Challenges in the Adoption of Business Intelligence and Analytics: A Case Study from the Perspective of Analytical Capabilities

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Abstract

In this study, we investigate analytical capabilities in the adoption of business intelligence and analytics. The research was carried out as a qualitative case study. The findings highlight challenges related to systems, management, and personnel capabilities. These include a lack of analytics goals, difficulties demonstrating the benefits, absence of concrete examples, gaps in communication and cooperation between the business units, as well as challenges in learning and executing analytics. We conclude by emphasizing the role of controllers and management accountants in identifying, managing, and controlling the challenges in the adoption of business intelligence and analytics. The results of this study are relevant also for managers who aim to develop analytical capabilities, and business intelligence and analytics in their organizations.

Keywords:

Business intelligence, Analytics, Analytical capabilities, Management control, Accounting, Digitalization

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1 Introduction

Organizations are becoming more reliant on data and digital technologies. Data and digitalization have become a source of competitiveness for companies (Wamba et al., 2017; Davenport & Harris, 2017). Digitalization has greatly also impacted the field of accounting by changing the way accounting information systems are designed and used (Granlund, 2011; Bhimani & Willcocks, 2014; Rikhardsson & Yigitbasioglu, 2018).

One of the main benefits of digitalization in accounting is that it allows for the automation of routine tasks, giving time for accounting professionals to focus on more strategic tasks, such as analyzing financial data and making decisions based on insights derived from that data (Franke & Hiebl, 2023). Business intelligence and analytics is one form of digitalization in accounting.

The basis of business intelligence and analytics is the transformation of data into information and then into concrete actions through decision making (Nielsen, 2018; Granlund et al., 2013). In prior literature, business intelligence has been characterized as delivering information to the right people at the right time (see, e.g., Popovič et al., 2012). It has also been argued to be one of the key drivers for developing a company's competitiveness and a thus key part of management accounting and control in contemporary organizations (see, e.g., Bhimani & Willcocks, 2014; Silvi et al., 2010). Digitalization enhances the possibilities for analysis, but it also requires analytical capabilities.

The adoption of accounting information systems is often challenging (see, e.g., Bodnar & Hopwood, 2013). Particularly in the adoption of business intelligence and analytics, new kinds of capabilities are needed (Gärtner & Hiebl, 2018). Unlike simply following a pre-programmed information system (like ERP), business intelligence and analytics requires the organization's analytical capabilities (systems–related capability, management capability, and personnel capability; see, e.g., Wamba et al. 2017) and especially applying these for performance.

According to prior literature, the users of business intelligence and analytics should have capabilities to understand business issues and provide analytical solutions, which include e.g. areas of accounting, finance, marketing, and operation management (Chen et al., 2012; Appelbaum et al., 2017). It is also the case that the need for analytical skills will become even more important for management accountants in the future (Nielsen, 2018). In addition, the adoption of business intelligence and analytics is typically led by business controllers but is not solely the task of the accounting function, but involves participants from several departments, functions, and processes (Schnegg & Möller, 2022).

Previous studies have reported the challenges in the adoption of business intelligence and analytics and several have also argued that organizations have failed or faced risks when attempting to derive the benefits of business intelligence and analytics. Stjeptic et al. (2021) identified the most important risks in business intelligence adoption, related to insufficient human, technical, and financial resources. Ain et al. (2019) categorized the challenges in business intelligence adoption into resistance to the use of business systems, a lack of motivation, a lack of knowledge, system issues, insufficient communication between IT staff and business users, a lack of timely response, and problems in reporting data. Appelbaum et al. (2017) argued that business analytic tools provide the ability to analyze various types of data but that it is a challenging task (see also Nielsen, 2015). Scholz et al. (2010) found that the main benefits relate to improvements in data support, decision support, and savings (e.g., costs and personnel) and that the challenges are mainly related to usage, IT solutions, and data quality and interfaces.

Hyvönen et al. (2022) argue that data analytics has the potential for financial forecasting, but organizations are facing challenges when transforming data analytics into action. They also call for more studies on the design and implementation of data analytics (referring also to business intelligence).

Since information is a central part of business intelligence and analytics, it is important to understand the organizational processes related to it (Elbashir et al., 2008; Shollo & Galliers, 2015). Business intelligence and analytics is not limited to the information systems used; people and organizational processes have an important role to play when data is transformed into information and then into decision making (Elbashir, 2021; Chapman & Kihn, 2009). If business intelligence and analytics is treated in an organization only as an IT solution, the results of the implementation may remain weak (Laursen & Thorlund, 2017). Prior studies have mainly focused on technology and system issues, while other related resources, such as expertise and analytical skills, have been largely neglected (see, e.g., Mikalef et al., 2021).

Challenges in analytical capabilities may likely exist as challenges in the adoption of business intelligence and analytics. By identifying challenges, it will be possible to ensure and control learning as well as the development of analytical capabilities in accordance with the goals, as well as prevent unfavorable outcomes (see also Ain et al., 2019). Investigating the challenges in organizations (lessons learned) can also be helpful for organizations to proactively mitigate risks in the adoption of business intelligence and analytics in the future (Ranjan et al., 2016). In addition, as accounting professionals play a key role in the development of business intelligence and analytics (Schnegg & Möller, 2022), understanding the maturity of analytical capabilities is important for them in managing and controlling organizations.

The previous literature includes many theoretical studies on business intelligence and analytics. For example, Davenport & Harris (2017) have presented their maturity model of analytics and categorized maturity levels. Rikhardsson & Yigitbasioglu (2018) have focused on theorizing the relationship between management accounting and business intelligence. Ain et al. (2019) have prepared a large systematic literature review on business intelligence and analytics. Lönnqvist & Pirttimäki (2006) present measures for the activity of business intelligence and analytics including capabilities of personnel's competencies and available information technology. We can say that more in-depth empirical studies in business intelligence and analytics is needed. Most of the previous studies have been conducted as survey studies (see, e.g., Stjeptic et al., 2021; Scholz et al., 2010).

In this study, we aim to examine analytical capabilities in business intelligence and analytics in more depth by using a case study approach. Our particular focus will be on the challenges in analytical capabilities. We will illustrate our findings using the model for analytical capabilities presented by Davenport & Harris (2017). In this way, our study aims to produce both theoretical and empirical observations and conclusions for the development of analytical capabilities in business intelligence and analytics.

The paper is structured as follows. In this section, we have introduced the field of our research topic. In Section 2, we provide an overview of business intelligence and analytics. In Section 3, we provide an overview of the research method. In Section 4, we present our findings, and finally, in Sections 5 and 6, we discuss our results and conclusions and suggest some future research options.

2 Analytical capabilities of business intelligence and analytics

Business intelligence can be defined as a systematic data management process the goal of which is to analyze relevant information for a company's decision makers (Peters et al., 2016; Nykänen et al., 2016). Business analytics is an extension of business intelligence. Laursen & Thorlund (2017) argued that business analytics can be described as a mathematical, statistical, and econometric study of business information and that the purpose of business analytics is to support strategic and operational decision making.

The combined concept of business intelligence and analytics (see, e.g., Rikhardsson & Yigitbasioglu, 2018) includes techniques, technologies, processes, systems, and applications the purpose of which is to analyze key business data and thus help a company better understand its business and support its decision making. Business intelligence and analytics also includes related business practices and methods (Chen et al., 2012), ranging from reporting and management methods for data to decision making (Davenport & Harris, 2017).

This study applies a definition of business intelligence and analytics that takes into account business, processes, and management. These issues play an important role when considering the competitive advantage obtained through business knowledge and the successful utilization of business intelligence and analytics in an organization (Elbashir et al., 2021; Wamba et al., 2017; Mikalef et al., 2021). Business intelligence and analytics offers an organization to create models and information from data (Elbashir et al., 2021). However, the data must first be collected from different sources, and then the data must be stored and made accessible (Peters et al., 2016). In addition, before business intelligence and analytics provides relevant information for decision making, an organization must have data and management processes and systems in place (Raffoni et al., 2018).

Integrated information systems provide the main database for information utilization (Granlund, 2011; Lepistö, 2014; Chapman & Kihn, 2009; Elbashir et al., 2021). However, the volume, velocity, and variety of a large amount of data in contemporary business contexts is challenging to store, process, and analyze using traditional methods, for example using only ERPs (Youssef & Mahama, 2021). Business intelligence and analytics is aimed to support analyzing that big data volume providing a deeper understanding of operations, customers, and markets, and preparing more informed data-driven decisions (Franke & Hiebl, 2023). Business intelligence and analytics and big data are closely intertwined. In this study, big data refers to a data source for business intelligence and analytics.

Business intelligence and analytics are typically cross-departmental operations, where controllers will have a leading role (Schnegg & Möller, 2017). Accounting professionals are typically between the technological and the business context, forming a bridge between these two, i.e. accountants and controllers are often expected to know both the company's business and the technologies used (see, e.g., Laursen, & Thorlund, 2017; Andreassen, 2020).

According to Davenport & Harris (2017), the issues related to an organization and its personnel are what ultimately differentiate it from others in terms of analytical capabilities. An organization needs competent people, such as business analysts and data scientists, to produce analytics (Shollo & Galliers, 2016). These people can be considered analytics professionals, but even more, organizations probably need so-called analytics amateurs. An increase in the extent to which decisions are made on the basis of analytics requires a concomitant increase in the need for organization members to understand analytics and its methods. Such analytical amateurs are employees who do not necessarily have a deep understanding of analytics but who

are able to produce and interpret analytics just as much as is necessary for their work (see, e.g., Franke & Hiebl, 2023; Barton & Court, 2012).

According to Wamba et al. (2017), business-oriented analytical capabilities consist of information systems–related capability, management capability, and personnel capability (see also Davenport & Harris, 2017; Laursen & Thorlund, 2017; Liu et al., 2013). Information systems–related capability refers to the applications, hardware, data, and networks; management capability refers to managing IT resources for business needs; and personnel capability refers to personnel's professional skills in analytics. Laursen & Thorlund (2017) state that the basis of analytical capability is that organizations must have the ability to turn the data into information, information into knowledge, and finally be able to analyze and interpret the information.

The literature differentiates also the dynamic and operational capability. Dynamic capability refers to the ability to develop new value-creating strategies (see e.g., Teece, 2007). Operational capability refers to the ability to execute and coordinate the various tasks resulting in firm performance (see e.g., Liu et al., 2013). Prior literature has also presented various typologies for IT capabilities, including quality of IT infrastructure, quality of IT business expertise, and intensity of organizational learning (see also Bhatt and Grover, 2005).

According to Davenport & Harris (2017), a company that utilizes analytics is one that makes extensive use of data, statistical methods, and fact-based decision making to support capabilities that are central to strategy. In their view, analytical capabilities can be analyzed by the "DELTA Plus" model, referring to data, enterprise, leadership, targets, and analysts, along with technology and analytical techniques (IIA, 2022). In this model, the term "data" refers to the organized, unique, integrated, accessible, and high-quality information that organizations can use in different kinds of analysis. "Enterprise" refers to an organization-wide approach to managing systems, data, and people for analytics. "Leadership" means that organizations embrace analytics into their routines in such a way that it leads them toward a data-driven decision-making organizational culture. With regard to "targets," the purpose of the analytics must be aligned with the organization's strategic targets. The term "analysts" refers to the personnel who are able to utilize the analytics in their duties. "Technology" refers to the technological infrastructure, tools, and technologies, and the term "analytical techniques" refers to the methods and techniques for analytics, such as reporting and visual analytics.

Recent studies on business intelligence and analytics that have used the DELTA model include Lismont et al. (2017) and Seddon et al. (2019). Lismont et al. (2017) found that companies that started earlier with analytics subsequently used more complex techniques and advanced applications for business analytics. Seddon et al. (2019) used the DELTA model in an effort to explain how business analytics contributed to business value. In this study, we will also use the DELTA model in the case study analysis.

3 Case Study Method

The purpose of this study is to investigate the analytical capabilities related to business intelligence and analytics at the early stage of adoption. The previous literature has called for more empirical case studies relating to business intelligence and analytics (Rikhardsson & Yigitbasioglu, 2018; Bronzo et al., 2013). Bronzo et al. (2013) argued that case studies have the potential to reveal constraints and challenges related to business intelligence and analytics. Our research method involves a qualitative case study, which is suitable for situations in which the phenomenon is to be examined in depth in a real-life context (Yin, 2018; Anderson & Widener,

2007). Our case organization is a Finnish engineering company that manufactures technologically advanced products for the international market. The company has approximately 1,500 employees, and its turnover is approximately 400 million euros. The name of the case company has been anonymized.

The company was selected because its management has a strong will and vision to develop analytics in its business operations. However, at the time of the study, the analytical capabilities of the case organization were still in the development phase, offering a good opportunity to analyze issues affecting the development of analytical capabilities. In the case company, Power BI and Databricks solutions, and Excel and ERP system were mainly used for analytics.

The company's key strategic priorities for the years 2021-2024 include business growth and people in delivering business performance. Achieving the goals means better profitability, competitive lead time, and better customer satisfaction, and requires e.g. transparent and 12-month sales forecast. In the case organization, the management considers it very important to understand the current status of the business.

By analyzing in depth an organization that is attempting to develop its business intelligence and analytics capabilities, we can obtain valuable information about how business intelligence and analytics develops and what kind of processes are affected by its development. Moreover, additional information can be obtained about the issues that are critical in terms of development, especially at the beginning of the company's analytical path.

The gathering of research material was carried out in several stages. The first phase included getting familiar with the company, as well as exploring the documentation related to business analytics. The aim was to gain an understanding of how business intelligence and analytics appears in the company's official plans and publications. Next, we organized an interview for two senior managers to refine the overall picture of the organization.

The main empirical material for the study was carried out in two stages, using a mixed-method approach (see, e.g., Bazeley, 2008). The first part consisted of a survey, with open questions, of 23 people. The second part included six themed interviews. All respondents were selected on the basis of their position, experience, and assumed knowledge of the topic. This same method has been applied in previous studies in accounting (see, e.g., Curry et al., 2019); we adopted it because we wanted to ensure that the interviewed persons were dealing with business intelligence and analytics, as well as IT systems. The assumption was that these people would be involved in influencing the processes of business intelligence and analytics. The interviews were recorded and transcribed.

The interviews and questionnaire responses form the main empirical data of this study. Details of the interviews have been attached in the appendix. In the findings section we will present quotations derived both from the interviews and open survey responses. In addition, one of the researchers spent a seven-month period in the company (in 2021-2022) observing and collecting data on the company's operations, familiarizing himself with the company's business intelligence and analytics processes in practice. The researchers read the material through several times, discussed the main findings, and analyzed the data according to the DELTA Plus model (Davenport & Harris, 2017). Finally, the findings were examined in relation to previous literature. In this way, we were able to identify issues that appeared to be significant challenges in the development of analytical capabilities (information systems–related capability, management capability, and personnel capability). We thereby aimed to show how the theoretical frameworks manifested themselves at the practical level and to determine whether there were contradictions between practice and theory.

4 Findings: Challenges in the Adoption of Business Intelligence and Analytics

4.1 Data

Our observations highlighted the poor quality, usability, and accessibility of the data. In particular, the quality of financial data (financial figures, data, and information) emerged as a negative issue affecting work.

> *"Analyzing financial figures is really difficult if you don't go to the financial team to ask for an explanation behind the numbers."* (Senior manager #8)

However, the quality of data, especially the quality of financial data, was not the only data-related issue that was problematic. In addition to quality, poor accessibility of data emerged as a clearly negative data-related issue; poor accessibility makes it difficult to perform work tasks, among other things.

> *"I don't have much information regarding operational performance. It is impossible to build comprehensive measurements. I spend a lot of time trying to find information and build reports based on the data that is available. We spend a lot of time looking for basic data."* (Senior manager #6)

The fragmentation of the data also came up in our observations.

> *"There is a lot of good information available here, but it is widely spread and distributed across different platforms and databases. Combined or processed information for a specific purpose must first be collected and created using different tools, such as reporting tools."* (Operational manager #23)

> *"There is a comprehensive amount of information, but it is complex. Sometimes it takes me a long time to find the information I need."* (Management accountant #20)

We observed that the organization had a relatively large amount of data available and separate databases from which this data could be collected. The problems related to the data seemed to be especially caused by the fragmentation of the data, which made compiling the data difficult and laborious. Our findings also highlighted the fact that the use of databases (collecting the data from databases) was difficult for some and therefore the accessibility of the data seemed poor. This was reflected in our observations, among other things, that certain IT professionals were actually employed because of the constant requests related to the compilation and delivery of data.

Our findings indicated that partial and uncertain data eroded trust in business intelligence and analytics while also appearing to cause issues raised on the basis of data not necessarily always taken seriously in the organization. This, in turn, clearly had a negative effect on the attitude toward business intelligence and analytics, so that it remained in the background of the organization. Our findings indicate that the quality and accessibility of the financial data were particularly important. Data accessibility was mainly related to the technologies used.

4.2 Technologies and techniques

Technologies are an integral part of analytical capabilities. They affect how efficiently and easily a company can utilize its analytics-related technologies. Technologies are important in terms of business intelligence and analytics (Davenport & Harris, 2017) and, more broadly, in terms of the capabilities related to an organization's information systems (Wamba et al., 2017; Raffoni et al., 2018) have also emerged in previous studies as key issues affecting an organization's analytical capabilities. According to Davenport & Harris (2017), technology refers to the technological infrastructure, tools, and technologies, while analytical techniques comprise the methods and techniques for analytics, such as reporting and visual analytics. Our findings highlighted a lack of uniform information systems (technologies like ERP systems). This was also evident from the challenges identified by the IT professional regarding technology.

> *"Too many IT systems are not connected to each other in such a way that they could support the business."* (Operational manager #13)

> *"The data is usually raw data, and there is no (technological) means to analyze it."* (Senior manager #8)

In the case organization, the problems caused by the lack of an enterprise-wide ERP system have been identified, and for this reason, the organization was running a development project to introduce a new ERP system. However, it is important to understand that technological system solutions are only one part of an organization's analytical capability. It can be harmful for an organization to focus too much on issues related to information systems when developing analytical capabilities because there is then a risk that other issues that are significant in terms of analytical capabilities will receive less attention. Our observations show that the ERP project also inhibited the development of other things. This view was supported by several comments in the case organization.

> *"The IT department is focusing too much on the new ERP system, so it has been said that there are no resources or money to support other things."* (Operational manager #6)

The business intelligence and analytics applications used by the organization set their own limitations on the kind of analytics the organization's members could produce (Grossman, 2018). The case organization had an application for business intelligence and analytics (Power BI), which was installed on all computers in the organization. The existence of the application was well known in the organization, and the organization's new data platform (Databricks) enabled very advanced analytics. However, by far the most common application used by organizational members for analytics was Microsoft Excel. Using all the applications required expertise and analysis techniques.

> *"We analyze numerical information mainly in Excel, or directly from the ERP system, which we still use. We also use other programs, such as the cube (a financial data management system). We need these weekly, but more commonly monthly or annually."* (Management accountant #15)

The use of numerical data in analytics was clearly more common than the use of non-numerical data. By far the most common analytics data were financial data. The integration of financial data with other data sources seemed to be very limited. In terms of non-financial data, data sources related to safety statistics and operational activities are key. Our findings indicated that the systems affected the amount of time spent on producing the necessary repetitive reports. The company had recognized the importance of technologies and data in the development of analytics, but the analytical techniques (Power BI, Databricks) were still unfamiliar. This did not mean, however, that more advanced analytical techniques were not already in use at the individual level or for a particular personnel group. Although the organization had introduced new technologies to enable business intelligence and analytics processes, the personnel very often used Excel spreadsheet software.

In relation to analytical techniques, the lack of any benefits emerged in our findings. In the case organization, management did not know how to present the benefits of business intelligence and analytics to customers or to its own staff. This can be seen as an obstacle to the development of analytical capabilities.

> *"So, what is the benefit for an individual employee or for the company?"* (Operational manager #27)

> *"We must be able to offer that data in a form that is useful in practice. This means that the request should come from the end users. It is my opinion that the end user is now missing from this overall analytical picture."* (IT professional #28)

The failure to present the benefits can be seen in the lack of examples.

> *"When you come up with these ideas, it's worth turning it into a business case and checking what the benefits are? Will we get some new business with it?"* (IT professional #28)

> *"One project was a pioneering case when it was possible to show what we could do with data. The employees began to understand how the data could be utilized and combined."* (IT professional #29)

> *"In other words, we should at least get examples of where the analytics might start to develop."* (Senior manager #26)

4.3 Enterprise, leadership, and targets

Management and leadership in the development of analytical capabilities are important to ensuring that analytics does not take place in silos (in specific locations within the organization) and that the goals of the analytics are in line with the organization's strategic goals. The organization must have goals for analytics so that the company can derive the best possible value from analytics with limited resources (Davenport & Harris, 2017). We found that the goals for the analytics were not known or very poorly known in the case organization, even though the top management communicated the goals in several meetings. The management tried to communicate the goals and showed their own strong commitment to business intelligence and analytics. However, our findings showed that the lack of clarity and concreteness of the goals

were the reasons for poor business intelligence and analytics knowledge.

> *"The strategy and goals are clear—that we want to invest in the data ... but then in practice, if we go one level lower, what exactly we want to achieve with the data is still a question, and we don't know what we want to achieve or do with the data."* (IT professional #28)

> *"We don't have the targets to be able to communicate them and tell everyone unequivocally so that everyone would understand them in the same way."* (Senior manager #26)

The above examples show that the business intelligence and analytics goals were still very local in the organization. An IT professional who works with the organization's analytics seemed to have a good idea of the organization's goals in terms of developing analytics.

> *"In the everyday life of the company, there is no talk about the development of analytics, and if you have not been exposed to it, then it has never been apparent to you what it is aiming for."* (Operational manager #27)

The lack of management and communication relating to the goals of business intelligence and analytics can pose a challenge and this can be interpreted to mean that what is really needed in the organization at the personnel level is communication. This finding supports the findings of Shollo & Galliers (2015) about the importance of communication in the development of business intelligence and analytics.

> *"In this process, the most important thing, or one of the most important things, is communication, constant communication about what can be done with the data, and to get everyone to understand that we now have the tools to process the data."* (IT professional #28)

> *"In my opinion, this kind of cross-functional communication and doing is something that should be improved. It's quite challenging, but it's something that should be improved, along with visibility for communication and doing things together."* (IT professional #29)

In the interviews, the conflicts of communication and management in the use of analytics at different levels and tasks of the organization were also brought up.

> *"The top management certainly knows the strategic directions we want to go in, but with regard to the data and the knowledge of how to get the most out of the data, I see that it will then come from the end users ... If we want to use the data, for example, in maintenance, planning the maintenance of machines, then it is not the top management that determines the information requirements but a service clerk."* (IT professional #28)

Our findings showed that the characteristics of the employee groups need to be taken into account in the communication in the adoption of business intelligence and analytics. In other words, the user of the information is not necessarily senior management. This requires that non-analysts also find the time and interest to be involved in business intelligence and analytics. Our findings also indicate that it is very likely that analytics will be done together with customers. In such cases, the analytics professionals must also be able to communicate the

benefits of analytics to external stakeholders.

> *"We already have a few projects under way in which the customer demands that they get data …, but often they don't know what they want to do with it."* (IT professional #28)

In the case organization, the management drove the development of business intelligence and analytics, but concrete evidence was still missing. The management was committed to developing business intelligence and analytics, but the lack of resources was also a challenge.

> *"I would say that the speech and goals are there, but the bottleneck is the lack of resources and understanding."* (Management accountant #1)

We found that managing business intelligence and analytics should involve concrete examples of utilizing analytics. Concrete examples help to illustrate to other members of the organization the benefits that can be achieved with analytics. Our observations indicate that the lack of concrete examples was an obstacle to the development of analytics in the organization.

> *"The first step is to show that we can make such reports, that is, to show people what can be done. But then the fact that we actually get the data into those normal processes requires a lot of management ability. Once we get motivated people to use it, we get an understanding that it is easy to use and we get to communicate those benefits."* (IT professional #28)

Managing business intelligence and analytics also involves challenges in the localization of analytics. The case study organization did not have a comprehensive approach to analytics; analytics was performed specifically by individual groups or individuals.

> *"I think we have so little information and analytical insights that this sharing of analytical insights is almost a dead end. However, we manage relatively well in sharing ad hoc information, such as sharing Power BI reports."* (Senior manager #2)

Several interviewees also highlighted the lack of communication and cooperation between different business units. In the case of an international organization in particular, the formation of silos like this is something that should clearly be addressed in the management of analytics.

> *"The business units operate in silos, and the national organization is also quite independent in its decisions. Because of this, there is a lack of knowledge about what is happening anywhere. There are still barriers at the organizational level in the organization. We try hard to work across business unit boundaries, but there is a lack of a common strategy."* (Senior manager #6)

> *"We don't share analytical insights, mostly because the local and global financial departments don't seem to be connected. In addition, not all countries have the same ERP system, so it makes it difficult to obtain information."* (Senior manager #8)

However, there were also opposing views. Those who felt that the communication regarding business intelligence and analytics was at a good level worked in specific, smaller units, which once again points to the locality of analytics in the organization.

"Yes, in my opinion, analytical insights are well shared with the company's personnel and con-sequently they have a good understanding of our business." (Management accountant #20)

All in all, it seems that the sharing and utilization of analytical information were related spe-cifically to the analytical culture, communication, and management. Our findings point to the lack and challenges of an analytical culture at the organizational level.

"Culture is probably the biggest obstacle; people are not used to or required to share analytical insights or successes." (Management accountant #1)

The development of an analytical culture, communication, and management in the case or-ganization was still at a very early stage. This can be caused by the fact that the organization had certain deficiencies in its information system and for that reason, the organization was fixing these problems at first.

4.4 Analysts

We found that the utilization of business intelligence and analytics was very local. The people who worked on the topic were most familiar with analytics and its utilization.

"We don't have that much capability yet to do those analytics. What we have is focused on a small group of people who can use the systems and get the most out of that data." (IT profes-sional #28)

The employees of the case organization were interested in learning things related to business intelligence and analytics. They seemed to be receptive to training and willing to learn new things, but training related to analytics alone is probably not enough to enable organizational learning and change. Our findings further emphasized the need for concrete examples.

"There is no need for training, but a discussion about analytics could help." (Senior manager #8)

"There is not necessarily a need for training as such, but more for success stories and examples of analytics that could act as a catalyst for development." (Management accountant #1)

The role of controllers was considered important in the development of analytics.

"Well, for sure, the business controllers are really great analysts because they have the figures and they are focused on the business." (Senior manager #26)

"The analyst may not need to understand much about the business, but they need to be able to do the analyses and use the tools that allow us to look at the business from different angles." (Operational manager #27)

Controllers played a central role in the case company when the data were transformed into analytical reports. However, this was associated with a management problem because the job

content and job descriptions assigned to the controllers did not support the development of analytics.

> *"The task description of the controllers is wrong and it's not because of the controllers but what the management wants them to do."* (Operational manager #27)

Controllers have an opportunity to bring analytics into the business. While controllers bring more analytical information to decision makers, the analytical capabilities of other employees may develop as well. However, the lack of competence in the development of analytics was clear. Our findings showed that analytics must be simple and easy to adopt. There were also challenges in training the staff in analytics.

> *"You look at the analytics a few times but then it stays there in the back again. It should be repeated often enough and staff should be reminded about the analytics."* (Operational manager #25)

Although business intelligence and analytics is new, the development of analytical capabilities also involves unlearning old practices.

> *"You can see where it works and where it doesn't, and that's because of the employee's work history and work experience."* (Senior manager #26)

> *"It may be that it is not so easy to adapt those old routines to it, especially for older staff, if you don't have that IT knowledge as a basis."* (Operational manager #25)

Competence also relates to a lack of available resources. The company recognizes that its own competence is not necessarily enough, and competence must then be acquired from outside the organization.

> *"It also requires more technical skills, so there is definitely a need to acquire know-how by acquiring additional resources from experts outside the company."* (IT professional #28)

5 Discussion

The purpose of this study was to explore the analytical capabilities related to business intelligence and analytics at the early stage of adoption. Our findings highlight the challenges related to analytical capabilities in information systems, management, and personnel.

Challenges related to information systems emerged mainly from difficulties of collecting the data, as the data existed in several places, i.e. in several functions, in several business units, and in several information systems. This also includes that there were no uniform information systems in use in the case organization. Challenges in systems-related capabilities were also related to the use of current techniques (such as Excel), as a presumption that new technologies and techniques included new methods for analytics.

Challenges related to management analytical capability emerged in the following ways: the case organization lacked analytics goals or goals were unclear; demonstrating the benefits of business intelligence and analytics was challenging for both employees and customers,

which were seen in the absence of concrete examples; there were gaps in communication and cooperation between the business units; and training in business intelligence and analytics was insufficient.

Challenges related to personnel analytical capability included: users were required to apply business intelligence and analytic knowledge (not only learning new technologies); learning business intelligence and analytics takes time (often alongside normal routine works); users had negative attitudes towards analytics; analytics were only performed by certain people in the case organization (in silos); and the job descriptions of key persons (such as controllers) were not supported the development of business intelligence and analytics.

One of the challenges in our study seemed to be the lack of a uniform technology platform. Analytical technologies (such as the new ERP system in our case organization) are an important part of an organization's analytical capability (see, e.g., Davenport & Harris, 2017; Wamba et al., 2017; Liu et al., 2013) but information systems alone are not enough to transform the organization into an analytical company.

In our case organization, analytical techniques (such as Power BI) were already in use, but they were still unfamiliar to most employees. We also found, that although new technologies had been adopted to enable business intelligence and analytics, employees also widely used old, familiar systems, such as Excel spreadsheets which places some constraints on the analytics such as data set size limitations. In this way, our findings support the study by Popovič et al. (2012) that it is necessary to have easy access to the data, an easy way to retrieve the data, and easy techniques to analyze the data.

We found that the first steps in analytical techniques were focused on reporting past information instead of building models from data. Analytics was mainly descriptive and sought to answer questions such as "what has happened". In other words, analytics uses past financial data, as opposed to focusing on the future. Also, the integration of financial data with other data seemed to be still very limited. However, information describing past business performance is important because descriptive analytics is often considered the starting point for other more advanced analytical techniques (Raffoni, et al., 2018). Such analytics focused on generating reports is typical of a company at the lowest level of analytics but helps to develop the organization's analytical capabilities (Grossman, 2018).

Business intelligence and analytics requires expertise. In our case organization, the lack of analytical skills seemed to be one of the main obstacles to the utilization of analytics. The organization had individual experts and certain groups of employees who were more advanced in analytics, but there seemed to be a need for education and training. Concrete examples of the utilization of business intelligence and analytics were especially needed. We understand, that there is a lack of concrete examples in the adoption stage of business intelligence and analytics, but we argue, that all examples at the early stage of adoption would be useful. This means demonstrating the benefits both from a business perspective (business cases) and for developing staff skills (examples and pilot cases).

We also found that expertise in business intelligence and analytics existed in siloes. The challenge was particularly reflected in the lack of communication and cooperation between different business units. Thus managing challenges might require cooperation and interaction between employees as well as with customers. Special emphasis should be on cross-departmental and cross-functional processes (cf. Wamba et al., 2017; Davenport & Harris, 2017).

Controllers seem to have a central role in the adoption of business intelligence and analytics (see also Schnegg & Möller, 2017). Although business intelligence and analytics is quite

new also for controllers, they are required to both manage the adoption and produce examples and various reports. Our findings highlight the controller's challenging role in the adoption of business intelligence and analytics as they operate in the middle of departments, people, functions, and technologies (c.f. Schnegg & Möller, 2022; Hyvönen et al., 2015). We can say, that this is also a management challenge because the tasks and resources assigned to controllers do not always support the development of analytics.

In this study, we have explored the challenges of business intelligence and analytics from the perspective of analytical capabilities. Our study presents that the adoption of business information and analytics is a result of technology, expertise, and management, and requires particular analytical capabilities (c.f. Gärtner & Hiebl, 2018). Based on our findings, we argue, that it is reasonable to try to identify and understand the challenges raised in this study when starting the adoption of business intelligence and analytics. By identifying the challenges, those can be managed and controlled, as business intelligence and analytics is an integral part of management accounting and control in contemporary organizations.

We can say, that in our case organization, in the early stage of adoption of business intelligence and analytics, analytical capabilities emerged in very heterogeneous forms across the organization. Very often, management aims for "fast" implementation and "quick" benefits, but often the situation is that the organization does not have enough capabilities to adopt these. Our research has highlighted several challenges in the early stage adoption of business intelligence and analytics, but as in previous studies, management commitment is important for an organization's analytical abilities to develop (see, e.g. Shollo & Galliers, 2015; Mikalef et al., 2021; Elbashir et al., 2021). According to Davenport & Harris (2017), senior management's commitment to analytics brings about change in the form of the utilization of analytics in other parts of the organization as well.

We can conclude that management is required to show direction and organizations need to have a clear goal in analytics. In addition, employees need to be given resources, as well as time in terms of learning and using analytics. All in all, there are very few studies dealing with analytical capabilities, and business intelligence and analytics in management accounting and control literature. In this research, we have highlighted in empirical case study the challenges of business intelligence and analytics, especially in its early stage of adoption. Our study contributes to the previous literature on analytical capabilities, and we propose that there is a need for identifying, managing, and controlling the challenges of analytical capabilities in organizations. In this way, we can promote digitalization in accounting and management control.

6 Conclusion

Digital technologies and data are essential aspects of management accounting and control in contemporary organizations (see, e.g., Bhimani & Willcocks, 2014; Silvi et al., 2010, Granlund et al., 2013). Business intelligence and analytics, in the form of digital technologies and data, enhances the possibilities for organizations' competitiveness by improving decision making and management control, but it also requires analytical capabilities (information systems-related, management, and personnel capabilities).

This study contributes to the previous research by increasing our knowledge about the challenges in the development of business intelligence and analytics (see, e.g., Stjepić et al., 2021; Ain et al., 2019; Appelbaum et al., 2017; Scholz et al., 2010). More broadly, the challenges in analytical capabilities can be seen as an obstacle to the development of organizations' com-

petitiveness (see, e.g., Wamba et al., 2017; Elbashir et al., 2021; Mikalef et al., 2021; Davenport & Harris, 2017).

The results of this study contribute to the literature on management accounting and control by leveraging the empirical findings on business intelligence and analytics. In the management control and accounting context, we can state that the role of business controllers is becoming even more important in the development of analytical capabilities (cf. Andreassen, 2020; Järvenpää, 2007). In the future, controllers seem to be those who have knowledge of business, who have knowledge of information systems, and who have knowledge of analysis and reporting (see also Hyvönen et al., 2015). They will probably be the ones who solve the challenges of management control, in terms of technologies and analytics (cf. Laursen, & Thorlund, 2017; Teittinen et al., 2008) and create the organization's analytical expertise, both by communicating and presenting concrete examples.

This study is limited to the findings in only one case organization. We do not claim to have identified all possible challenges and we state that different challenges may occur in different organizations in different forms, and in different stages of the adoptions. In the future, a potential research topic could be to explore the challenges of business intelligence and analytics in other organizations, as well as the role of controllers in more mature stages of business intelligence and analytics.

References

Ain, N., Vaia G., DeLone W., & Waheed, M. (2019). Two decades of research on business intelligence system adoption, utilization and success – A systematic literature review. *Decision Support Systems* 125, 113113.

Anderson, S., & Widener S. (2007). Doing quantitative field research in management accounting. In Chapman, C. S., Hopwood, A. G., & Shields, M. D. (eds.), *Handbook of Management Accounting Research*. Elsevier.

Andreassen, R. I. (2020). Digital technology and changing roles: a management accountant's dream or nightmare? *Journal of Management Control* 31:3, 209-238.

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.

Barton, D., & Court, D. (2012). Making advanced analytics work for you. *Harvard Business Review* 90:10, 78–128.

Bazeley, P. (2008). Mixed methods in management research. In Thorpe, R., & Holt, R. (eds.), *The SAGE Dictionary of Qualitative Management Research*. Sage.

Bhatt, G. & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of Management Information Systems* 22, 253–277.

Bhimani, A. & Willcocks L. (2014). Digitisation, big data and the transformation of accounting information. *Accounting and Business Research* 44:4, 469–490.

Bodnar, G. & Hopwood, W. (2013). *Accounting Information Systems*. 11th Edition. Pearson Education.

Bordeleau, F.-E., Mosconi, E., & de Santa-Eulalia, L. A. (2020). Business intelligence and analytics value creation in Industry 4.0: A multiple case study in manufacturing medium enterprises. *Production Planning & Control* 31:2-3, 173–185.

Bronzo, M., de Resende, P., de Oliveira, M., McCormack, K., de Sousa, P., & Ferreira, R. (2013). Improving performance aligning business analytics with process orientation. *International Journal of Information Management* 33:2, 300–307.

Chapman, C., & Kihn L. (2009). Information systems integration, enabling control and performance. *Accounting, Organizations and Society* 34:2, 151–169.

Chen, H., Chiang, R., & Storey, V. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly* 36:4, 1165–1188.

Curry, A., Hersinger, A., & Nilsson, K. (2019). Operations managers' use of (ir)relevant management accounting information: A mixed-methods approach. *Nordic Journal of Business* 68:1, 5–33.

Davenport, T., & Harris, J. (2017). *Competing on Analytics: The New Science of Winning*. Harvard Business Review Press.

Elbashir, M., Collier, P., & Davern, M. (2008). Measuring the effects of business intelligence systems: The relationship between business process and organizational performance. *International Journal of Accounting Information Systems* 9:3, 135–153.

Elbashir, M., Sutton, S., Mahama, H., & Arnold, V. (2021). Unravelling the integrated information systems and management control paradox: Enhancing dynamic capability through business intelligence. *Accounting and Finance* 61:1, 1775–1814.

Franke, F., & Hiebl, M. (2023). Big data and decision quality: the role of management account-

ants data analytics skills. *International Journal of Accounting & Information Management* 31:1, 93–127.

Gärtner, B. & Hiebl, M. (2018). Issues with Big Data. Martin Quinn and Erik Strauß (Eds.*): The Routledge Companion to Accounting Information Systems*. Routledge.

Granlund, M. (2011). Extending AIS research to management accounting and control issues: A research note. *International Journal of Accounting Information Systems* 12, 3–19.

Granlund, M., Mouritsen, J., & Vaassen, E. (2013), On the relations between modern information technology, decision making and management control. *International Journal of Accounting Information Systems* 14:4, 275–277.

Grossman, R. (2018). A framework for evaluating the analytic maturity of an organization. *International Journal of Information Management* 38:1, 45–51.

Hyvönen, T., Järvinen, J., & Pellinen, J. (2015). Dynamics of creating a new role for business controllers. *Nordic Journal of Business* 64:1, 21–39.

Hyvönen, T., Lepistö, L., & Mäki, S. (2022). Data analytics and financial forecasting: A field study from Finnish enterprises. *Nordic Journal of Business* 72:2, 54-62.

Järvenpää, M. (2007). Making business partners: A case study on how management accounting culture was changed. *European Accounting Review* 16, 99–142.

Klatt, T., Schlaefke, M., & Moeller, K. (2011). Integrating business analytics into strategic planning for better performance. *The Journal of Business Strategy* 32:6, 30–39.

Laursen, G., & Thorlund, J. (2017). *Business Analytics for Managers: Taking Business Intelligence beyond Reporting*. Second edition. Wiley.

Lepistö, L. (2014). Label in context: On the enterprise resource planning system in a medium-sized enterprise. *The Finnish Journal of Business Economics* 63:1, 48–72.

Lismont J., Vanthienen J., Baesensa B., & Lemahieu W. (2017). Defining analytics maturity indicators: A survey approach. *International Journal of Information Management* 37:3, 114–124.

Liu, H., Ke, W., Wei, K., & Hua, Z. (2013). The impact of IT capabilities on firm performance: The mediating roles of absorptive capacity and supply chain agility. *Decision Support Systems* 54:3, 1452–1462.

Lönnqvist, A., & Pirttimäki, V. (2006). The measurement of business intelligence. *Information Systems Management* 23:1, 32–40.

Mikalef, P., van de Wetering, R., & Krogstie, J. (2021). Building dynamic capabilities by leveraging big data analytics: The role of organizational inertia. *Information & Management* 58:6, 103412.

Nielsen, S. (2018). Reflections on the applicability of business analytics for management accounting – and future perspectives for the accountant. *Journal of Accounting & Organizational Change* 14:2, 167–187.

Nykänen, E., Järvenpää, M., & Teittinen, H. (2016). Business intelligence in decision making in Finnish enterprises. *Nordic Journal of Business* 65:2, 24–44.

Popovič, A., Hackney, R., Coelho, P., & Jaklič, J. (2012). Towards business intelligence systems success: Effects of maturity and culture on analytical decision making. *Decision Support Systems* 54:1, 729–739.

Raffoni, A., Visani, F., Bartolini, M., & Silvi, R. (2018). Business performance analytics: Exploring the potential for performance management systems. *Production Planning & Control* 29:1, 51–67.

Ranjan, S., Jha, V. & Pal, P. (2016) Literature review on ERP implementation challenges. *International Journal of Business Information Systems* 21:3, 388–402.

Rikhardsson, P., & Yigitbasioglu, O. (2018). Business intelligence & analytics in management accounting research: Status and future focus. *International Journal of Accounting Information Systems* 29, 37–58.

Schnegg, M., & Möller, K. (2022). Strategies for data analytics projects in business performance forecasting: a field study. *Journal of Management Control* 33:2, 241-271.

Scholz, P., Schieder, C., Kurze, C., Gluchowski, P., & Böhringer, M. (2010). Benefits and challenges of business intelligence, adoption in small and medium-sized enterprises. *ECIS 2010 Proceedings* 32.

Seddon, P., Constantinidis, D., Tamm, T., & Dod, H. (2017). How does business analytics contribute to business value? How does analytics contribute to business value? *Information Systems Journal* 27:3, 237–269.

Shollo, A., & Galliers, R. (2016). Towards an understanding of the role of business intelligence systems in organisational knowing. *Information Systems Journal* 26:4, 339–367.

Silvi, R., Möller, K., & Schläfke. M. (2010). Performance management analytics – The next extension in managerial accounting. Available SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1656486.

Stjepić, A-M., Bach M., & Vukšić V. (2021). Exploring risks in the adoption of business intelligence in SMEs using the TOE framework. *Journal of Risk and Financial Management* 14:2, 58.

Teece, D. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28:13, 1319–1350.

Teittinen, H., Pellinen, J., & Järvenpää, M. (2013) ERP in action? Challenges and benefits for management control in SME context. *International Journal of Accounting Information Systems* 14, 278–296.

Wamba, S., Gunasekaran, A., Akter, S., Ren, S. J., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research* 70, 356–365.

Yin, R. (2018). *Case Study Research and Applications: Design and Methods*. Sixth edition. SAGE.

Youssef, M. & Mahama, H. (2021). Does business intelligence mediate the relationship between ERP and management accounting practices? *Journal of Accounting & Organizational Change* 17:5, 686–703

Appendix.

Questionnaire:

1. Can you describe the information sharing activities at [case company]. For example how you receive information, how you search information to support your activities and how you construct information.
2. How would you prefer to receive organizational business and management information and in which form, like what is happening and what is about to happen in [case company]'s business?
3. How would you describe information availability at [case company]?
4. How do you analyze numeric or non-numeric information at your role? For what kind of purposes do you mostly analyze information and how often?
5. How do you see the current situation of analytics and data-based decision making in your organization?
6. Do you think that analytical insights and information are effectively shared in the organization and in a coordinated manner? If not, are there some obstacles or organizational barriers preventing it?
7. From your point of view, how well do the IT-systems support decision making and business activities? Are there some limitations caused by IT-systems that you have encountered?
8. How would you describe the cooperation between IT and business teams at [case company]. For example how well does IT and business personnel understand each other and how closely do they work together?
9. Is the company's current data quality affecting your work? If yes/no, can you describe how/why?
10. From your point of view is analytical capabilities actively being pursued by management? How does this occur in practice?
11. Do you know what the current targets of the company regarding analytical capabilities and what do you think about those targets?
12. From your point of view, are there some current issues in the way of working that can affect the implementation of data-based insights into actual actions at [case company]?
13. Do you think that [case company] is doing enough to become a more analytically capable company? Are there some concerns that you would like to address here regarding this subject?
14. What kind of analytical solutions would be beneficial for your work? Do you have some examples of current or potential solutions?
15. Do you feel that some kind of training would be beneficial for you or your organizational unit regarding analytics? If yes, can you describe what kind of training?

Thematic interviews:

1. How would you describe [case company] as a company?
2. How would you describe [case company]'s competitive environment?
3. How would you describe [case company]'s operating environment?
4. How would you describe [case company]'s technological ability compared to competitors?
5. What are the current and potential activities that [case company] can utilize in managing and analyzing business intelligence?
6. Where is [case company] in terms of analytics currently?
7. How actively does [case company] share business information with external parties, such as subcontractors and customers?
8. How extensively is data currently utilized at [case company]?
9. Where do you see the greatest potential in terms of utilizing data?
10. What kinds of activities have been identified to increase the company's analytical capability?
11. How would you describe [case company]'s current decision-making process?

Interviews:

1. Top management, 8.2.2022, 40min
2. Senior manager, 8.2.2022, 40min
3. Operational manager, 14.3.2022, 58min
4. Operational manager, 14.3.2022, 1h 30min
5. Senior manager, 14.3.2022, 31min
6. IT-manager, 17.3.2022, 1h 12min
7. IT-manager, 17.3.2022, 38min
8. Business controller, 21.3.2022, 42min