data should be transformed into meaningful information and, in the context of management accounting as defined above, targeted primarily towards executives as receivers of information. The third broad phase in the following sections will thus be termed *(3) reporting and decision support*.

Data generation and storage

The need to handle increasing amounts of data can significantly change management accounting (LaValle et al., 2011). Although many companies generate large amounts of real-time-data, in most cases such companies base their decision-making on data that are orientated to the past and highly aggregated. However, it seems that in management accounting, future-orientated or real-time data will be increasingly necessary for management to make well-informed decisions (Manyika et al., 2011; Wrobel, 2012). Selective use of Big Data can take this challenge into account (cf. Table 1): by means of Big Data, a combination, or rather an integration, of traditional, structured databases—for instance, data from relational databases—with new, unstructured data—for instance, from social media—is made possible (Bhimani and Willcocks, 2014). Thus, data collected from new information channels, such as social media or mobile applications, may possibly be used in management accounting (Gänßler and Losbichler, 2014; Griesfelder, 2014; Wimmes et al., 2015). Such data may better enable management accountants to learn about and understand, as a few examples, customer relations, supplier relations or employees (Gray and Alles, 2015; Vasarhelyi et al., 2015). Moreover, thanks to machine learning, modern Big Data technologies are able to automatically gather such data without specific help from humans (Chen and Zhang, 2014; Wang and Alexander, 2016). If management accountants take this opportunity, this new type of data gathering can make available to top management a completely different and extended level of knowledge (Bhimani and Willcocks, 2014).

The possibilities of integrating different streams of data can also lead to cost savings (Davenport, 2014; Wrobel, 2012). Through the application of Big Data, not all data no longer must be stored in company-owned computer centres, as companies can increasingly make use of more cost-efficient technologies, such as cloud computing, to outsource the storage of less sensitive data to external servers. However, such outsourcing of data can entail new or additional risks for management accounting. For example, concerns may develop about data protection or later terminations of service contracts with specific cloud providers. Hence, the

above-mentioned opportunities must be realized with special care (Bhimani and Willcocks, 2014; Gärtner and Rockenschaub, 2015).

Phase	Opportunity	Selected references
Data generation and storage	Integration of new data channels, unstructured data (e.g., social media)	Bhimani and Willcocks (2014), Gray and Alles (2015), Manyika et al. (2011), Markham et al. (2015), Warren et al. (2015)
	Automatic generation of data	Gänßlen and Losbichler (2014), Griesfelder (2014)
	Cost savings	Davenport (2014), Gandomi and Haider (2015), Wrobel (2012)
	Increasing value of data	Bhimani and Willcocks (2014)
Data processing, verification and analysis	Time savings	Davenport (2014)
	Availability of data in real-time	Bhimani and Willcocks (2014), Hashem et al. (2015), Hurwitz et al. (2013), Manyika et al. (2011), Krahel and Titera (2015), Vasarhelyi et al. (2015), Wrobel (2012)
Reporting and decision support	Improved decision support for top management	Davenport (2014), Gandomi and Haider (2015), LaValle et al. (2011), Markham et al. (2015), McAfee and Brynjolfsson (2012), Warren et al. (2015), Wrobel (2012)
	Improved operational planning	Wimmes et al. (2015),
	Improved strategic planning	Davenport (2014)

Table 13.1: Opportunities with Big Data for management accounting

Another opportunity in data generation by means of Big Data lies in the increased value of data that are available much faster than before. For instance, in the retail sector, real-time data makes it possible to reduce costs in sales or logistics. For capturing such opportunities, Bhimani and Willcocks (2014) suggest that future management accountants be able to identify both the potential and the value of unstructured data in terms of their financial impact. Accordingly, in the future, internal reporting may also need to consider events that are unstructured but that significantly influence the value of the firm.

Data processing, verification and analysis

As shown in Table 1, one of the most significant opportunities Big Data presents is the availability of real-time data (e.g., Bhimani and Willcocks, 2014; Hashem et al., 2015; Hurwitz et al., 2013; Manyika et al., 2011; Krahel and Titera, 2015; Vasarhelyi et al., 2015; Wrobel, 2012). For example, recent developments mean that real-time data from RFID, GPS, internet applications and sensors can be included in management-accounting data analysis (Gänßlen and Losbichler, 2014). Compared to traditional methods of data analysis, Big Data analysis can be carried out faster, potentially even safer, and should ideally "*give the right insights, at the right time, based on the right data"* (Hurwitz et al., 2013, p. 15).

Big Data analyses are not only suitable for large enterprises, which often have separate IT departments and abundant resources. Small and medium-sized enterprises can also make use of attractively priced analytical tools (Bartram, 2013; Kristandl et al., 2015). Concerning suitable business sectors, too, there are hardly any limits for the use of Big Data, though some sectors may benefit more than others. For customer- or rather service-orientated sectors, such as financial services or IT services, the usage of up-to-date, real-time data seems especially powerful (Davenport, 2014; Wimmes et al., 2015).

According to Davenport (2014), time savings in data processing and analysis may also materialize due to Big Data technologies. He suggests that the availability of real-time data allows for faster analysis, sometimes even at the proverbial push of a button. Detailed analyses become less time-consuming, sometimes only taking a few minutes. They can thereby contribute to competitive advantage.

Through the use of Big Data analyses, consumers and markets can be segmented faster and more readily. For example, products or services can be better matched to user requirements (Manyika et al., 2011), including the individualization of interactions with potential customers (Provost and Fawcett, 2013). Each customer can thus be offered a service or product that is uniquely selected for him or her, a package which can be adjusted in real-time according to his or her choices (Gandomi and Haider, 2015). In this connection, in-memory applications—wherein analysis is completely performed in the working memory, thus ensuring fast processing—seem especially valuable (Chen and Zhang, 2014; Davenport, 2014; Gänßlen and Losbichler, 2014). By analysing data in real-time, management accountants can subsequently provide better decision support. As will be detailed below, a further issue for management accounting lies in the automation of data analysis and processing, which may be an opportunity and a challenge at the same time.

Reporting and decision support

As discussed above, supplying information to top management is one of the core tasks of management accountants. As illustrated in Table 1, previous research shows that apart from data gathering and data analysis, the integration of analytical methods by means of Big Data may lead to better decision support for top management (Davenport, 2014; Gandomi and Haider, 2014; Markham et al., 2015; McAfee and Brynjolfsson, 2012; LaValle et al., 2011; Warren et al., 2015; Wrobel, 2012). Thanks to the time-saving use of Big Data in data processing, verification and analysis, more management-accounting time may become available for the actual analysis of data. Accordingly, data interpretation and the recommendations for action derived from such analyses may gain in importance, which again can lead to better decision support for top management (Tretbar et al., 2013; Wimmes et al., 2015). In turn, increased resources of time available for decision support may lead to better decisions, thereby leading top management to trust management accounting functions more highly (Weber, 2013). For example, management accountants could increasingly integrate unstructured consumer data into their analyses. Such unstructured data, including large amounts of non-financial data and accounting for approximately 80% to 90% of all available data (Gray and Alles, 2015), could then be utilized to get a better understanding of customer relationships, make better cost estimations and set more accurate prices (Bhimani and Willcocks, 2014).

As making accurate forecasts with traditional methods becomes increasingly difficult because of market volatility, further significant opportunities with Big Data may be found in the field of operative planning and forecasting. Through Big Data solutions and the increasing processing power of contemporary computer hardware, a wide variety of scenarios can be simulated in real-time from large amounts of data. Moreover, the quality of such forecasts can be improved through new statistical forecasting methods, such as time-series analysis (Wimmes et al., 2015). The increased transparency of Big Data can also support strategic planning, as trends and risks can be detected and estimated faster due to the above-mentioned analytical velocity (Davenport, 2014; Gänßlen and Losbichler, 2014; Vasarhelyi et al., 2015). In competitive and market research, better decisions become possible, as trend and range analyses can be carried out in real-time and enterprises can get more accurate insights into their environments. Additionally, assumptions may be verified through real-time data, which accordingly facilitates decisions (Manyika et al., 2011). In turn, receivers of information, such as executives, may use tablets, smartphones or other mobile devices to view and illustrate data in real-time, independent of their specific locations (Gänßlen and Losbichler, 2014).

Challenges with Big Data for management accounting

Data generation and storage

Besides the opportunities considered above, the application of Big Data also entails some risks and respective challenges. The main difficulty in this regard often concerns the amount of possible data (cf. Table 2). Today, large, even seemingly unlimited amounts of data are available, so the selection of data samples, data filtering and the subsequent profitable usage of data present considerable challenges (Tan et al., 2015).

When management accountants are confronted with the task to identify relevant data from an almost infinite amount of data, dealing with Big Data can lead to "information overload" (Eppler and Mengis, 2004; Schick et al., 1990). Information overload generally arises from a "combination of more information and limited information processing capacities" (Schick et al., 1990, p. 199) and seems especially likely in the application of Big Data technologies, since the data are often available in real-time and large amounts of additional data are generated continuously. In order to avoid information overload, management accountants are thus required to pay particular attention to data quality, selecting only high-quality data for further processing (Bhimani and Willcocks, 2014). By contrast, undirected gathering of large amounts of data can lead to faster decisions, which however may not rely on those data that would be optimal for the situation. Quattrone (2016, p. 120) therefore fears that due to Big Data technologies, "people take wrong decisions much more quickly than before".

Closely connected to the general issue of information overload is the necessity to facilitate the appropriate veracity of relevant data—a crucial aspect of the definition of Big Data discussed above (Brands, 2014; Gandomi and Haider, 2015; Hashem et al., 2014). Hazen et al. (2014) therefore emphasize that a core challenge in the use of Big Data lies in the verification of the reasonableness, correctness, immediacy, completeness and format of the used data. Besides these issues, there is also the difficulty that the usage of Big Data—in management accounting as in many other fields—often fails due to a lack of qualified personnel (Davenport, 2014). This general lack of qualified personnel may also explain why many enterprises lack experts who can credibly explain to top management the opportunities presented by Big Data. In turn, this shortage of Big Data experts may also explain many top managers' present lack of acceptance of Big Data technologies. Put differently, this lack of top management support could be interpreted as a further challenge of Big Data in management accounting, one out of which further resistance from other employees might emerge. Such lack of top-management support can also lead to unnecessarily long times-to-implementation of Big Data technologies, especially when decisions are not made in real-time or are insufficiently delegated (King, 2013). Thus, management accountants—probably in collaboration with other potential users of Big Data—may need to push for managers' increased understanding of Big Data. This way, managers may avoid trying to use traditional ways of dealing with data in the context of Big Data—which is a frequent reason Big Data implementations fail in practice (Jacobs, 2009; Provost and Fawcett, 2013).

Phase	Challenge	Selected references
Data generation and storage	Large volumes of data	Bagnoli et al. (2012), Bhimani and Willcocks (2014), Gandomi and Haider (2015), Moffitt and Vasarhelyi (2013), Tan et al. (2015)
	Information overload and data veracity	Bhimani and Willcocks (2014), Quattrone (2016)
	Lack of resources (knowledge, qualified personnel)	Davenport (2014)
Data processing, verification and analysis	Necessity of new technologies for data analysis	Davenport (2014), Hashem et al. (2015)
	Loss of data sovereignty	Tretbar et al. (2013), Lin (2014), Weber (2013)
Reporting and decision support	Changing cost structures	Bhimani and Willcocks (2014)
	Making false decisions faster	Quattrone (2016)

Table 13.2: Challenges with Big Data for management accounting

Data processing, verification and analysis

Besides the changes in gathering data, further challenges may arise from the use of Big Data in data processing, verification and analysis (cf. Table 2). As indicated above, the processing and storage of exponentially increasing amounts of data is a challenge. When the volume of data grows faster than the performance of traditional databases, it seems impossible to analyse data at consistent levels of quality or accuracy. In the future, then, management accountants will probably have to attempt to draw correct conclusions from ever-larger amounts of data through intensive analysis (Wimmes et al., 2015). New technologies and methods are probably necessary for such analysis within the framework of Big Data, among which likely include, in addition to relational databases, NoSQL database systems and analytical databases (Martin, 2012; Hashem et al., 2015).

Traditional methods of data separation also reach their limits in Big Data due to huge data volumes and velocity. To cope with these challenges, a new technology called Hadoop has been established, backed by numerous technology providers (e.g., EMC, Intel, Hortonworks, Cloudera). The open-source software framework Hadoop allows the processing of Big Data to be performed on multiple servers in order to increase processing power. In this way, Hadoop offers a harmonized processing environment and high scalability to process complex volumes of data (Davenport, 2014; Hashem et al., 2015; Ishwarappa and Anuradha, 2015).

Automation of data analysis, indicated above as an opportunity, can simultaneously be a challenge for management accountants. Increased automation in data processing, verification and analysis raises the danger that top management may increasingly handle data analyses themselves (Weber, 2013), changing or even reducing the need for management-accounting positions. Management accountants could also lose their leading positions in terms of information analysis and supply to IT departments: as Big Data will require increasing IS support activities, IS experts may not only handle technology-related aspects of Big Data but may also be asked to deliver analyses of such data (Tretbar et al., 2013; Lin, 2014). At the same time, however, this challenge could also be interpreted as an opportunity, or rather a necessity, for management accountants, who could take these developments as an impetus to gain additional qualifications and skills in dealing with Big Data in order to avoid obsolescence in their respective organizations (Gänßlen and Losbichler, 2014).

Reporting and decision support

Despite the numerous opportunities Big Data offers for the decision support of top management, it should be noted that Big Data must be handled carefully. Big Data also confronts management accountants with new challenges in the decision support of executives (cf. Table 2). As Quattrone (2016, p. 120) argues, due to Big Data there may be "even less room for the exercise of wisdom beyond the increasing compliance that affects various realms of decision-making, from finance to risk management". In other words, it seems risky to place blind trust in the information gained through sophisticated Big Data technologies; there is still a need for human "wisdom" to critically question the relevance of the gathered data and information. Relatedly, such "wisdom" may also be needed when Big Data technologies draw on outdated data, or when the latest data are not available for any reason (Manyika et al., 2011).

Moreover, Big Data and the associated emerging business models may affect firms' cost structures and thereby also the applicability of traditional management-accounting practices. For instance, one typical assumption of the traditional management-accounting practice of functional costing or activity-based costing is that production volumes drive costs. However, business models based on data provision and drawing on Big Data technologies will likely be contingent on much different cost drivers and cost structures. Therefore, the applicability of traditional management-accounting techniques (e.g., activity-based costing, target costing, product lifecycle costing) may need review in an environment of Big Data and increased digitalization more generally. Such a re-think will also likely include the increased application of structured data in combination with unstructured data, which, as discussed above, is enabled by Big Data technologies (Bhimani and Willcocks, 2014).

Conclusions

Big Data can no longer be understood as a completely new trend; it is a current topic that also affects management accounting. For corporate management more generally and for particular

business functions, such as management accounting, Big Data offers many opportunities. These include, for example, the availability of real-time data or improved support for decision making. Besides highlighting such opportunities, this chapter has also shown some challenges for management accounting related to Big Data. For example, management accounting may need to cope with missing Big Data expertise or the possibility of making wrong decisions based on information retrieved from Big Data.

Regardless of the identified opportunities and challenges, management accounting probably faces considerable changes as a result of Big Data (Wimmes et al., 2015). As indicated above, many management accounting practices, such as activity-based costing, will likely change because of newly emerging business models and new possibilities for data gathering, data analysis and decision support (Bhimani and Willcocks, 2014). Because of the diversity and complexity of Big Data and its various opportunities and challenges, the true potential of Big Data for management accounting probably cannot yet be foreseen. At the same time, however, the demands for management accounting and management accountants will likely evolve alongside the increasing use of Big Data—for instance, with more IS knowledge becoming necessary in the field.

Despite the increased practical importance of Big Data for management accounting illustrated in this chapter, scientific research into how Big Data relates to management accounting remains in its infancy. In particular, scientific research published in high-quality research journals may hardly be found at present. There are, then, various open questions for further research. For instance, it would be interesting to examine how various management-accounting practices may change due to Big Data, how such practices can be adapted to new business models relying on Big Data and which practices are most suitable to appropriately process and communicate data generated by Big Data technologies. Furthermore, it would be relevant from both a scientific and a practical perspective to understand how management accountants meet the increasing demands for IS knowledge in the era of Big Data. It can be expected that Big Data, just as did past developments such as the increasing usage of ERP systems (e.g., Goretzki et al., 2013), will affect their role and responsibilities. In turn, it would also be exciting to investigate how much management accountants and Chief Financial Officers (CFOs) exert influence on decisions about and the implementation of Big Data technologies. Such influence can be expected as previous research has shown that—due to their frequent role as users of such systems—senior officials in finance and accounting are often quite influential in such IS investment decisions (e.g., Hiebl et al., 2017). Of course, this short list of future research needs cannot be regarded as exhaustive; it is meant to offer inspiration for future research. We believe that investigating these and other issues may help resolve some current open questions with Big Data in management accounting, thus allowing management accounting to reap the opportunities that Big Data holds.

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