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Editor's Letter

This issue of the *Nordic Journal of Business* includes two peer-reviewed articles. In the first article, Henri Teittinen and Valtteri Bovellan investigate analytical capabilities in the adoption of business intelligence and analytics. The second article by Mika Vaihekoski and Habeeb Yahya examines whether firms' environmental, social and governance (ESG) performance is associated with financial performance in the Nordic countries.

I hope you enjoy reading the interesting contributions featured in this issue of the *Nordic Journal of Business*.

Sami Vähämaa

Editor

Nordic Journal of Business

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

Henri Teittinen and Valtteri Bovellan

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

Henri Teittinen is an Assistant Professor of Accounting at the University of Eastern Finland, Finland. Valtteri Bovellan, M.Sc., is working as a Commercial Analyst in the industry, Finland

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 (Schneegg & 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. Stjepić 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 (Schneegg & 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 (Schneegg & 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 & Yigitbasiglu, 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 consequently 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 specifically 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 organization 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 professional #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.

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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

*ESG and Firm Performance: Evidence from the Nordic Countries**

Mika Vaihekoski and Habeeb Yahya

Abstract

This study examines the relationship between ESG and firm financial performance and market valuation using data on publicly listed firms in the Nordic countries from 2010 to 2020. The results show that ESG scores and individual pillar scores are positively related to profitability and firm valuation except for the governance pillar score which is negatively related to profitability. Further analysis shows a bi-directional relationship between ESG and firm profitability. This aligns with earlier studies suggesting that corporate sustainability is a predictor as well as a consequence of corporate financial performance.

Keywords:

ESG; financial performance; firm valuation; Nordic countries

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Mika Vaihekoski is a Professor of Finance at Turku School of Economics, University of Turku, Finland. Habeeb Yahya is a Doctoral Researcher in Accounting and Finance at Turku School of Economics, University of Turku, Finland.

1 Introduction

Sustainability has received increased attention during the past decade, as climate change, biodiversity loss, human rights, and social justice have taken center stage in public discussion. Following public interest, investors have begun to direct investments into firms that align their operations to meet sustainability goals. For firms, this has meant a tremendous challenge, yet an opportunity at the same time. As a result, many studies have been carried out on the relationship between corporate social responsibility, which has evolved into corporate sustainability, and firm performance. The relationship between sustainability and firms' financial performance is still an open issue with conflicting results (c.f., Khan, 2022). Some studies support a positive relationship (see, e.g., Fatemi et al., 2015; Wang and Sarkis, 2017; Pulino et al., 2022) whereas others find a negative relationship (see, e.g., Branco and Rodrigues, 2008; Lee and Faff, 2009; Duque-Grisales and Aguilera-Caracuel, 2021). A few studies have even found no evidence of linking sustainability performance to financial performance and the value of firms (e.g., Statman, 2006; Horváthová, 2010; Orlitzky et al., 2003).

These mixed results in empirical research on the relationship between sustainability and firm profitability as well as valuation are arguably due to several issues. Earlier studies suffered from measurement concerns and data constraints (Li et al., 2018). Namely, there was no commonly used measure for firms' actions and commitment toward sustainable operations. Luckily, more recently, many new measures for sustainability have emerged – although still somewhat controversial – with one of the most used being the ESG scoring. It typically considers firms' past performance on Environmental (E), Social (S), and Governance (G) issues. Furthermore, earlier results were often based on short sample periods which can hide the fact that incorporation of sustainable practices into existing firm operations may take some time before it is fully reflected in their ESG score and, in their financial performance. On the other hand, studies may have used a too narrow focus for the financial performance by examining only on a single measure. The impact of sustainability can differ, e.g., for valuation and profitability.

However, the main concern with the prior studies can be said to stem from the fact that the relationship between financial performance and sustainability is likely to be bi-directional which is a cause for concern econometrically.¹ For example, improved ESG performance can lead to higher profitability (e.g., via brand recognition and higher sales) and valuation (e.g., via positive screening), but firms with better financial performance can reciprocally do more to improve their ESG performance. From the theoretical point of view, research on the relationship between sustainability/ESG and firm financial performance is motivated by both shareholder and stakeholder theory. The main question centers around diverging views on the goal of the firms. Studies that document negative relationships have justified the finding with the shareholder theory of Friedman (1970) which suggests that a firm's sole responsibility is to maximize profits and deliver wealth to owners. Similarly, a positive relationship has been seen as support for the stakeholder theory of Freeman (1984), which concludes that the firm is responsible to all stakeholders (including the shareholders, creditors, employees, and community). Ultimately, the relationship between sustainability and a firm's financial performance is still a controversial one, and further empirical research is warranted.

In this study, we use ESG and financial data of publicly listed firms in the Nordic countries

¹ There are also other econometrical issues. For example, studying the relationship between stock price and ESG performance, as done in some studies, is a questionable approach from an econometric perspective because non-stationarity of stock prices can inflate the t-statistics which then results in false interpretation.

– a region with a long history in sustainability – to study the relationship between ESG and the financial performance of the firms. We use a long sample from 2010 to 2020 to capture the improvements in firms' sustainability performance over longer periods. Most of the earlier studies on ESG have utilized shorter samples. Although a few studies on corporate sustainability have been carried out in the Nordic countries, our approach to studying the relationship with firm performance differs. For example, Lueg and Pesheva (2021) studied the relationship between corporate sustainability and total shareholder return (i.e., observed stock market return), whereas we utilize two different measures of financial performance. The first one is the return on assets (ROA), which reflects the profitability of the firm and allows for testing the tendency for reverse causality as could be the case in the profitability relationship with firm ESG performance. This is done with the approach of including lags of either variable (ESG and ROA) as a determinant of the other in alternative models explaining the relationship. The second one is Tobin's Q, which measures the valuation of the firm, and, as such, is more a forward-looking measure of the firm's financial performance. Our approach provides a robust conclusion that goes beyond the limitations of myopic interpretation caused by using only short samples and one measure of firm performance.

Generally, most studies on the relationship between firms' valuation and financial performance with firms' ESG performance have been done on the US market or less ESG-developed markets (see, e.g., Jayachandran et al., 2013; Fatemi et al., 2018; Buallay, 2019; Miralles-Quirós et al., 2018; Duque-Grisales and Aguilera-Caracuel, 2019; Ahsan and Qureshi, 2021). Our focus on the Nordic countries is motivated by the *ex-ante* expectation of good incorporation of sustainability values in companies' practice. Thus, one can expect to see a robust impact between sustainability and financial performance, if such a relationship exists. For example, Gjølborg (2010), and Strand et al. (2015) note that Nordic countries are characterised by thoughtful leadership in corporate sustainability. This is also seen, for example, from the Global Sustainable Competitiveness Ranking 2021, where all the Nordic countries occupy a position in the top six. The Nordic countries send strong signals to the rest of the world through leadership on human rights issues, social and welfare policies, and unwavering dedication to development aid. All of these show the homogeneity of the Nordic countries in pursuing these common goals.

Furthermore, the Nordic area shares unique regional similarities in sustainable development, yet few interesting national differences in governance approaches that tickle down to the implementation of the SDGs in their respective countries. These countries also share relatively similar welfare systems. A good welfare system can influence a firm's decision to align with sustainability values such as employee welfare, social inclusion, and gender equality. In addition, the ESG scores are calculated based on companies' self-reported activities in various areas of the components. This means the scores rely on the credibility and transparency of the companies to report genuine performance in issues of sustainability. The Nordic countries are known for integrity and transparency in reporting which can be expected to transcend through to comparable ESG scores. Overall, these countries have a culture that is grounded in creating value for society through deliberate and designed corporate sustainability practices that influence the companies' business models (Strand et al., 2015).

Thus, this paper contributes to the literature on sustainability most notably by establishing that the relationship between ESG and firms' financial performance does not have to be one-way but rather a complement of each other. The result contributes to the ongoing discussion on the purpose of the company. For example, Graham (2022) reports a shift from shareholder wealth maximization towards a more balanced view of the stakeholders during the past two

decades in US firms. In addition, the uniqueness of the employed data from countries, in which companies can be said to be at the forefront of actions on sustainability, shows evidence of future development in other countries.

The result of this study shows that using the whole sample, profitability is influenced by the current and immediate past year ESG scores of the firm. At the same time, firms tend to have higher ESG performance when the company has had higher profitability in the current and immediate past year. In pillar scores analysis, only the social pillar of ESG is positive and significantly related to profitability, the governance pillar is related to decreased profitability as we find a negative and significant relationship between the governance pillar score and ROA. Firm valuation is found to be positively related to all individual ESG pillars, the overall ESG score of firms, and immediate past year ESG scores. However, the significance of past period ESG scores seems to matter when more than one year of ESG historical performance is considered with firm valuation.

The rest of the article is organised as follows. In Section 2 we review existing literature in this field of study in more detail and develop testable hypotheses. In Section 3 we discuss our research design. In Section 4 we present the main empirical results, and additional considerations and discuss their implications while the final section summarises the paper and sets out the conclusions while we offer suggestions for further research.

2 Literature review and hypothesis development

2.1 Motivation for sustainability in firms

Over the years, the world has witnessed several environmental disasters that can be said to be the results of company actions.² However, it is the accumulated daily impact of companies that has the biggest impact on the environment going forward. The role of the companies in the environmentally sensitive industry (ESI) will be critical for the development, ranging from emission issues (e.g., global greenhouse gas emissions) to resource use. Companies' environmental impact has also social and economic effects on our world. Social issues like employee welfare, community development, and product responsibility are actions demanded from all companies regardless of their industry.

The motives for companies to engage in ESG activities have been widely explored in the literature over the years. Brønn and Vidaver-Cohen (2009) examined the topic by answering three important questions: what do managers see as important reasons for engaging in society-benefiting activities, whether the reasons differ across industries, and whether empirical support can be found for documented theoretical explanations for firms engaging in ESG activities. They addressed these questions from the theoretical perspective of Davis (1973) highlighting key motives for firms as long-run self-interest that will ensure long-term future performance as well as preservation of public image, the need to maintain continuous relevance which is essential in societal value creation and would ensure that the institution of business retains social power. In addition, the avoidance of regulation which may force companies to lose the flexibility in decision-making and can be costly is cited as another incentive for them to adopt a cheaper alternative in social initiatives and engagements. Other motivation includes changes in sociocultural norms and the business profitability attributed to solving social and societal issues.

² One could mention, for example, the 1986 Nuclear Power Plant Explosion in Chernobyl Ukraine, the Exxon Valdez Oil Spill of 1989, and the 2010 British Petroleum Oil Spill in the Gulf of Mexico.

Largely, the strategic perspective for motives why firms engage in ESG activities is argued from both instrumental and institutional perspectives (Hahn and Scheermesser, 2006). Several studies have shown that the instrumental perspective stems from the belief that the profitability of a firm is improved and maintained through social/ESG initiatives (see, e.g., Gardberg and Fombrun, 2006; Aguilera et al., 2007). The institutional perspective of the motive results from institutional pressures faced by firms to engage in social/ESG initiatives (Babiak and Trendafilova, 2011). According to Davis (1973), the increasing demand for CSR/ESG values has redefined legitimacy criteria for businesses such that economic outlook is not enough to maintain public support, but CSR/ESG values are also required. Finally, a moral perspective is identified as another motivation for firms' engagement in CSR/ESG activities. This is based on the ethical idea that the business has a duty to 'give back' to society. While this perspective is said to have been replaced by the strategic perspective (Kotler and Lee, 2005), the desire to positively contribute to society is still a moral value that some businesses uphold (Hahn and Scheermesser, 2006).

Other motives for companies' sustainability actions have also been discussed in the literature. For example, Bansal and Roth (2000) argue that firms go green for the reason of ecological responsibility while at the same time taking care of their competitiveness and legitimation. The actions to achieve green performance by these firms include reduction in energy consumption, waste generation, and using ecologically sustainable resources with a good environmental management system implemented. Wu and Shen (2013), on the other hand, show that the primary motive for banks to engage in CSR is a strategic one as they find that CSR is positively associated with financial performance. They assert that altruistic motives are not driving banks' CSR activities as they document a negative relationship between CSR and non-performing loans.

Companies' actions toward sustainability have at times been criticised for various reasons. First, the companies are being seen as only greenwashing their operations – no real development takes place in the end. Second, the companies can be seen as only acting to avoid the risk of sanctions or backlash from stakeholders. Confirming either view is challenging because it is obviously in the firm's interest to act to some degree in the interest of the stakeholders and to avoid sanctions that can be enforced when the guidelines and expectations for achieving a more sustainable world are not followed. However, it must not overshadow the fact that the opportunities (e.g., inviting investors whose interests are more aligned with sustainable companies, or attracting new customers who prefer sustainable products) presented to firms who are performing excellently in sustainability issues are enormous.

2.2 Research hypothesis

According to Branco and Rodrigues (2006), CSR (in this case ESG) and the financial performance of firms should not be considered tradeoffs. This assertion is supported by earlier studies (e.g., Orlitzky, 2005; Orlitzky et al., 2003; Waddock and Graves, 1997) that document evidence of high CSR or ESG performance being both a determinant and consequence of high firm financial performance. This suggests the ESG-financial performance relationship can be bi-directional. Thus, as a starting point for the analysis, we study whether profitable firms, especially those in the prior period(s), would be able to financially commit more to environmental, social, and governance issues than those that are not. Vitezić et al. (2012) established that companies with higher financial performance and who fall in the big-size category of firms

have a better urge to engage in CSR activities. Similarly, Alshorman et al. (2022) document evidence that slack resources, including profitability, positively moderate the CSR disclosure and firm market value.

H1: Firms' profitability has a positive impact on firms' (future) ESG scores.

As noted earlier, our main interest is whether firms with sustainable operations do well financially. Initial studies on corporate social responsibility investments (the root of ESG) suggested that a negative relationship exists between ESG and firm profitability and valuation (see, e.g., Vance, 1975; Wright and Ferris, 1997). These studies supported their findings with the shareholder theory of Friedman (1970), who argued that the sole social responsibility of a firm is value maximization and that there are no commensurate rewards to ESG investments by firms. More recent studies have also found continued support for the negative relationship. For example, firms with good environmental performance experience negative abnormal returns (c.f., Lyon et al., 2013) and ROA (Duque-Grisales and Aguilera-Caracuel, 2019), implying that shareholders see investment in this sustainability approach as costly and they usually do not support it (Fatemi et al., 2018).

On the other hand, some studies have found inconclusive results (see, e.g., Horváthová, 2010; Renneboog et al., 2008a and 2008b) as well as evidence in favor of a positive effect of ESG on both firm profitability and valuation (see, e.g., Margolis et al., 2009; Edmans, 2011; Dimson et al., 2015; Fatemi et al., 2015; Krüger, 2015). The positive effect can be motivated using different channels through which ESG impacts firm performance. These channels include, for example, sustainable innovations, efficient processes, as well as reduced energy and material consumption. They have been studied widely in the literature and they are documented to improve firm performance (Aras and Crowther, 2008). In addition, researchers have found a conducive work environment for employees (Bhattacharya et al., 2008), improved customer relations and loyalty (Ramlugun and Raboute, 2015), and general customer satisfaction (Xie, 2014) to be positively related to financial performance. Finally, Choi and Wang (2009) and Hennisz et al. (2014) find that firms that deliver values to a broad spectrum of stakeholders also have higher financial performance. Most of these channels, however, typically require significant operational changes in firms that require extended time to materialise which could account for the inconclusive results on ESG's effect on firm performance. As a result, we form the following hypothesis.

H2: Higher ESG scores have a positive impact on a firm's (future) profitability.

When studying the hypothesis, we acknowledge this type of study faces a major issue with the argument that ESG performance is endogenous (see, e.g., Karnani, 2011; Hategan et al., 2018; Eisenbeiss et al., 2015). The studies argue that the significant effect of ESG performance on financial performance may be biased by the fact that firms do good when doing well (as opposed to doing good leads to doing well). However, we tackle this issue by studying temporal leads/lags in the relationship and using more advanced econometric techniques.

Ultimately, however, we can see that the first two hypotheses are not mutually exclusive. Investments in sustainability (higher ESG scores) can lead to higher profitability which, in turn, can lead to higher sustainability investments. As such, we argue that the relationship between ESG and firm profitability is bi-directional i.e., the ESG performance of a firm can be influenced

by its profitability and vice versa. This argument is in line with Waddock and Graves's (1997) study that established two-directional significance in corporate social performance (CSP) and corporate financial performance (CFP). Their conclusion is based on the theory that slack resource availability to firms improves their CSP and that good management (as in improvements in all areas of CSP) leads to better CFP in the future. Surroca et al. (2010), capture the findings of Waddock and Graves (1997) as implying that CSP is a predictor as well as a consequence of CFP in a virtuous circle. More recently, Lueg et al. (2019) found a bi-directional relationship between organizational sustainability and risk. Similarly, Nelling and Webb (2009), argued that there is a tendency for a bi-directional relationship between ESG and firm profitability due to endogeneity e.g., the timing of CSR/ESG disclosure is strategic to when firms are or are expected to be more profitable and vice-versa. From the strategic theoretical perspective (as in, Hahn and Scheermesser, 2006), the instrumental and institutional motives for firms to engage in ESG activities justify the bi-directional tendency since profitable firms would engage more in ESG activities and ESG activities are the current legitimacy criteria for businesses.

Our third and final hypothesis focuses on the influence of ESG scores on firms' market value. Recently, studies (see, e.g., Kang and Jung, 2020; Miralles-Quirós et al., 2018) found that ESG performance has a positive impact on firm value. These studies have interpreted the positive relationship as evidence in favor of the Freeman (1984) stakeholder theory or value-enhancing theory which implies that ESG ensures optimal contracts between stakeholders in order to foster growth and risk reduction (c.f., Fatemi and Fooladi, 2013). One can also argue that ESG disclosure is capable of reducing agency costs as well as enhancing investor trust as it reduces information asymmetry (Cheng et al., 2014). In addition, an increasing number of investors conduct positive (investing more in high ESG-rated firms) and/or negative screening (disinvesting low ESG-rated firms) which can give highly rated ESG firms preferential access to the capital market i.e., more capital and with the lower required rate. Finally, recent studies have shown that innovation through investment in ESG improves firm value (Hao and He, 2022; Jia et al., 2022). Thus, we state our third hypothesis as follows:

H3: There is a positive relationship between ESG and firm valuation (Tobin's Q).

3 Research data and design

3.1 Sample and data

This study uses both the financial and ESG rating data of publicly listed firms on Nordic (Finland, Sweden, Norway, and Denmark) stock exchanges. The data is downloaded from Thomson Reuters Eikon's database for the period from 2010 to 2020. The sample includes all main stock exchanges (Nasdaq Helsinki Ltd, Nasdaq Stockholm AB, Nasdaq Copenhagen A/S operated exchange in Finland, Sweden, and Denmark respectively, and the Oslo Børs ASA in Norway) and the multilateral trading facilities (MTF) operated by them, i.e., First North Sweden, First North Finland, and Nordic SME. The inclusion of MTFs, which are commonly used by growth companies in their early stages of growth and development, is to ensure all publicly listed firms in the Nordics with ESG ratings during the sample period are captured in the study. This is particularly important given the significance of sustainability in company practices that go beyond the size and status of the firm.

The initially collected data includes 1782 Nordic firms (active or delisted during the sample period) with 501 firms having parallel financial and ESG data at least for one year over the sample period. The loss in observations is because the data on ESG is not available for all companies and/or for all years in the sample period. In addition, banks and insurance companies are excluded from the sample. The remaining 472 firms consist of 61 firms from Finland, 270 from Sweden, 85 from Norway, and 56 from Denmark.³ Overall, 1885 rating observations are obtained for the firms in the sample over the sample period. Our eleven-year sample period is longer than in most prior studies. The sample period covers years when the interest in sustainability was still in its infancy as well as the recent surge in global interest in sustainability. As such, we believe that the sample size and coverage provide enough observations for a representative sample in the study.

3.2 Variables

Our study is concerned with how the opportunity presented by the ESG performance of firms is associated with their profitability and valuation. As such, we limit our research to establishing the direction of the relationship between ESG and firm performance for continuous understanding and efforts towards developing a system that incorporates this non-financial performance measure as much as the established financial performance measures of firms.

The main dependent variables, i.e., measures of firm financial performance in this study are return on assets (ROA) and Tobin's Q. Many studies have used Tobin's Q, the market valuation of a company divided by its assets' replacement cost, where replacement costs have typically been proxied by equity book value plus the liabilities book value (see, e.g., Tang et al., 2012; Fatemi et al., 2018; Alshorman et al., 2022). In this study, we define Tobin's Q as the market value of the company's equity plus liabilities divided by the company's book value of equity plus liabilities. Our second dependent variable, ROA, has also been used in many studies (see, e.g., Choi and Wang, 2009; Fatemi et al., 2018; Ahsan and Qureshi, 2021). It is calculated by dividing a company's net income during a particular year by the book value of assets (equity and debt) at the end of the year.

Tobin's Q is a measure of firm valuation said to represent a firm's investment or growth opportunities (Fu et al., 2016) and ROA reflects current period profitability (Jayachandran et al., 2013). The choice of Tobin's Q and ROA in this study is particularly motivated by the nature of sustainability issues which are both forward-looking and present assessment-focused; as such, the choice of these variables aligns well as a measure of firm performance in this subject matter.⁴

Our main independent variable of interest is the ESG rating score collected from Thomson Reuters/Refinitiv Eikon terminal as a measure of firm sustainability performance. The minimum score is zero and the maximum is one hundred. In effect, we have time-series ESG scores for the firms in our sample. Besides the overall score, the ESG performance in three sub-areas (referred to as pillars) environment, social, and governance is included. According to Refinitiv's definition, overall ESG scores are aggregated scores based on 10 category weights based on Refinitiv's magnitude matrix. A category weight is the magnitude weight of a category divided

³ Icelandic companies are excluded because ESG ratings are available only for year 2020 and there are only six companies in our sample.

⁴ We also tested the model using the Market-to-Book ratio in place of Tobin's Q for robustness and the results are basically similar.

by the sum of the magnitudes of all categories and the magnitude matrix is calculated using numeric and Boolean data points. The ESG score is based on pillar scores which are the relative sum of the category weights. These pillar scores are composed of sustainability categories: resource use, emissions, product innovation, human rights, product responsibility, workforce, community, management, shareholders, and CSR strategy.

As our main control variables, we use firm size as in Buallay (2019), and financial leverage (debt-to-equity ratio) as in Grewal et al. (2008). These variables are particularly important to mitigate the effect of individual firms' characteristics that are due to size and financial strength. Firm size is proxied by the logarithm of total assets and leverage is the ratio of total debts to the book value of equity. In addition, we include two additional control variables as in Hu and Zhang (2021). Namely, cash holding is measured as a firm's cash and short-term investments over its total assets, and tangibility represents the firm's tangible assets (property, plant, and equipment) over its total assets. According to Brush et al. (2000), improvement in revenue of the firm can affect profitability and valuation, hence we control for the effect of sales on firm performance with the percentage change in sales i.e., sales growth variable. Finally, as pointed out by Buallay (2019), in economics-based integrated report research, endogeneity concern is often an issue and this includes correlated variables, reverse causality, and simultaneity (Larcker and Rusticus, 2010). Economic condition positively affects the influence of different ESG disclosure practice on firm financial performance (Alfalih, 2022). For this reason, we also include a macroeconomic variable, the GDP growth (i.e., change in the GDP for the country of the firm in question) which captures the difference in technological advancement, economic development, intellectual property regimes, and other geographical differences (Contractor et al., 2016). We use year, firm, and country-fixed effects to control time and group-specific characteristics.

4 Empirical results

4.1 Descriptive statistics

Panel A of Table 1 provides descriptive statistics for the variables in this study. The average ESG score is 50.89 with a median of 52.39. The score values below 50 are regarded as weak and those above 50 as strong in the Thomson Reuters Refinitiv ESG scores methodology. The average social pillar score, 54.33, is better than the average environmental and governance pillar scores which are 49.23 and 48.45, respectively. Environmental pillar scores are not available for all ESG-rated firms in the sample (hence lower N) and for a very small number of firms they are reported as zero. The standard deviation of ESG and pillar scores (between 20 and 27) shows a widespread as a result of cross-sectional dispersion in the data, indicating that the ratings cover a wide range providing us an interesting starting point for the analysis. The last three columns show the first three partial autocorrelation coefficients for the variables in this paper. It is evident that the dependent variables exhibit strong serial correlation, yet the partial autocorrelation diminishes after the first lag in most cases. Autocorrelation can be of concern in linear regression, as the standard adjustment for robustness considers mostly heteroscedasticity. However, we re-estimate our main regressions with Newey-West adjustment for robustness. In most cases, there is no major impact on the t -values which might be due to short samples. Panel B of Table 1 provides us with an insight into the correlation between the variables of interest in this research. There is a positive contemporary correlation between ESG and pillar

Table 1. Sample descriptive statistics and correlation matrix.

This table shows the descriptive statistics (Panel A) and the correlation matrix (Panel B) for the main variables used in this study. The variables include the ESG score, its three pillar scores (environment, social, and governance) as well as six financial variables: Tobin's Q, Return on assets (ROA), Leverage, Tangibility, CashHolding, natural logarithm of total assets, Ln(Asset), and Sales_growth. Tangibility and CashHolding are calculated as the sum of tangible assets (property, plant, and equipment) and cash in the firm balance sheet divided by the total assets of a firm, respectively. Annual data from 2010 to 2020 is used in the analysis.

PANEL A: DESCRIPTIVE STATISTICS										
	N	Mean	Std. Dev.	Median	Skewness	Kurtosis	ϕ_1	ϕ_2	ϕ_3	
ESG	1885	50.89	20.19	52.39	-0.29	-0.63	0.906	0.165	0.146	
Env	1833	49.23	26.66	51.90	-0.20	-1.09	0.879	0.158	0.109	
Soc	1885	54.33	22.76	56.22	-0.38	-0.72	0.871	0.103	0.097	
Gov	1885	48.45	22.59	48.50	0.03	-0.99	0.759	0.132	0.069	
Ln(Tobin's Q)	1885	0.52	0.66	0.37	1.07	2.44	0.639	0.083	-0.043	
ROA	1881	0.04	0.14	0.05	-4.08	46.99	0.428	0.061	0.022	
Leverage	1885	0.01	0.14	0.01	36.34	1409.94	0.011	0.012	0.007	
Tangibility	1875	0.21	0.22	0.13	1.29	1.12	0.756	0.099	0.023	
CashHolding	1709	0.12	0.17	0.07	4.61	40.68	0.564	0.160	0.037	
Ln(Asset)	1885	21.60	1.98	21.67	-0.02	0.52	0.837	0.083	0.041	
Sales_growth	1658	0.03	0.34	0.04	5.47	144.60	0.142	-0.054	-0.016	
PANEL B: PEARSON CORRELATION MATRIX										
	ESG	Env	Soc	Gov	Ln(Tobin's Q)	ROA	Leverage	Tangibility	CashHolding	Ln(Asset)
Env	0.848***									
Soc	0.894**	0.708**								
Gov	0.722**	0.433***	0.456**							
Ln(Tobin's Q)	-0.085*	-0.158*	-0.049	-0.060						
ROA	0.132**	0.101***	0.166***	0.015**	0.165***					
Leverage	0.022	0.013	0.028	0.016	-0.051	-0.083				
Tangibility	0.107***	0.189**	0.086***	-0.021*	-0.226***	-0.017*	0.063			
CashHolding	-0.152*	-0.176**	-0.169	-0.015**	0.380**	-0.222*	-0.014*	-0.150**		
Ln(Asset)	0.522*	0.580**	0.441**	0.368*	-0.434	0.140**	0.033*	0.040***	-0.409	
Sales_growth	-0.053	-0.072*	-0.057**	-0.024	0.141**	0.136*	-0.036**	-0.072*	0.058**	-0.036

scores with profitability (measured with ROA) but a negative correlation with firm valuation (measured with Tobin's Q). For each model in this study, we conduct the Hausman test of panel regression and variance inflation factors (VIF). The Hausman test is conducted to confirm the choice between random and fixed effects models and find that the fixed effect is appropriate for our models. The test of multicollinearity using the variance inflation factors (VIF) shows lower than 5 for all the models. This means our results are not biased due to issues of multicollinearity (Hair et al., 2012).

Table 2 shows descriptive statistics for the ESG score for each country in the sample. Somewhat surprisingly, Finnish firms are doing better than other Nordic countries in all ESG pillars and the overall ESG score. The statistics in the other countries are relatively similar for the firms on average.

Table 2. ESG statistics by country
This table shows statistics on the ESG performance of firms across Nordic countries.

	N	Mean	Std. Dev.	Median	Skewness	Kurtosis
SWEDEN						
ESG	905	49.63	21.47	51.72	-0.27	-0.83
Env	874	46.40	28.73	48.82	-0.09	-1.29
Soc	905	53.60	24.19	56.07	-0.40	-0.86
Gov	905	48.42	23.02	48.52	-0.03	-1.01
FINLAND						
ESG	283	57.84	18.68	59.46	-0.41	-0.41
Env	283	62.21	22.80	66.83	-0.69	-0.17
Soc	283	59.82	20.28	62.93	-0.54	-0.32
Gov	281	49.78	23.23	49.37	0.10	-1.09
DENMARK						
ESG	321	49.73	17.78	50.95	-0.39	-0.27
Env	316	45.82	24.00	45.40	0.01	-1.12
Soc	321	53.15	20.40	54.58	-0.31	-0.45
Gov	318	47.62	21.63	48.43	-0.08	-0.93
NORWAY						
ESG	376	49.70	19.01	51.34	-0.14	-0.61
Env	360	48.90	23.29	51.97	-0.19	-0.79
Soc	376	52.94	22.35	53.30	-0.19	-0.88
Gov	373	48.22	21.89	47.71	0.21	-1.00

Looking at the mean and average scores alone may not be enough to represent the relative time-series performance in these countries. So, the time-series development of individual countries' overall ESG scores performance is shown in Figure 1. Overall, the ESG scores seem to have improved until 2017 after which they started to weaken. This is likely to be caused by the rise in the bar of reported sustainability practices and activities due to stakeholder demand for increasing standards of sustainability performance in firms as well as the addition of new entrants whose ESG scores typically only grow over time. In addition, the graph shows that Finnish companies post-2014, on average, have consistently performed better than their Nordic peers on sustainability (overall ESG score). Somewhat strikingly, Firms in Norway and Denmark have ESG scores of around 50% on average over time overall.⁵

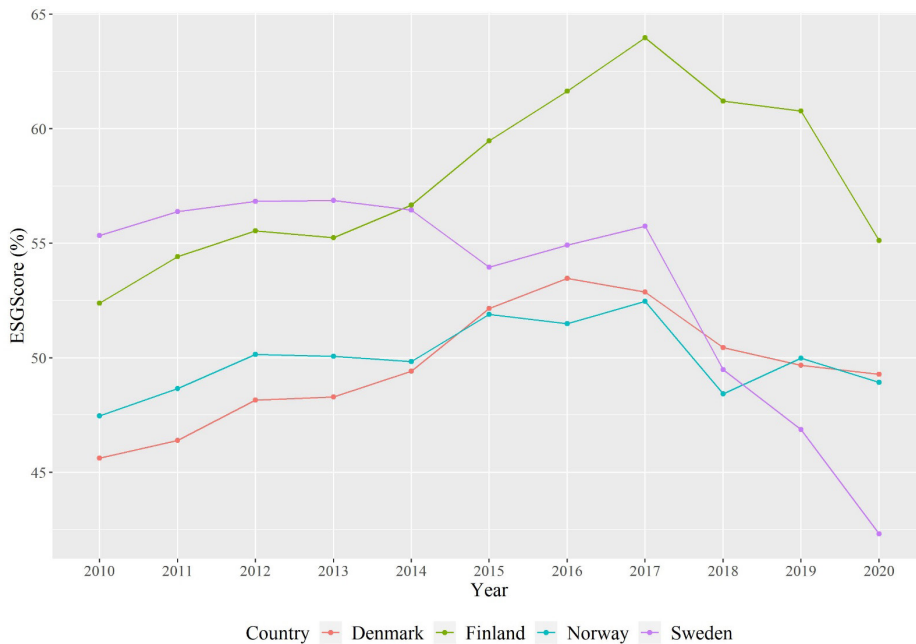


Figure 1. Average ESG score performance 2010-2020

4.2 ESG and firm financial performance

The first hypothesis is based on the idea that the causal relationship runs from profitability to sustainability – profitable firms do good. To test the first hypothesis, we study the impact of firms' financial performance on ESG scores. Estimation is conducted using a fixed-effect unbalanced panel regression model with clustered standard errors. In practice, we estimate the following regression model:

⁵ We show in additional graphs (available upon request) how the existing ESG scores are influenced retrospectively when new companies are added into the Refinitiv ESG database. This is due to the Refinitiv score methodology which is based on industry peer performance in ESG.

$$ESG_{i,t} = \alpha + \beta_1 ROA_{i,t} + \text{Controls} + \gamma_i + \eta_t + \epsilon_{i,t}, \quad (1)$$

where $ESG_{i,t}$ is the overall ESG score, and $ROA_{i,t}$ is the return on assets, both for firm i at year t . Note that both values are for the same year, even though they are reported the next year; ROA is typically in the spring when the financial results are reported and ESG score is a bit later in the year when they are announced by Refinitiv.⁶ Parameter α is the common constant, γ_i is the fixed effect for firm i , and η_t is the time (year) fixed effect. As control variables, this study uses the size, leverage, cash holding, tangibility, sales growth, and GDP growth measures. The results are shown in Table 3.

We test two models where we first use the contemporary and then the lagged ROA to explain the current ESG scores. The results suggest that firms' ESG performance is dependent on how profitable the firm is. The same result holds regardless of using contemporary and lagged profitability in the analysis, although again we find stronger evidence for the lagged effect which is more in line with the intuition that profitability needs to be established before firms invest in sustainability. Next, we re-estimate Model 2 with the addition of the sales growth control variable (Model 3) and lagged values of all independent variables (Model 4). The results are unchanged, an indication of robust outcomes in the influence of firm profitability on ESG performance.⁷ Finally, we again test a finite distributed lag model with three lags of the ROA variable to test whether and in what capacity past profitability matters for ESG performance.⁸ The coefficients are often interpreted as the lag weights and their sequence as a lag pattern (Hill et al., 2018). Interestingly, firms' profitability two years ago is found to be the only significant of the three lag years.⁹ As a result, we re-estimate Models 2 to 4 with ROA lagged by two years instead of one, and again the results stayed practically the same (results available upon request). All coefficients remained significant, although with slightly higher p -values. Overall, the results are consistent with the intuition – profitable companies can invest in changing their operations to be more sustainable, but it takes time before the impact of these actions becomes visible in the ESG scores.

⁶ The timing issue is not of major importance here unlike in event studies as it is obvious that the firm's profitability and sustainability are both revealed to investors throughout the year and the surprise element is quite small.

⁷ We again re-estimated Model 3 with the Newey-West adjustment. The standard error for the lagged ROA is basically unchanged and the coefficient is clearly significant at five percent.

⁸ Distributed lag (DL) models are suitable if the impact from the regressor is distributed over future periods and as such the lags can reveal something about how the impact is borne. DL models are also shown to produce better results than single lag models although they can suffer from collinearity if the explanatory variables suffer from autocorrelation (see, e.g., Basagaña and Barrera-Gómez, 2022). Collinearity typically leads to higher estimator standard errors which make it harder to conclude that parameter estimates are significantly different from zero. However, the least squares estimator is still the best linear unbiased estimator. (Hill et al., 2018).

⁹ The result is the same even if we add the contemporary ROA into the model.

Table 3. Firm financial performance impact on ESG

This table presents results from unbalanced panel regression. The dependent variable is the ESG score for firm *i* during year *t*. Note that ESG is the ESG score for each firm for year *t*, but publicly announced the next year. ESG_1 is a value lagged by one year. ROA_1 are values lagged by one year. All other lags are indicated similarly. ROA is net income over the total assets of the firm. ESG is the overall score for the individual pillars measured as the combined weighted average of the pillars. Ln(Asset) is the natural logarithm of the book value of total assets of a firm at the end of the year *t*, Leverage is the debt to equity ratio of the firm at the end of the year *t*, Tangibility is tangible assets (property, plant, and equipment) over total assets of a firm at time *t* in percentage, CashHolding is cash in the firm balance sheet divided by the total assets of the firm at time *t* in percentage. Sales_growth is the percentage change in firm *i* sales at time *t*. ΔGDP is the percentage annual change in GDP for the country in question during year *t*. Models 3 and 4 are similar but all independent variables including control variables are values lagged by one year in Model 4. The last rows include the fixed effects, Country control, Year and Firm fixed effects, the number of observations in the models estimated, and adjusted R2. Firm-level clustered standard errors are given in parentheses, and *** (**, *) denotes significance at the 1% (5%, 10%) level (two-sided test).

	ESG				
	(1)	(2)	(3)	(4)	(5)
ROA	0.046* (0.027)				
ROA_1		0.060** (0.023)	0.063** (0.028)	0.048** (0.024)	-0.025 (0.045)
ROA_2					0.139** (0.054)
ROA_3					-0.022 (0.052)
Ln(Asset)	0.082*** (0.003)	0.082*** (0.003)	0.082*** (0.003)	0.073*** (0.003)	0.081*** (0.003)
Leverage	0.030 (0.026)	0.031*** (0.008)	0.028 (0.026)	0.024 (0.026)	0.033 (0.025)
Tangibility	-0.022 (0.018)	-0.022 (0.023)	-0.025 (0.019)	-0.039* (0.022)	-0.026 (0.020)
CashHolding	0.147*** (0.026)	0.150*** (0.026)	0.148*** (0.030)	0.134*** (0.038)	0.139*** (0.032)
Sales_growth			-0.027** (0.011)	-0.036*** (0.014)	-0.034** (0.015)
ΔGDP	0.194* (0.111)	0.276** (0.137)	0.297** (0.123)	0.436** (0.171)	0.404*** (0.130)
Country control	Yes	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	1,698	1,607	1,587	1,156	1,384
Adjusted R2	0.379	0.386	0.392	0.294	0.412

As discussed earlier, our main interest is whether the causal relationship also runs from sustainability to profitability – whether doing good is profitable. To test this second hypothesis, we re-estimate equation (1) after switching the role of ROA and ESG in the equation. Results are reported in Table 4. Results for Model 1 show a significant and positive contemporary relationship between the ESG score and financial performance. This result is consistent with previous studies (e.g., Kang and Jung, 2020; Chams et al., 2021). The contemporary relationship asks for a closer look. *A priori* one expects to see the firm's sustainability take some time to be reflected in the firm's profitability. To study this, we re-estimate the model with lagged ESG scores, initially by one year. The positive coefficient for the lagged ESG (Model 2) implies that a good sustainability performance seems to lead to higher profitability. This result is in line with the earlier reviews on empirical CSR literature (see, e.g., Margolis and Walsh, 2003; Orlitzky et al., 2003) that found a positive relationship between investing in what was then termed socially responsible activities and firm financial performance.

In Model 3 we include the sales growth variable to control for the effect of sales on profitability through free cash flow as suggested by Brush et al. (2000). The coefficient for the lagged ESG is highly significant (0.087 with a *p*-value of 0.013 percent) which gives strong support for our hypothesis 2 stating that firms financial performance is positively influenced by its past ESG score.

To validate this result, we do a number of additional tests. First, we estimate Model 3 with Newey-West standard errors which take into account both heteroscedasticity and autocorrelation. The results (available upon request) are similar to those reported although the *p*-value is slightly higher (1.65 percent). Second, we re-estimate Model 3 with all control variables lagged by one year to match the ESG score lag. The results (Model 4) are similar to those for Model 3 indicating that the main result is robust to past development in the control variables. Third, we consider the hypothesis that the impact of ESG on profitability can take years to materialize. To test this and to take into account the serial correlation in the ESG scores, we again test this using a finite distributed lag (DL) version of the model. Model 5 includes the first three lags of the ESG variable. The results show interestingly that only the first lag is significant suggesting that sustainability improvements, in terms of higher ESG score, can result in higher profitability, perhaps even surprisingly fast.¹⁰ Finally, we estimate a dynamic version of Model 3 by adding a one-year lagged ROA among the regressors. Again, the results (Model 6) are consistent with the earlier ones, although now the coefficient on lagged ESG is significant only at a ten percent level (*p*-value is 6.09%).

¹⁰ DL models assume that the error term is not autocorrelated. If this assumption is violated, one can use, e.g., Newey-West standard errors (Hill et al., 2018, p. 448). As the ESG variable shows evidence of autocorrelation even past the first lag, we re-estimated the DL model using the Newey-West standard errors. The results are again basically the same, only the first lag is statistically significant. However, a word of caution is warranted when making inferences from the results as one can still consider the estimation samples quite short and, as a result, the statistical nature of the ESG variable is yet to be discovered.

Table 4. ESG and firm financial performance

This table presents results from unbalanced panel regression. The dependent variable is the return on asset (ROA) for firm *i* during year *t*. Note that ROA is made public at the beginning of the next year when the company announces its financial statement. ESG_1 are values lagged by one year. All other lags are indicated similarly. ROA is net income over the total assets of the firm. ESG is the overall score for the individual pillars measured as the combined weighted average of the pillars. Ln(Asset) is the natural logarithm of the book value of total assets of a firm at the end of the year *t*, Leverage is the debt to equity ratio of the firm at the end of the year *t*, Tangibility is tangible assets (property, plant, and equipment) over total assets of a firm at time *t* in percentage, CashHolding is cash in the firm balance sheet divided by the total assets of the firm at time *t* in percentage. Sales_growth is the percentage change in firm *i* sales at time *t*. ΔGDP is the percentage annual change in GDP for the country in question during year *t*. Models 3 and 4 are similar but all independent variables including control variables are values lagged by one year in Model 4. The ESG coefficients are scaled up by 100 for reporting. The last rows include the fixed effects, Country control, Year and Firm fixed effects, the number of observations in the models estimated, and adjusted R². Firm-level clustered standard errors are given in parentheses, and *** (**, *) denotes significance at the 1% (5%, 10%) level (two-sided test).

	ROA					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG	0.037*					
	(0.022)					
ESG_1		0.021*	0.087***	0.046**	0.141**	0.053*
		(0.012)	(0.030)	(0.019)	(0.070)	(0.028)
ESG_2					-0.089	
					(0.086)	
ESG_3					-0.010	
					(0.065)	
ROA_1						0.384***
						(0.032)
LnAsset	0.008**	0.050***	0.056***	-0.003	0.004	0.028***
	(0.003)	(0.017)	(0.008)	(0.003)	(0.003)	(0.008)
Leverage	-0.071***	-0.032*	-0.031***	-0.148***	-0.056***	-0.018
	(0.023)	(0.018)	(0.012)	(0.017)	(0.016)	(0.011)
Tangibility	-0.055***	-0.008	0.047	-0.080***	-0.057***	0.043
	(0.016)	(0.043)	(0.035)	(0.014)	(0.016)	(0.032)
CashHolding	-0.157***	0.109***	0.197***	-0.006	0.058*	0.203***
	(0.023)	(0.035)	(0.048)	(0.025)	(0.033)	(0.045)
Sales_growth			0.074***	0.053***	0.143***	0.081***
			(0.008)	(0.009)	(0.015)	(0.008)
CGDP	0.293***	0.320***	0.258***	0.251**	0.468***	0.172***
	(0.099)	(0.092)	(0.059)	(0.113)	(0.117)	(0.056)
Country control	Yes	Yes	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,698	1,256	1,240	1,156	768	1,239
Adjusted R ²	0.059	0.059	0.171	0.123	0.189	0.076

Overall, the analysis here examines the debate in the literature on whether firms are doing good as a result of doing well (see, e.g., Hategan et al., 2018; Eisenbeiss et al., 2015). However, our result is in line with the earlier conclusion by Branco and Rodrigues (2006), which argues that CSR (in this case ESG) and the financial performance of firms should not be considered as tradeoffs, and other studies documenting evidence that high CSR or ESG performance can be both a determinant and consequence of high firm financial performance (see, e.g., Orlitzky, 2005; Orlitzky et al., 2003; Waddock and Graves, 1997).

4.3 Firm valuation and ESG

Next, we study the relationship between firms' ESG and stock market valuation. We estimate the following regression to test our second hypothesis. Estimation is conducted using a fixed-effect unbalanced panel regression model with clustered standard errors.

$$\text{Tobin's } Q_{i,t} = \alpha + \beta_1 \text{ESG}_{i,t} + \text{Controls} + \gamma_i + \eta_t + \epsilon_{i,t}, \quad (2)$$

where Tobin's $Q_{i,t}$ is the natural logarithm of Tobin's Q for firm i at the end of year t , and the rest of the variables are similar to those defined in equation (1). In addition, we estimate a finite distributed lag model with lagged ESG scores.¹¹ Results are presented in Table 5.

The results show that there is a contemporary and positive relationship between the overall ESG score and firm valuation. A similar relationship exists when we re-estimate the model with the ESG lagged by one year. These results may sound partly confusing as the first result implies that investors take the firm's actions on sustainability into account as they happen even though the official ESG rating is announced the next year whereas the latter result supports delayed impact.¹² To test this further, we run again a distributed lag model with three lags. The results are shown in Model (3). Now, we can see that the contemporary ESG score is the only significant relationship that indicates that firms' ESG activities are reflected on valuation without lag. Thus, the results are consistent with the idea that investors can track a firm's actions, or lack thereof, on sustainability as they happen – as one would expect in efficient stock markets – and that the relationship is positive. The result is further corroborated when we re-estimate Model (1) with lagged control variables as Model (4). Although the results from the estimation give stronger support for the contemporaneous relationship, one should be cautious about interpreting the result. As the ESG variable shows relatively small, but significant levels of serial correlation after the first lag, the DL models may produce biased results as noted earlier.

¹¹ For consistency, we test the (unlikely) relationship from valuation to the ESG score as we did in the profitability estimation. We find that the result is in line with our expectation that firm valuation does not determine ESG performance of firms.

¹² Remember that ESG scores for year t are reported in the second or third quarter of the next year. Tobin's Q for year t is calculated with year-end market and book data.

Table 5. ESG and firm valuation

This table presents results from unbalanced panel regression. The dependent variable in all models is the natural logarithm of the firm's Tobin's Q for each firm at the end of the year t. ESG is the ESG score for each firm for year t, but publicly announced the next year. ESG_1 is a value lagged by one year. All other lags are indicated similarly. Tobin's Q is the market value of the firm divided by the asset replacement cost. ESG is the overall score for the individual pillars measured as the combined weighted average of the pillars. ROA is net income over the total assets of the firm. Ln(Asset) is the natural logarithm of the book value of total assets of a firm at the end of the year t, Leverage is the debt to equity ratio of the firm at the end of the year t, Tangibility is tangible assets (property, plant, and equipment) over total assets of a firm at time t in percentage, CashHolding is cash in the firm balance sheet divided by the total assets of the firm at time t in percentage. Sales_growth is the percentage change in firm i sales at time t. ΔGDP is the percentage annual change in GDP for the country in question during year t. Models 3 and 4 are similar but all independent variables including control variables are values lagged by one year in Model 4. The ESG coefficients are scaled up by 100 for reporting. The last rows include the fixed effects, Country control, Year and Firm fixed effects, the number of observations in the models estimated, and adjusted R², Firm-level clustered standard errors are given in parentheses, and *** (**, *) denotes significance at the 1% (5%, 10%) level (two-sided test).

	LN(TOBIN'S Q)			
	(1)	(2)	(3)	(4)
ESG	0.539*** (0.081)		0.899*** (0.275)	0.584*** (0.088)
ESG_1		0.451*** (0.086)	-0.453 (0.362)	
ESG_2			0.519 (0.478)	
ROA	1.550*** (0.098)	2.427*** (0.271)	2.636*** (0.143)	2.223*** (0.130)
Ln(Asset)	-0.156*** (0.011)	-0.153*** (0.012)	-0.153*** (0.013)	-0.160*** (0.012)
Leverage	-0.001 (0.082)	0.061 (0.041)	0.073 (0.073)	0.232*** (0.076)
Tangibility	-0.361*** (0.060)	-0.296*** (0.062)	-0.311*** (0.067)	-0.374*** (0.064)
CashHolding	1.482*** (0.095)	1.670*** (0.131)	1.431*** (0.127)	1.545*** (0.114)
Sales_growth	0.125*** (0.037)	0.117* (0.063)	0.037 (0.056)	0.056 (0.04)
ΔGDP	0.656* (0.397)	0.813* (0.417)	0.859* (0.442)	0.508 (0.509)
Country control	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes
Observations	1,590	1,240	981	1,156
Adjusted R ²	0.410	0.486	0.480	0.481

4.4 ESG pillar scores analysis

As a final test, we study the relationship between individual pillar scores and firm profitability (models 1-3) and valuation (models 4-6). This is also in line with common practice in research on this topic (e.g., Nollet et al., 2016; Lueg and Pesheva, 2021). The results with pillar scores are reported in Table 6.

Somewhat surprisingly, we do not find a significant relationship between the environment pillar score and firms' profitability. This might be due to the nature of actions that influence environmental pillar scores compared to other pillar scores. Namely, the actions take typically longer to execute and they often require investments that result in lower profitability in the short term. This view is supported by the results for model 4 where we find a positive and highly significant relationship between the environmental pillar score and the market valuation of the company. Stock valuation, by nature, is forward-looking and as such, it overlooks short-term financial hurdles in favor of the long-term impact of the cash flows.

We find a positive and significant relationship between the social score and return on asset as well as on market valuation. This implies that social performance is beneficial for the firms. This is understandable as social issues of ESG have to do with the workforce, product responsibility, human rights, and the community and they all have immediate and long-term impacts on firms' financial performance. This finding is supported by earlier studies that evidenced the positive impact of CSR on firm performance through positive human resource management (see, e.g., Boesso & Michelon, 2010).

On the other hand, the results show that the governance score has a negative and significant relationship with ROA. This governance-ROA relationship could be down to the fact that companies have invested hugely in related issues such as the gender quotas system that is quite pronounced in Nordic countries. Expectedly, this could affect the profitability of firms in the short term as found by Ahern and Dittmar (2012) who suggested that gender quotas led to younger and less-experienced boards and the accompanying poor firm performance. The result contrasts with the study of Fatemi et al. (2018) on US firms, documenting a more substantial impact on governance-induced ESG disclosure than environmental and social issues.

Table 6. ESG and firm performance.

This table presents results from unbalanced panel regression. The dependent variable in columns (1) to (3) is the return on asset (ROA) whereas in columns (4) to (6) the dependent variable is the natural logarithm of Tobin's Q for firm *i* during year *t*. ROA is net income over total assets of the firm and Tobin's Q is the market value of the firm divided by the asset replacement cost. The E, S, and G pillar scores in ROA models are values lagged by one year while the scores in Tobin's Q models are current period values. Ln(Asset) is the natural logarithm of the book value of total assets of a firm at the end of the year *t*, Leverage is the debt to equity ratio of the firm at the end of the year *t*, Tangibility is tangible assets (property, plant, and equipment) over total assets of a firm at time *t* in percentage, Cash-Holding is cash in the firm balance sheet divided by the total assets of the firm at time *t* in percentage. Sales_growth is the percentage change in firm *i* sales at time *t*. ΔGDP is the percentage annual change in GDP for the country in question during year *t*. The E, S, and G coefficients are scaled up by 100 for reporting. The last rows include the fixed effects, Country control, Year and Firm fixed effects, the number of observations in the models estimated, and adjusted R², Firm-level clustered standard errors are given in parentheses, and *** (**, *) denotes significance at the 1% (5%, 10%) level (two-sided test).

	ROA			LN(TOBIN'S Q)		
	(1)	(2)	(3)	(4)	(5)	(6)
Env_1	0.013 (0.013)			0.338*** (0.067)		
Soc_1		0.046** (0.019)			0.549*** (0.072)	
Gov_1			-0.045*** (0.014)			0.114* (0.069)
Ln(Asset)	0.003 (0.002)	0.0002 (0.003)	0.007*** (0.002)	-0.123*** (0.011)	-0.139*** (0.011)	-0.103*** (0.011)
Leverage	-0.064*** (0.016)	-0.064** (0.026)	-0.061*** (0.017)	-0.087 (0.089)	-0.118 (0.088)	-0.093 (0.089)
Tangibility	-0.058*** (0.014)	-0.062*** (0.015)	-0.069*** (0.014)	-0.534*** (0.067)	-0.442*** (0.064)	-0.463*** (0.066)
CashHolding	0.03 (0.025)	-0.023 (0.050)	-0.005 (0.025)	1.443*** (0.107)	1.416*** (0.101)	1.426*** (0.104)
Sales_growth	0.074*** (0.01)	0.079*** (0.025)	0.075*** (0.010)	0.197*** (0.040)	0.207*** (0.039)	0.188*** (0.040)
ΔGDP	0.354*** (0.089)	0.365*** (0.102)	0.382*** (0.091)	1.060** (0.435)	1.028** (0.425)	1.201*** (0.432)
Country control	Yes	Yes	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,215	1,240	1,240	1,562	1,593	1,593
Adjusted R ²	0.093	0.098	0.098	0.298	0.321	0.298

4.5 Robustness analysis

It is possible that the relationship between ESG and ROA could be driven by large and successful firms as they have higher slack resources to invest in ESG (Aguilera-Caracuel et al., 2015) and as the high-ESG firms have been found to have increased access to external finance (Wellalage et al., 2022). To test this, we re-estimate our Model (3) in Table 3 after removing the top decile of firms with the best financial performance (ROA) each year. The results (available upon request) are similar to those reported earlier, the one-year lagged ESG is still positively related to ROA, although the coefficient of 0.051 is now only marginally significant (p -value 5.4%). The same happens if we estimate Model (3) in Table 4. Again, the one-year lagged ROA is found to be positively related to ESG, now with a coefficient of 0.072 significant at a 10 percent level (p -value 3.2%). All in all, the result supports our earlier conclusion that there is a bi-directional relationship between ESG and ROA.

Typically, there are very little within-firm changes in ESG scores (Bauer et al., 2022). As such the ESG scores are quite sticky and establishing short-term (i.e., year-on-year) impact on firm performance may look forced. Unlike in firm valuation which relies on external multiples like the value of a firm's outstanding shares and debt compared with its asset replacement cost, the relationship of the 'sticky' ESG scores on profitability which is based on internal multiples i.e., net income ratio to total asset can be a challenge. To analyze this, we study the impact of the change in the ESG scores over a longer period on financial performance. Two different methods are used (results are available upon request). First, we run a cross-sectional regression where the dependent variable is the last available value of ROA and the independent variable is the corresponding difference in the ESG (ESG_t minus ESG_{t-5}) calculated over the longest period possible (potentially up to eleven years). The same control variables are used as before. We find the change in the ESG to be positively related to the ROA although the coefficient (0.046) is significant only at the ten percent level (p -value 1.8%). Second, we estimate a panel model where the dependent variable is again ROA, but now the independent variable is the change in the ESG over five years (as a result, the sample includes only ROAs from 2015 onwards). The result is again consistent with the earlier ones. An increase in ESG rating leads to higher ROA. The coefficient is significant at a five percent level (0.089, p -value 4.5%) and economically meaningful (e.g., an increase of 10% would indicate an increase of 0.89 percentage points in ROA). Overall, the result suggests that an improvement in ESG leads to an improvement in profitability, at least during the latter part of the sample (as the five-year difference results reflect the situation in the latter part of the sample).

5 Summary and conclusion

The debate on whether environmental, social, and governance practices of firms are related to the firm's financial performance and valuation has been largely explored in academic research. Most of the earlier studies have argued that firms are doing good because they are doing well rather than doing well because of doing good. Our study addresses the (reverse) causality challenge documented in the literature on ESG-firm financial performance by considering the lag effects and by arguing that the relationship is not necessarily one-way. We add to the understanding of shareholders and other stakeholders on the impact of a firm's ESG performance on their profitability (short-term firm performance measure) or valuation (long-term firm performance measure) with data on representative economies for valid generalisation using data

from the Nordic countries from 2010 to 2020 via the panel regressions model.

Consistent with the earlier result, the result shows that the firm's past profitability is positively related to overall ESG and pillar scores except for the governance scores. The negative relationship with the governance pillar is in line with some findings on corporate governance e.g., Ahern and Dittmar (2012) who found that gender quotas led to younger and less-experienced boards and the accompanying poor firm performance. More importantly, we also found that past ESG performance is positively related to firms' profitability (and valuation). In the robustness analysis, we found clear evidence that an improvement in ESG increases future profitability. Taken together, the results suggest that ESG performance can be a cause and an implication of better firm profitability. These findings have important practical implications for the firms and their stakeholders as far as sustainability is concerned ranging from the importance of reporting positive actions on sustainability to actual steps to improve a firm's ESG score.

This study has some limitations. First, the Refinitiv ESG data suffers from the backfilling issue which reduces replicability to some degree. However, this issue is not a major concern for this study as we are not interested in the stock market reaction to the rating announcements, but rather in the overall effect of firms' sustainability actions on firms' financial performance. These actions are mostly observable even without the ESG rating. Second, one may raise the question of whether the results from the Nordic countries can be generalized to other countries and markets. The Nordics area has been in many ways at the forefront of the change, but the casual observation of the recent development taking place in many countries gives us reason to believe that the results apply to other markets as well.

A good idea for future research is to examine how different types of shareholders affect the performance of firms in ESG and consequently firm profitability and valuation because of the fundamental role shareholders play in promoting sustainable development globally. Similarly, it would be interesting to conduct, a comparative study between developed and emerging markets to understand what aspect of sustainability is important at the different levels of development especially as sustainability issues are fast spreading across borders.

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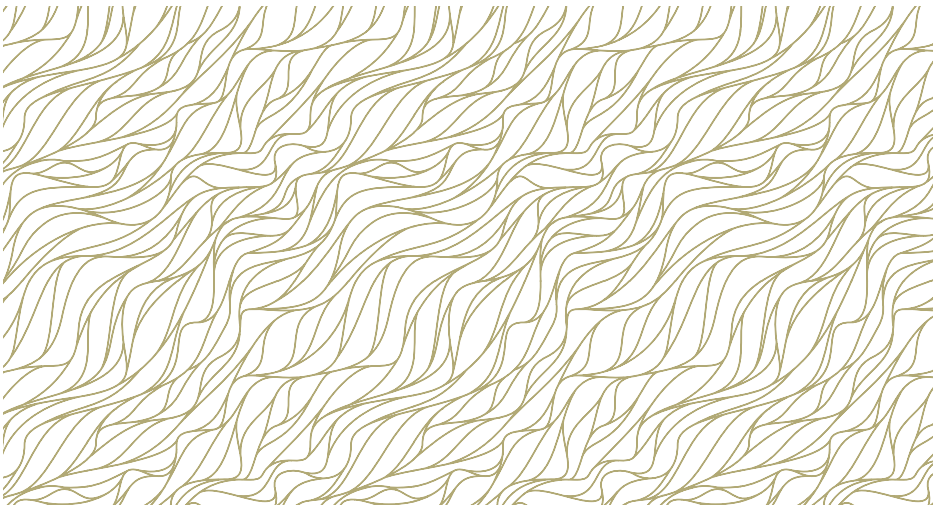
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Editorial correspondence: The Association of Business Schools Finland, Mr. Juuso Leivonen, Pohjoinen Makasiinikatu 7 A 2 00130 Helsinki, Finland.

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