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Impact of Business Intelligence and Analytics on Routine Reporting of Management Accountants in Finland

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ABSTRACT

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The aim of this thesis is to discuss the relationship between business intelligence & analytics and the work of the business controller. The focus is on reporting performed by the business controller, and on how modern analytics tools may impact routine reporting and the role of a controller.

The theoretical framework consists of both Finnish and international literature addressing the topic of the development of the role of the controller and the topic of BI & A. The research is executed through qualitative research methods and the data is collected through semi structured interviews. The interviewees consist of four business controllers and four managers, that are coming from four different companies. All of the organizations are from different industries.

The findings of this thesis conclude that Business Intelligence & Analytics enable management accountants to automate routine reporting and focus more on adding value to the organization. Routine reports, such as, monthly sales, profit & loss and balance sheet can be automated, which enables management accountants to focus more on predictive analytics and being a partner to the management. Furthermore, ad-hoc reporting has become easier as data collection, consolidation and visualization has become easier. BI & A also supports controller's transformation from a more traditional watchdog towards a business-oriented change agent.

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Tämän tutkimuksen tavoitteena on selvittää, miten Business Intelligence ja analytiikka vaikuttavat controllerin rooliin raportoinnin näkökulmasta. Keskiössä on controllereiden tuottamat rutiiniraportit ja miten modernit BI työkalut vaikuttavat näiden raporttien tuottamiseen ja controllerin rooliin.

Työn teoreettinen viitekehys koostuu sekä suomalaisesta, että ulkomaisesta kirjallisuudesta liittyen controllerin rooliin ja Business Intelligenceen & analytiikkaan. Tutkimus toteutettiin laadullisin tutkimusmenetelmin. Aineisto kerättiin haastattelemalla neljää controlleria ja neljää johdon jäsentä. Haastateltavat tulivat neljästä eri organisaatiosta ja kaikki organisaatiot toimivat eri aloilla.

Tutkimustulokset osoittavat, että BI & A mahdollistaa rutiiniraporttien automatisoinnin, mikä siirtää controllerin työnkuvaa yhä enemmän lisäarvon luomiseen. Rutiiniraportit, kuten tuloslaskelma, tase ja myyntidata pystytään automatisoimaan täysin, jolloin controllereilla ei kulu aikaa kyseisten raporttien luomiseen sekä visualisointiin. Lisäksi controllerit kokevat ad hoc-raportoinnin vaivattomaksi, sillä BI-työkalut mahdollistavat nopean datan keräämisen, -yhditämisen sekä -visualisoinnin. Analytiikkatyökalujen mahdollistama ylimääräinen aika mahdollistaa ennustetyökalujen kehittämisen ja liiketoiminnan johdon tukemisen.

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In Helsinki, April 26, 2021

Akseli Peltoniemi

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1.Introduction

This thesis discusses the relationship between business intelligence & analytics and the work of the business controller. The focus is on reporting performed by the business controller, and on how modern analytics tools may impact routine reporting and the role of a controller.

Management accountant's role has been studied since the 80s. Due to the development within the role itself, and ERP technologies, the research has intensified in the 21st century. The role change has gotten the attention of researchers both in Finland and abroad, and the findings seem to be similar: There is no need for a traditional "bean-counter" in a modern organization where enormous amounts of data are available, but rather the trend is changing towards a versatile controller that is management's partner (For example see Granlund & Lukka 1997; Järvenpää 2007). Technological advances in automation have enabled large amounts of data, which is defined by Lee & See (2004) as data collection, data modification and process handling. As a result of automation, this data is also collected and formed automatically, thus enabling controllers to manage their time in a manner that is more beneficial for their organization. (For example see Granlund & Malmi, 2002; Brands & Smith, 2016)

The new trend impacting management accountants is business intelligence and analytics, which drives a change towards modern role development of controllers. Business intelligence and analytics (now on referred to as "BI & A") have been claimed to reduce routine work, and to create pressure for the controller role to change from a "bean counter" to a business partner, by enabling management accountants to be more consultative and produce analytical reports (Brands & Smith, 2016). Eventually, all these new developments decrease the strain of periodic reporting which enables flexible task distribution for controllers (Järvenpää, 2007). Management accountant's functions have developed from data collection towards business analytics. (For example see Bhimani & Willcocks, 2014; Nona & Rahmati, 2011)

On the other hand, some studies have been questioning this modern controller role development towards a more versatile controller (For example see Byrne & Pierce 2007; Vaivio & Kokko 2007). These studies also point out the need for further research to better understand the controller role development. This study is executed due to this need for further research. Furthermore, the subject is topical, as a greater number of organizations utilize BI tools. Management accountant's role is constantly developing as business environments evolve. This is mostly due to technological developments which aim to take away routine tasks from controllers. This claimed decrease in routine work due to development in Business Intelligence and analytics, is highlighted in this study. These developments in analytics create a need for controllers to move away from creating routine reports towards a more analytical, forward looking role (Scapens et al. 2003).

The results presented in this study help organizations that strive to understand the modern demands of controllers, and what improvements BI tools create. In addition, the findings of this study can help recruiters, as this study makes it easier to recognize skillsets and characteristics required in a modern environment. Furthermore, management accountants themselves can better comprehend what is required of them, as the development of BI creates a need for new skillsets. These skillsets can then be improved by allocating resources to best fitting training programs. Lastly, this study can benefit organizations that contemplate on investing into modern reporting tools and analytical processes.

The change in the role of the management accountant has mostly been studied through interviews with controllers. However, it is important to add views of the management as well. This is because management actively work with controllers, and there can be different views on the importance of certain aspects. (For example see Pierce, O'Dea, 2003, 261; Verstegen et al, 2007, 19). Moreover, Pierce and O'Dea (2003) point out that there is a risk if only controllers are interviewed, that they might exaggerate their role within the organization to make their work seem more important than it is. Thus, this study is going to introduce management's point of view to the research of controller's role development in addition to managements accountant's own perspectives. In this study, the

controllers and management will be from different organizations, to ensure a variety of perspectives. Multiple organizations enable comparison of the technology in use to better understand the utilization rate of business intelligence and analytics.

1.1 Focus and scope of the research

Figure 1 showcases the focus of this research. In the larger scale, we are moving in the fields of management accounting, business analytics and finance. From these aspects, we are going to drill down into the controller's role and how it has developed throughout the years. Business intelligence and analytics are reflecting the technological development, which is in this research, studied as the changing force in the routine reporting and the role development of controllers. The focus will cascade to cover the subject of how BI&A impact controller functions through routine reporting.

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┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│   Management    │   │    Business     │   │                 │
│   accounting    │   │    analytics    │   │     Finance     │
└─────────────────┘   └─────────────────┘   └─────────────────┘
        │                     │                     │
        ▼                     ▼                     ▼
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│   Controller's  │   │                 │   │                 │
│      role       │   │     BI & A      │   │    Reporting    │
└─────────────────┘   └─────────────────┘   └─────────────────┘
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        │ Impact of Business Intelligence and Analytics│
        │      on the work of a business controller    │
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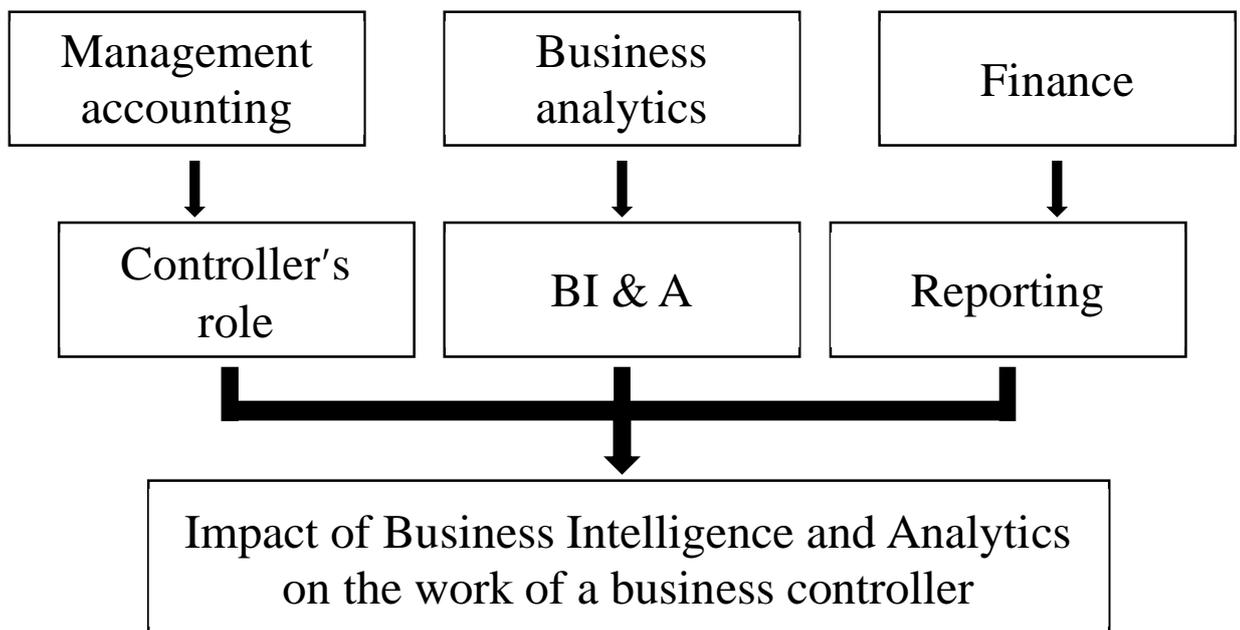
Figure 1. Focus of the study

This study focuses on BI & As effect on controllers' role due to its modern standpoint. Management accountant's role change has been studied widely, but it needs to be re-examined when technological development works as a change

agent within organizations. Furthermore, personal interest of the author played a role, and the question of how the role has changed due to BI, has come from own experiences at work. Lastly, when reading former studies, one cannot disregard the fact that they are quite optimistic to an extent. This study is going to discover, whether the idea of a modern controller, indeed, exists and whether BI & A is part of this change. The need for a modern controller, a controller that communicates with management and can be part of growth creation that is, has been identified a while ago. Granlund and Luukka (1997) already talked about this before the 21st century.

Based on the literature regarding the topic of management accountant's role change, routine work is decreasing, but by interviewing controllers and their management, we may discover that parts of the traditional role exist in every organization and business unit that employs controllers. Management is added to the interview mix because Pierce and O'Dea (2003) discovered that controllers can sometimes overstate their functions as they want to indicate the importance of their role within the organization. Also, there is a strong co-operation between management and controller's, so both views need to be considered. (Pierce & O'dea, 2003)

To confine the study to a tractable whole, we are going to address only Finnish controllers from the private sector. The focus will be in four different companies in order to gain insight from different business environments. This also enables comparison of the different companies, when it comes to levels of implementation of BI & A. Furthermore, it is important to get insight from experienced controllers in order to understand what the controller work was like before the development of automation and BI software. Also, management of these companies is interviewed to reach an unfamiliar perspective and to better understand the expectations a controller has from the management's perspective.

1.2 Objectives & Research Questions

The goal of this thesis is to study how business intelligence and analytics affect the role of the business controller from a reporting perspective. Are BI software enabling more of a modern approach to the role? Meaning that there are more analyticial aspects in reporting, instead of history based monthly reporting. It is important to get the management accountants view to see if the role is really changing. Is BI & A releasing valuable time from routine work towards analyzing business environments and developing processes? We can mirror the results to theory, and see if our findings support the development of the controller role discovered by former research. We want to discover if BI & A are the changing force making the traditional role of management accountant obsolete by erasing routine reporting. It can also be as valuable to discover that even with modern software solutions, controllers still must do traditional functions, such as, crunching numbers and manually producing visualizations. Some studies have recognized that technology or organizational culture do not affect the role development, but rather, characteristical traits of a controller define a certain role adaptation.

For this study, it is important to comprehend what is meant by the word controller. Controller, management accountant, business controller or financial controller can all mean different things depending on organization and geographical location. For example, in the United States, a controller is quite often a senior worker from an experience standpoint. Responsibilities of a Northern American controller often include management accounting and financial accounting. In contrast to this, in Finland a controller is usually an advisor to the management team. In Finland, controllers can be found sprinkled in the business units or profit centers, producing information for decision making. (Ahrens & Chapman 2006, 827: look also Granlund & Lukka 1997, 235-238) In the literature, the term controller is used as a synonym for the term management accountant (Rieg R. 2018). Thus, the terms controller and management accountant are used interchangeably in this study. Furthermore, in this study the term controller is used as an abbreviation of the term business controller.

Former studies have covered the role change and the effect of ERP-systems to the role, which is why BI & A needs to be taken into the conversation and research as well. Even though early 21st century software development has surely changed the way controllers work, the automation of information and BI-tools that make data visualization easier, must have a relevant force of change as well.

The main theme in this research is the changing role of the controller, from management reporting perspective, in an environment where an organization uses BI-solutions to further develop reporting. Usually, organizations use multiple software that each serve a purpose. For, example CRM and Financial software can be separate, but the data from them can be gathered to a BI solution. The goal is to find out the main changes in the controller's role, from reporting perspective, in this modern environment, where BI-tools are in use and automation of ERP data enabled. Furthermore, it is important to look at all the different role adaptations in modern businesses, and to what extent can we expect the time spent on reporting to be reduced. Can we really see the disappearance of "bean counters" role, or is it still in the far future? Perhaps the traditional role is not obsolete despite the fact that we can automate data flow and visualization of data, which enables a more analytical approach. The main research question is:

How do Business Intelligence and Analytics impact controller's job description in routine reporting?

The research around the main research question entails the BI as the changing force of management accountant. Do controllers think that BI tools enable them to use more time to analyze and communicate with the management, or are the routine tasks still present? Secondly, it is important to know how well these BI-software work and how effortless they really are. This can of course vary between organizations. If BI & A enables automated data flow and less time-consuming data visualization, which direction is the role of the controller headed? Former research has noticed the lack of research on the topic of BI & A and controllers. For example Rikhardsson & Yigitbasioglu (2018) point out that even though BI & A can have a significant impact on management accountants, very few papers

focus on the subject. They especially mention the lack of addressing key tasks, such as, reporting. Some studies have noted that controllers do not seem to have taken a full advantage of the opportunities that BI & A creates (For example see Spraakman, Sanchyez-Rodriguez & Tuck-Riggs, 2020; Appelbaum, Kogan, Vasarhelyi, Yan, 2017).

As the study progresses, additional questions are taken into consideration. The main research question is supported by sub-questions as follows:

Does BI reduce the amount of time used by controllers on routine reporting? If so, in which parts of the process is the time reduced and by how much?

How does the time spent on routine reports in controller's work change after the implementation of BI tools?

If BI & A reduces controllers time spent on routine reporting, how do they utilize the additional time gained?

What are the benefits of implementing BI & A in an organization?

For example, Quattrone (2016) claims that BI & A leads to a situation where there is too much data to be managed, which leads to poor decisions from controllers and management, as reports are not accurate anymore. This was disproved by Spraakman, Sanchez-Rodriguez and Tuck-Riggs (2020), but they do point out that studying management accountant's relationship with BI & A is in its infancy and requires more research. Burns et al. (2014) identify a risk in BI & A, which is that vast amounts of data forces controllers to focus on the accuracy of the data. This could lead to a situation where management accountants spend most of their time on validating data and reports, instead of becoming strategical partners of management. This controversy demonstrates the need for further research.

As the management accountants interviewed come from different organizations with different background and time in the profession, we need to ask these sub questions to really get insight on the effect of BI & A. It also helps to discover the

effect of software development on role adaptation to see if technology supports the change towards a change agent, as former studies suggest. It is also important to find out if routine reports are still mainly focused on or has there been a change towards a more analytical reporting.

1.3 Research methods and data

In this thesis, the data underlying the analysis done in this research is collected through existing literature. Furthermore, to gain fresh insight on the topic, empirical research is done. The reason for this is, as mentioned before, the technological development in automation and BI, or more precisely, the automation of data flow and BI-software's ability to produce reports in a visual form. The goal is to comprehend how BI & A drive management accountant's reporting functions forward.

BI & A's impact on controllers' reporting is studied through qualitative data collection methods. The data for this study is gathered through multiple interviews with management accountants and management from different organizations. Qualitative method was chosen because individual controllers and management team members are needed for detailed opinions and stand points. Moreover, qualitative research enables an individualistic gathering of data and interviews have been used regularly when studying management accounting. When it comes to studying practical subjects, such as, the topic of this research, a qualitative method is viewed as a very efficient way of executing the study. (Yin, 2009, 6-7) It enables us to get a more personal look into the subject and makes it possible to map out different procedures used by variety of controllers. The best results are gained through interviews, as this does not limit the possibility for management and controllers to answer openly to questions given to them. An open dialog is needed for proper insight on the topic of management-controller relationship and information production through reports. Additionally, this enables the interviewer to involve in the discussion as well. (Alasuutari, 2011)

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Managers of the organizations selected are interviewed because former studies have mostly focused on controllers without collecting the insights of management. This is not preferable, as management-controller co-operation is vast. Thus, management has insight on what they expect from their controllers. ((Verstegen, Loo, Mol, Slagter, Geerkens. 2007) This study creates a possibility to receive insight from the management about how technological development in analytics has changed the way controllers communicate information within the organization.

Furthermore, information to support our empirical findings, is collected through existing literature of controller's role change through time. Combination of former studies and interviews executed in this study, larger amount of insight is received. Also, comparison of former research gives more insight of the topic. This study brings something new to the table through the topic of business intelligence and analytics. BI & A are new topics that are a new phenomenon, and a topical phenomenon, in this field of study. Along with this, former studies bring an additional comparison to our findings. For example, Verstegen et al. (2007) discovered that individual characteristics of controller's dictated the role adaptation they embraced. Meaning that technological developments did not have a large role on the daily work and use of analytics. Another interesting study for comparison is Granlund's and Lukka's research (1998) that discovered how Finnish cultural traits effect the role adaptations and how controller work is always changing due to software development and changing business environments.

1.4 Structure of this thesis

Chapter 2 covers former studies and the background on the topic of controller's role change and different changing forces that have molded the role from the past to the present day. This entails the coverage of controller's role development's history. Furthermore, different controller roles identified by former literature are described, and some differences between the studies are presented. Chapter 2.2 covers the forces that have affected the development of management accountants. This chapter looks at different triggers that studies have found for the controller role to change. This part of the study also focuses on automation and BI, as they are important concepts to understand. It is covered how these technological developments have molded the role and push it towards a modern controller and how these triggers support former findings of a modern era controller.

Chapter 3 covers the literature review. The most topical articles about business intelligence and analytics' effect on management accountants are presented. Moreover, a documentation of the procedures and steps taken to discover the relevant articles is demonstrated.

Chapter 4 is the empirical part of this study, covering the interviews and findings. Chapter 5 concludes this study and gives suggestions on future research. Additionally, it creates a connection between the former studies and the empirical evidence discovered by this study.

2. Background - BI & A and The Development of the Role of the Business Controller

Stereotypically controllers have been viewed as "bean counters", whose main focus is on the production of financial information for company leadership. In the literature, this bean counter has also a nickname of a "watch dog" or a "number cruncher", which signifies the simplistic connotation that others have for the role. This role has a strong stigma of focusing in the past instead of the future. (For example see Friedman & Lyne,2001; Granlund et al. 1997; Byrne & Pierce 2007, 470) There is a trend that can be recognized from the literature: The traditional role covers the basic roles of a controller but does not create added value for the organization, nor does it develop to any extent. Vaivio and Kokko (2006, 50-52) point out that the traditional role is not valued, as it tends to make management accountants' job too narrow. Furthermore, a "bean counter" does not usually have a proper comprehension of the business environment they are working in, thus making value creation difficult.

Though the existing literature recognizes the need for change from the number cruncher, Granlund et al. (1997) discovered that the traditional role still very much existed in Finland. This can be partly explained by the characteristical aspect of controllers. Friedman and Lyne (1997) point out that controllers can sometimes have difficulties in communicating with others in the organization, which forces them to stay in that traditional role instead of changing towards a change agent. It must be observed that these findings were discovered over 20 years ago. More time and technological development of software was required before a noticeable change could be seen.

A large change in the front of controller's role change happened in the 21st century, when studies noticed that management accountants started to create value and drive for change by supporting management teams. This meant letting go of looking in the history of the organization, and instead, trying to predict the future. Therefore, controllers had to change. Now, they needed to be able to present information and communicate between profit centers, which makes the

job's social aspect to stand out. Figure 2 indicates this change that has been discovered by multiple studies: A transformation from historian to a change agent. For example, Byrne and Pierce (2007) noticed a similar change where the traditional role is forced to change towards a more communicative and modern version of a management accountant.
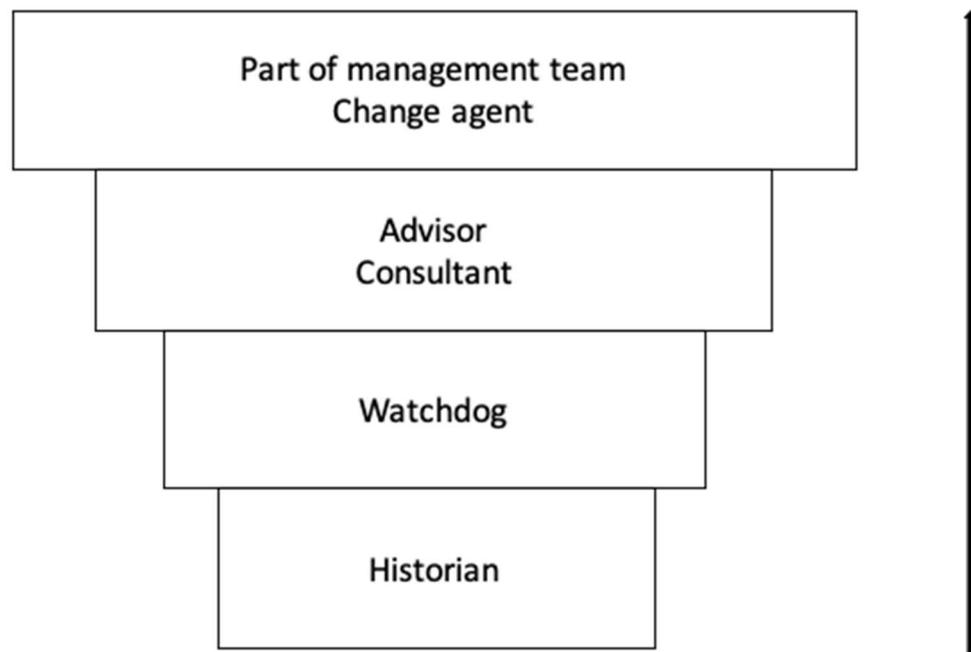
Figure 2: Management accountant's role development through time. The arrow indicates the direction of change (Granlund & Lukka 1998b,187)

It is important to point out that some studies do not believe in the complete disappearance of the "bean counter". For example, Granlund & Lukka (1998) believe that there will always be a part of the job where a bean counter is needed, and that it is impossible to fully adapt into the role of a change agent. This seems rational, as theory and actual business environments always differ. In more recent studies, this view has been supported. Lambert and Sponem (2012) noticed that there is more of a hybrid version of management accountants, meaning that they are partially historians as they do routine work and reports, and partially change agents when that role is more needed or beneficial for them.

ERP systems development also play a role in the role change. As Scapens et al. (2003) point out, ERP systems made it possible for data to flow within an organization, which had not been seen before. This created the "storyteller", who needed to be capable of making use of these data flows to add value. This enabled the transformation from reporting focused, to data analytics focused thinking. (Katz, 2014) This automation has further developed in the 21st century, and BI&A has come strongly to support this mentality. This development of BI solutions and vast amounts of data also create a front of new challenges to controllers, such as data integrity (Appelbaum et al. 2017).

2.1 Variations in role adaptation

As it can be rationalized that a controller's role varies, especially depending on the organizational culture where the controller is working in. A study was executed by Verstegen et al. (2007) in the Netherlands where 300 management accountants were interviewed about their role within organization. 37 different roles were discovered in this study alone. All these roles can be divided into 2 main categories. First one being the watchmen, and second being the information adapters. Like Järvenpää (2001), this study also found out that controller's own characteristics played a significant role in the role adaptation. What also molds the controller role, is the experience of the person. Two different roles were also discovered by ten Rouwelaar (2006, 7) but he points out that the controllers do not only adapt to one role, but rather, they jump between different roles, depending on the situation and which role best suites that specific situation. These two roles discovered by ten Rouwelaar are the controlling role and the supporting role. The controlling role being more of the traditional end of the spectrum, is often useful when precise reporting and accuracy is required. The supporting role comes out usually when working with management, and speculating the data.

Partanen (2001) discovered 11 different role adaptations that a management accountant can have. These roles are divided into three groups: Information and supervision, interactive- & management roles and future focused roles. As Figure 3 showcases, most of the role adaptations can be discovered in the Information- & supervision roles. These are more like the traditional "bean counters" that is covered earlier in this study. According to Partanen (2001, 140-147), "an ambassador" is able to share information and take into consideration different cultures and general differences within the organization. "An interpreter", on the other hand, masters the skill of transforming information to different people in a comprehensive manner. Figure 3 also indicates a certain agenda that other studies, such as, Pihlanto (1998,200) has recognized: Personal preferences and certain attributes dictate what kind of a role one adapts. Additionally, the transformation towards "a codriver" seems to be an outcome of social phenomena and different kind of interactions within an organization.
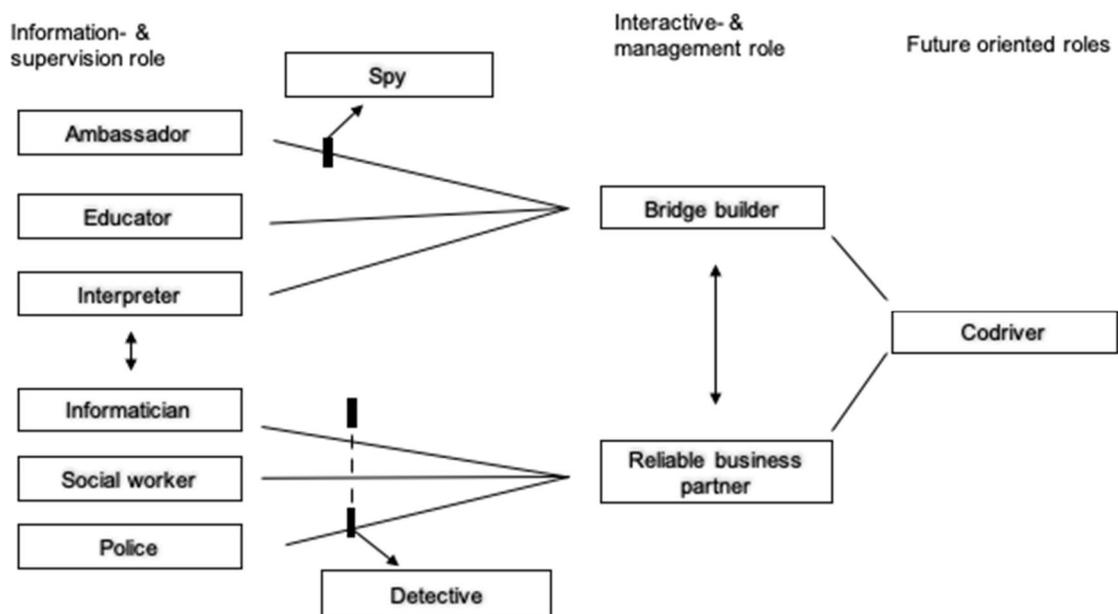
Figure 3. Partanen's role adaptations and their relationships (Partanen2001, 176)

These roles or responsibilities can also be divided in differently. One way is dividing the controllers' responsibilities into local and functional. Functional responsibilities are strongly related to reporting to the management in the head offices, or in so called central management units. Local responsibilities are more about producing information for the profit units and their management. (Maas &

Matêjka, 2009, 1234-1235) Interestingly, it is also indicated that controller cannot do both of these functions, which means that it is needed to choose between these two.

2.1.1 The Hybrid role of the business controller

The hybrid role of the controller, discovered in former studies, supports the idea that management accountants do not just simply adapt to a certain role and stay in that frame. The hybrid role suggests that a controller changes the role depending on the situation and characteristics needed at that point and time. (For example see Granlund & Lukka 1998; Baldvinsdottir, Burns, Nørreklit, Scapens, 2009) Baldvinsdottir et al. (2009) discovered that new innovations should not be adapted too hastily, as they have to be understood by the whole organization. Therefore, some innovations, such as balanced scorecard, is still used by a wide range of companies: Such innovations have proven time and time again that they work. This phenomenon itself creates an environment where the old procedures and responsibilities stay present in the work of a management accountant. Interestingly, Holmgren Caicedo, Mårtensson, Tamm Hallström (2018) present a new point of view, where a possibility of dehybridization, is also seen as a viable result due to the diminishment of a controller's job description.

Other research recognizes the role of the controller combining both modern- and old roles. De Loo, Verstegen and Swagerman (2011) recognize that the role development is headed to the direction of a hybrid role, meaning that modern management accountants are both number crunchers and business partners. They conclude their research with the realization that a fully modern controller has not yet been materialized, and this might never happen, as the demands change quickly with technological innovations. This mixed role of the controller is described by multiple other studies as well, and the hybrid role seems to be recognized by majority of the research executed (for example see Caglio, 2003; Vaivio & Kokko, 2006). Interestingly, the role development of is viewed by many of the studies as unidirectional. Meaning there is only a possibility of changing

from a watch dog towards a change agent, thus neglecting the possibility to transform from a change agent to a watchdog. (ElSayed & Youssef, 2015) This is not surprising, as there is little empirical evidence of this phenomenon (Hyvönen, Järvinen & Pellinen, 2015). It is important to take into consideration Byrne's and Pierce's (2018) discovery that quite often a role is adapted because of expectations from the management, and not from individual desires or the business environment.

Even though intuitively the hybrid role of the controller makes sense, it has not gotten away without criticism. The double role creates conflicts due to expectations from the organization that require a controller to execute both a task of producing information for both management and profit units. Maas and Matejka (2009) point out that it is impractical to demand both bean counter and change agent roles from a management accountant as it creates conflicts. This conflict between the roles makes time management difficult, and often controllers neglect the profit units, thus deteriorating local decision making. This phenomenon is recognized by other researchers as well. Granlund & Lukka (1998) discovered that a bean counter role is of more value in an organization, if a controller is located close to the management instead of the local profit centers.

2.1.2 Modern controller role of the business controller

A modern role of the controller, discovered by studies, is an outcome of cumulative factors related to the changing environment where management accountants' function. The direction of the role development is towards a change agent that is part of the management team. As mentioned before, multiple studies have discovered this change towards a change agent (Byrne et al. 2007; Järvenpää, 2001; Granlund & Lukka 1998b). The development of automation and business intelligence also support this ideology of a modern controller.

The main function of a modern controller is the ability to speculate different scenarios by assessing numbers, and by these actions, predict the future

business environment. This brings more emphasis on the characteristic aspects of a controller, as filling this kind of function requires excellent communication skills to be able to communicate information forward to the management. This transformation to a professional consultant and a partner for the management, creates a situation where the old number cruncher role of the controller is obsolete. (For example see Granlund & Lukka 1998, Järvenpää 2001) Malmi et al. (2001) studied the role development in Finland and mapped different functions that management accountants were occupied in. They asked what the most important tasks in their area of work were. The top three was:

1.1.   Budgeting and yearly planning
1.2.   Reporting of financials
1.3.   Ad hoc analysis of some kind

What makes these tasks interesting, is the fact that these are all affected by automation and BI tools. It is interesting to examine in this study how technological development has affected different organizations in these fields.

Granlund and Lukka (1998, 202) studied the difference between a modern controller and a traditional controller. Table 1. showcases the differences in the ways these characters operate in their fields of business. The traditional role is represented in a negative light, as the modern role is seen to be the only right way forward.

Table 1. Traditional- vs. Modern controller (Granlund & Lukka 1998, 202).

Character	Traditional role	Modern controller
Secular orientation	Emphasis on the past	Emphasis on the present and the future
Knowledge of the business in which the firm operates	Not expected	Expected
The primary aim of communication	Fulfilling of formal information requirements	Active attention attraction in order to get the message through
Felt scope of responsibility	Narrow; covers the production of correct accounting reports in time	Wide; covers both the production of relevant accounting figures and their application in business decisions
Cross-functional appreciation	Limited; based often on fear	High for an active and capable person
General operating style	Information collector and processor	A member of the management team and a change agent

Though it may be harsh to showcase the traditional role in a negative light, other studies have discovered this role change as well. For example, Vaivio and Kokko (2006) executed a study where they question eight controllers from a pool of six companies to discover their role adaptations. They identified that in these six organizations, a traditional watch dog was no longer needed. However, they also discovered that, even though none of the controllers adopted the bean counter role, some of the characteristics of a traditional role were needed when accuracy and attention to detail was required in routine tasks. This gets support from Granlund and Lukka (1998) as well. If we go back to the figure 2. we can rationalize that the arrow should not only point forward, but also backwards. A change agent sometimes must be a historian and a watch dog, to successfully support the management.

2.1.3 Development of the role of the business controller in Finland

A controller and the role of the controller can be viewed in many different ways, depending on organizational culture but also on the country one is working in. For example, in the United States and Germany, a controller is usually a senior worker – a person that has experience and knowledge from the past. In such business environments a controller's responsibilities are not only management accounting but also financial accounting. In these cases, a term Chief Financial Officer (CFO), is often used when talking about experienced controllers. (For example see Zimmerman, 2005, 784; Ten Rouwelaar 2006, 235-238)

This role description can be compared to the role description of Finnish controllers. Usually, the controller term is used to describe a management accountant, whose main function is to provide data for different profit centers. A controller is put into a certain business unit, where calculations for that unit are made to help the management in their decision making. Granlund and Lukka (1997, 238) point out that a controller is someone, who does not work in centralized financial units, but rather is deployed within the business units. Their main function is to produce insight through data, and make sure that the information is used for the greatest benefit of the organization.

2.2 Triggers for the role change of the controller towards being a partner to the business management

Technological development has been one of the major drivers of the role change of the controller. That is why it is the main point of focus in this study. Examples of new innovations are automation of financial software, development of ERP software and Business Intelligence. What does this signify in terms of information production? Well, financial automation enables information flow of payroll, purchasing ledger and accounts receivable. ERPs can produce customer data for controllers in a manner that it does not have to be gathered from multiple places. Eventually, BI tools can visualize all this data into a form that can be used

in decision making. Järvenpää (2007) has named these kinds of solutions "software packages". It is a very descriptive term, as it indicates that there is multiple software being used at the same time, which is realistic as organizations tend to have multiple software in use at the same time.

When it comes to general triggers for change, Järvenpää (2001) has made an onion model (figure 4) where we can see different kind of functions that can force controller functions to change. Changes can come from internal or external variables that change the business environment to an extent that management accountants must adapt. An example of an external trigger could be new requirements in sustainability reporting. Internal trigger could be an adaptation of new software that automate routine reporting. These triggers change the skill set and competence required from controllers. Järvenpää (2001) concludes that these changes eventually mold the character and role of management accountant, eventually forcing the role to adapt into the new environment.
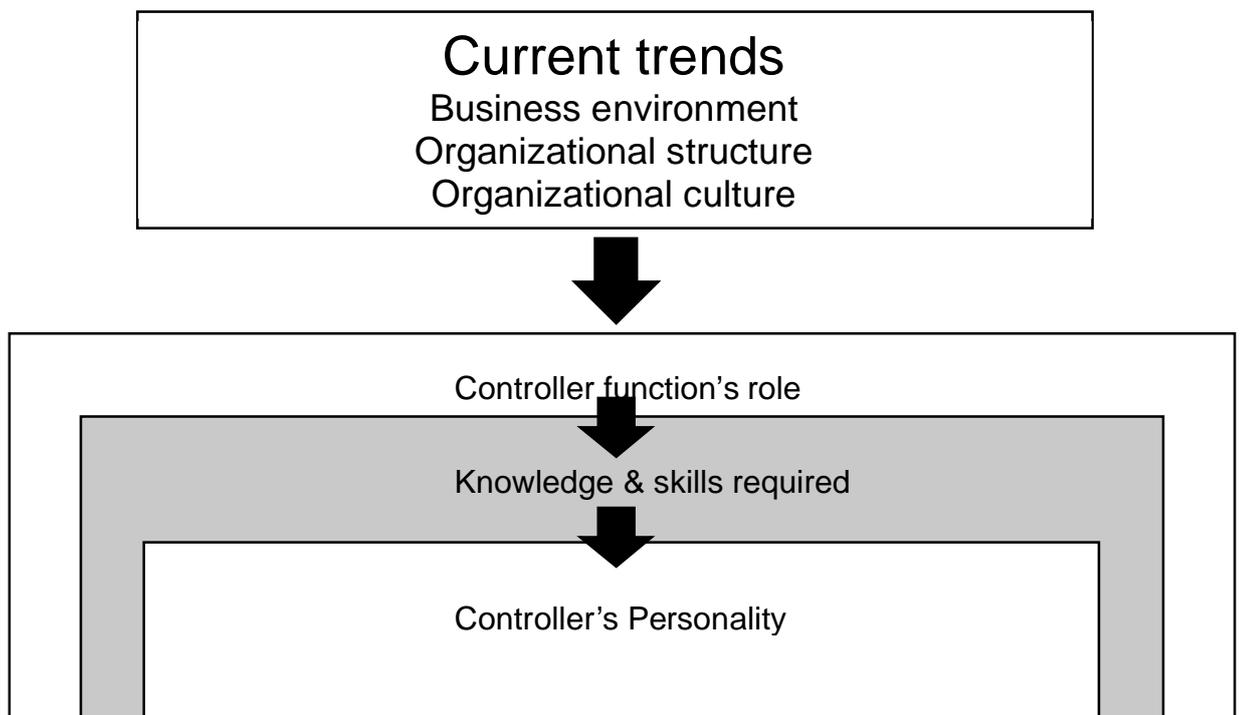
Figure 4. Controller's changing role (Järvenpää, 2001, 454)

ERP systems have their importance in the role change of the controller. For example, Scapens & Jayzeri (2003) point out that one of the major triggers for change have been the development of ERP systems, which has enabled the integration of different profit units, and has also supported processed thinking. This leads to an environment where data is analyzed in a productive manner, triggering more analytical thinking and causality. This again moves the management accountant´s role more towards a forward-thinking change agent that creates value for the management. Moreover, digging deeper into data takes time, which forces the role change to move more into data digging instead of number crunching. (Scapens et al. 2003, 215;223-224)

It is worth noting that technological leaps as triggers for change, especially ERP systems, have been under debate. Some studies have discovered very minimal effect of ERPs on the role of a management accountant. Zarzycka (2012) points out that implementation of new ERP systems does not seem to push for new innovations and ideas. However, the implementation of ERP systems increases the speed and quality of data. Jack and Kholeif (2008, 43) discovered that the implementation of new ERP systems drove controllers even more towards the traditional role. Gullkvist (2013) executed a study in Finland where 70 different companies were involved in. The goal was to see how ERP systems have affected organizations and an interesting discovery was found. It seemed that late adaptors of enterprise resource planning software were more successful in adaptation and taking benefits out of new software.

2.3 Accounting Automation's effect on routine reporting

It is not uncommon for financial statements to be reported to the management multiple days after closing of the books. This is because the information must be collected manually. (Drum, Pulvermacher 2016) Accounting automation's main objective is to make financial management more effective by reducing manual work often done by accountants and controllers. This manual work created by accounting and data transportation takes time that can be reduced by automation of routine tasks to increase effectiveness. (Lahti & Salminen, 2014;27-28)

According to Granlund & Lukka (1998) automation supports the role change from bean counter to change agent, and the direction where controllers are heading in the future. Decrease of routine work enables more time to be spent on analysis, which enables the role of the controller to be more towards the change agent. Also, automation enables the effective collection of ERP data, and effective use of BI tools.

Some benefits of accounting process automation according to Brand & Smith (2016) are:

- Reduction of repetitive functions and decrease in human error
- More current information due to faster process cycles
- Improved control of internal processes

If we look at management accountants daily work, Brand & Smith (2016) point out that automation enables an increased amount of output due to the reduction in routine work. Controllers can focus more on the data instead of manually putting in the data, which rationally increases the quality of information. Harrast (2020) holds the same point of view by pointing out how automation takes away collection of data and entry of data from processes, which saves money and enables a better usage of resources. Also, it enables management accountants to create more value and critically look at the business for new innovations. Thus, extra time should lead into more detailed and specified reports being created.

Software development does not come without a price. Accounting automation, for example, demands more knowledge in IT from controllers. EY executed a research in the UK about the development of controllers and the main discovery was that demand for IT skills had increased rapidly. 82% of financial controllers viewed that the job had become more demanding and requirements for IT skills had been increasing during their careers. The management accountants participating to the survey claimed that this was due to development in technology. (EY 2007) This has also been recognized by other studies. It has been noted that development in technology creates a demand for controllers to

develop their skills in statistics and econometrics so that they can get more out of their work (For example see Nielsen, 2018; Wadan & Teuteberg, 2019)

2.3.1 Software development and the change in controller functions

If we look at the most basic function of management accounting, it can be viewed as production of information for the organization. The end purpose is to mitigate decision making and help the management in their decision making. In addition to this, controllers supervise their organization. (Burns & Scapens, 200, 4) The development of the role has been on the agenda for quite a while, and there is an abundance of research material about the role change and what controllers should do. Sathe (1983) points out that controllers can either work in the business units or higher up in the organization. Either way, they produce information for their units so that it is easier to function. Like Sathe, many of these studies from the 80s and 90s focus on basic functions such as budgeting and monthly reporting. Nowadays this is rather obsolete focus as the world has moved on. Early 2000s introduced us to the development of ERP software, and this was is recognized by studies, as it is a common subject when figuring out the controller's role change due to technological developments. These studies indicate that the development of ERP software has no substantial effect on the role of the controller. (for example see Granlund et al, 2002; Scapens & Jayzeri, 2003)

The technological development has been quite rapid in the 21st century due to many technological innovations, such as, EVA (economic value added), which have influenced the role of management accountants. (For example see Burns & Vaivio, 2001; Järvenpää,2001) Development has created new opportunities through new innovations, such as, software with integration possibilities. Classis example of this in larger corporations would be the implementation of SAP. Integrations or APIs have an important role in being the changing force in the role change of the controller, as well as automation. For example, Granlund and Mouritsen (2003) noticed the changing force and mention that technology will change the role drastically from the traditional bean counter towards a change agent.

These past ten years have been substantial when it comes to the development of software and automation of financial data. Automation in the area of financial data entails, for example, Robotic Process Automation or artificial intelligence (Harrast, 2020). Automation is the new change agent, that drives the change towards a modern controller that has been widely speculated upon in the past research. (Brand & Smith, 2016) Automation does not simply mean fast management of data, but it also opens the doors for business intelligence and development of processes. We have never had as much information available as we have today, and this creates new opportunities (Richins, Stapleton, Stratopoulous, Wong, 2017). What Richins et al. (2017) are after, is the fact that technological development does not make management accountants obsolete, but rather creates new opportunities and jobs for controllers.

Modern software enables the automation of financial information to a large extent. This means that purchasing- and sales ledgers are automated, and basic accounting does only require human attention when it comes to anomalies and special procedures. Through this automation we get balance sheet and income statement to the use of controllers without having to use manual work. When we have automated financial information, through APIs, we can transport this information to BI tools where the data can be transformed into visual form.

2.4 Business Intelligence and Analytics

As Steen (2018) points out, analytics can entail a wide variety of definitions and functions depending on the person. Therefore, it can be difficult to define analytics perfectly. Rikhardsson and Yigitbasioglu (2018) define BI & A as technology that entails automated collection of data, analysis of data and movement of information that supports decision making. This is a suitable definition that we can use in our research as well. Others have defined BI very similarly. Business intelligence, or BI, means automated processes that gather data from different sources for the organization. It turns raw data into information that can be used in decision making and strategical planning. Nowadays the BI&A is developing fast as we have more and more devices & sensors that enable automated data collection and refinement. (For example see Vo et al. 2018; Chen et al. 2012; Chauduri, Dayal & Narasayya, 2011)

Even though BI was recognized already in the 90s, plenty of organizations have not fully acknowledged its benefits. These software keep on developing and controllers need to be ready to learn new skillsets and make use of the technological development. (for example see Chen et al. , 2012; Granlund & Lukka, 1997) To keep up with competition and technological development, companies need to invest in BI tools. Furthermore, companies need to make sure that their controllers have the skillset and knowledge to produce quality information with the data at hand. (Chen, 2012)

Data itself does not create value, and it needs to be turned into information that mitigates decision making from the management perspective. Management of this information can be divided into different categories. For example, Chen et al. (2012) have divided it into BI&A 1.0, BI&A 2.0 and BI&A 3.0. In BI&A 1.0 the data is collected from ERP tools and mainly statistical methods are being used to gain insight of the business environment. In addition, basic visualizations are created to understand the data. BI&A 2.0 differs from the earlier development stage as it takes advantage of web-analytics. This indicates that an organization gathers data from its customers through Internet and can analyze their needs and preferences. The data is usually unstructured and needs different procedures to

further develop than in BI&A 1.0. BI&A 3.0 is the next step because it takes into consideration the vast amount of data coming from mobile devices and various kinds of sensors. With 3.0 big data and internet of things comes into the conversation, and we have not yet seen the full potential of it.

Development of IT systems and data warehouses has enabled a more advanced analyzation of information within an organization and enables a better prediction of business environments. One of the major developments is the combination of external and internal data, that also affects the reporting functions of management accountants. Not only can we predict what has happened, but also, what is going to happen in the future. Further analyzation enables calculation on what is the most optimal outcome or a scenario in the business environment. (Appelbaum et al. 2017) The flow of this data is enabled by development in sensors and software, thar are linked into the data management systems such as ERP software (Porter & Heppelmann, 2014). This data flow combined with automated functions creates an abundance of information, which creates a problem form management accountant's perspective as it can be challenging to recognize significant information from these data masses.

2.4.1 BI & A and Controllers

How are controllers and BI&A related to each other? Management accountants are expected to produce reports for organizations, and BI&A can support this function. To execute this strategic role, it is beneficial to have a skillset that enables the usage of analytics tools such as BI software. (Pickard & Cokins, 2015). This kind of adaptation of analytical tools is also an enabler towards the business partner role for controllers. It also enables controllers to create information that create competitive advantage for businesses, which changes management accountant's role toward more strategic, rather than the classical bean counter. (for example see Granlund et al 1997; Pickard & Cokins, 2015.) Companies have been awakened to this realization, and data driven thinking has been acknowledged to create competitive advantage, and it craves more from controllers, than just technical knowledge on how to use BI tools.

Quinn (2014) has identified three ways a management accountant can support an organization through data analytics. First, a controller can create good relationships with analytics specialists. Second, they can refine data analytics into insightful business ideas by constantly asking about variables that effect the business. Third, they can make sure that data being gathered is of high quality and relevance. This is already being done with financial data, so it is easy to expand it to non-financial data. Opportunities created by data analytics clearly work as an enabler towards the modern role of a controllers.

These kinds of modern functions can also strengthen the old watch dog role. As Burns et al. (2014) points out, massive data flows and analytical tools that enable high volumes of information production can force management accountants to regress to more traditional functions founded by research. This is because reports need to be monitored and made sure that it complies and is relevant. So, perhaps the BI&A pushes, in some cases, controllers away from the business partner aspect. This would indicate that BI & A does not further develop reporting nor controller-management relations.

2.5 BI & A and the Development of the Role of the Controller

This section presents all the important concepts in the form of a table. Table 2 presents a summary of these important topics and explains what they are. More details can be found from above in the background part of the study.

Table 2. A summary of concepts

Controllers' role development	Originally the role entailed mostly producing financial reports to the management and there was no extra value created. With technological advancements, such as development of ERP software created a change towards more involved controller. The role started to change towards a more analytical, forward looking managements partner.
Watch dog/number cruncher	A traditional controller who focuses on historical data. No emphasis on added value. Does not have a deep understanding of the business environment.
Triggers for change	ERP systems, BI & A , automation, business environment, personal traits etc.
Modern role	A management accountant that analyses data and is part of the management team. Knows the business very well and can support management decision making.
Hybrid role	Combination of a watchdog and a modern role. Management accountants adapt depending on a situation and task they are working with
Automation of financial data	Reduces manual work by automatic processes such as purchasing ledger. Also enables automated reports such as balance sheet and financial statement.
API	Application Programming Interface enables communication between to applications. For example, BI software and financial software can be connected to create an automated dataflow, which reduces manual work.
Business intelligence & analytics	The Business Intelligence and analytics is the automated process of collecting raw data from heterogeneous sources and organizing this data in a systematic manner such that models and insights can be created from the information/data to improve business processes.

3. Literature review

In this part of the research, we are going to look at the existing literature covering the topic of BI & A, and its effect on routine reporting from controller's point of view. The databases used for this literature review are as follows: Emerald Journals, Google Scholar, ProQuest Central and Elsevier, to name a few. A proper literature review is going to support our empirical part of the study. Subjects that are too broad should be avoided in literature review so that the focus stays relevant (Rowleyt & Slack, 2004)

The main goal is to support our research with existing literature about the subject. Webster and Watson (2002) have divided the literature review into three steps. First step is to find the leading articles supporting our topic. These are most commonly found in leading journals from the field of study. Second step entails familiarizing oneself with citations found from articles in the step one, to find more related articles. The third step is to discover studies that have in turn cited articles from the step one. We are going to implement these procedures suggested by Webster and Watson. This process is demonstrated in figure 5.

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│        Step 1           │
│  Search using the optima│
│       keywords          │
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│        Step 2           │
│  Going through abstracts│
│      and titles         │
│                         │
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            ⬇
┌─────────────────────────┐
│        Step 3           │
│   Backtracking. Going   │
│   through introductions │
│ and literature reviews to│
│    find more relevant   │
│       articles.         │
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Figure 5. Three steps for discovering relevant articles
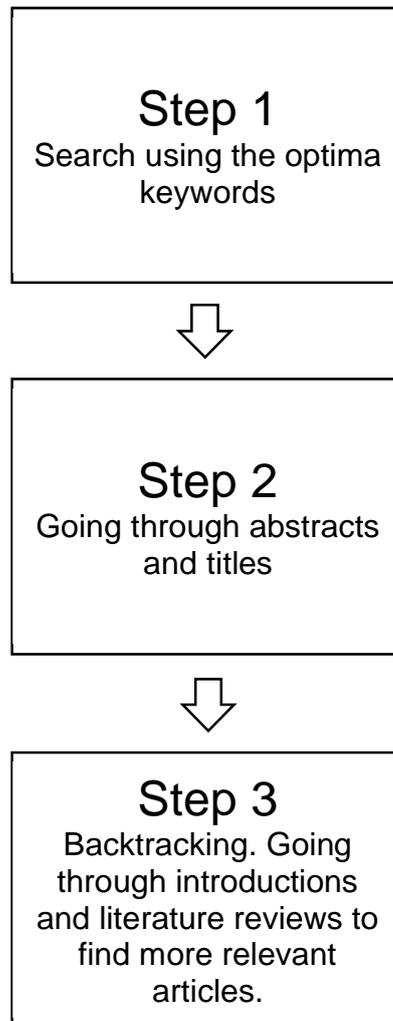
Through this literature review, we want to build a solid basis for our empirical part of the study. Through existing literature, we can discover the current trend on the topic. We can also benefit from questions that have been asked before. Eventually we want to bring something new to the table and get support to our findings through discoveries of existing research.

3.1 BI & A's effect on management accountant's routine reporting

The process is started by using certain keywords to discover the most relevant literature covering the topic of business intelligence and analytics' impact on routine reporting. The search words used can be seen from table 3. Additionally, table 3. highlights the amount of search results each combination created and visualizes the search process executed.

Table 3. Process of finding the right keywords

Keywords	Results
"Business intelligence and analytics impact on controllers"	0
business intelligence and analytics, management accountants	4582
"Business intelligence and analytics" and "management accounting" and "management accountant"	23
Subject contains Business intelligence AND any field contains Controller AND any field contains Reporting	69
Subject contains "business intelligence" And any field contains "management accounting" AND any field contains "reporting"	18
"business intelligence" AND "management accountants" AND "reporting" OR "business intelligence" AND "controller" AND "reporting" OR "business intelligence" AND "management accounting" AND "reporting"	1889

These different search combinations gave as various results and yielded various amounts of articles. One noticeable aspect was that the keyword:" management accountant" yielded more articles than "controller". Furthermore, reading the relevant articles found from the abstract, intro and literature review, we notice that studies about business analytics involved the topic of BI & A. Some combinations of keywords did not work. For example, some of the combinations created too few hits but combining relevant articles from different searches, we were able to collect the most relevant ones. Finally, *106 articles*, that are used in this research, were yielded through the validation process.

There is a risk of missing some relevant articles, if the search is not expanded. Ultimately, using more advanced search methods is the most beneficial. We narrow down the search using advanced search, in which we limit the search to include only articles written in English, and the publish date is no later than 2014. There was a need to search the terms management accountant and controller separately, as they did not work well combined. Eventually, all the necessary articles were found from the last combination of the queries seen in the table 2. From 1889 articles we filter away, industry snapshots, as they were not addressing our topic. This yields to a total of 106 articles that we are going to use. It was easy to find the topical ones, as we only read articles including all these keywords in the text. For example, articles containing only the keyword "management accountant" are not used at all as they are missing important topics related to this study. We have collected some of them to table 4, where one can have a quick look at their main findings.

The problem in finding the right key words, is that BI & A, was often combined with research papers about business analytics in general. For example, the search word "business intelligence and analytics, management accountants" produces a very wide variety of articles about BI, analytics and management decision making, etc. Due to this, the keywords must be very precise. This way we can narrow the search into only a few articles. One criterion was, that studies covered in the literature review had to cover the topic of BI & A, even if the study has keywords such as analytics, managerial analytics or business analytics.

An additional difficulty is created by a variety of definitions when it comes to management accountants. For example, lots of articles were eventually about accountants, not controllers or management accountants, so we need to disregard these studies. Adding the search term "management accountant" into the search query helped with this problem. Also, controller term is rarely used, and former studies tend to favor the term management accountant.

Main articles selected are only covering the topic of management accountants and their relationship with business intelligence and analytics. Some of the article's headlines indicate that they are about analytics, but all of these subjects include business intelligence and analytics as well. This mixture of terminology is nothing new as Rikhardsson and Yigitbasioglu (2018) point out about defining BI & A as a term: "BI&A is an "umbrella term" in that it encompasses a variety of technologies and methodologies that enable organizations to collect data from internal and external sources, prepare it for analysis, develop and run queries against the data, and create reports, dashboards and data visualizations to make the results available to end users." This indicates that we must settle with the fact that the exact word of BI & A might not always be on the headline of a paper, even though the paper is, in fact, covering the topic of BI & A.

Table 4 presents selected studies from the yielded 106 studies and summarizes the main findings. In the first column, the authors and publishing date of the article. Second column entails name of the articles. In the third column, a brief summary of the content is given.

Table 4. Relevant articles

Author & Date	Headline	Summary
Brands (2014)	Big data and business intelligence for management accountants	Technological development of BI and Big data will transform management accounting towards more predictive and analytical role. Management accountants must adapt.
Rikhardsson & Yigitbasioglu (2018)	Business intelligence & analytics in management accounting research: Status and future focus	Even though BI & A might have a significant impact on controller's functions and roles, very few studies focus on the impact.
Appelbaum, Kogan, Vasarhelyi, Yan (2017)	Impact of business analytics and enterprise systems on managerial accounting	The role of a controller is evolving towards more strategical role, which indicates moving away from historical information towards supportive functions in decision making.
Kowalczyk & Buxmann (2015)	An Ambidextrous Perspective on Business Intelligence and Analytics Support in Decision Processes: Insights from a Multiple Case Study	BI & A can be a very effective tool to mitigate decision making but it has multiple aspects to be taken into consideration for it to truly work.
Brands, Holtzblatt (2015)	Business Analytics; Transforming the Role of Management Accountants	Emerging trend from transaction-based accounting to analytics is changing the role of management accountants. The role development is mostly due to vast increase in data available.
Oesterreich & Teuteberg (2019)	The role of business analytics in the controllers and management accountants' competence profiles: An exploratory study on individual-level data	It seems that controller's do not have the skills needed to fully benefit from BI & A and there is a large skill gap between a controller today and controller of the future. la

Spraakman, Sanchyez-Rodriguez & Tuck-Riggs (2020)	Data Analytics by Management Accountants	According to the findings of the study, BI & A supports the quality of data and predictions. This is because BI & A reduces complicated processes from analysis and presenting reports.
Lawson (2016)	How Controllers Become Business Partners	Traditionally controllers have been producing routine reports such as end of the month reports. Nowadays more and more controllers need to use their analytical skills for more strategy-oriented functions.
Fatema El-Wakeelm, Jiles & Lawson (2020)	Storytelling With Data Visualization	Management accountants need to find new ways of creating value with the help of BI & A. The role has moved from a watch dog to a business partner. Routine reports such as financial information is not enough. Ad-hoc reports and reports supporting strategy are needed.
Smith & Mishler (2016)	Better Performance Through Analytics	BI & A are vital for management accountants. Bi takes away manual processes, thus saving time when creating reports. Also, BI enables predictive analytics
Möller, Schäffer & Verbeeten (2020)	Digitalization in management accounting and control: an editorial	BI & A has resulted in automation of routine processes from controller point of view. These developments can change not only the management accountant function, but also the role as whole. Controllers most likely must update their competences.
Smith & Driscoll (2017)	Key Skill Sets for Management Accounting	Controllers must develop in reporting and using of BI & A. New skillsets can be divided into three aspects: Domain knowledge, Technical ability and Analytics

These relevant articles about the topic indicate that there is very little academic research to be found from the databases mentioned above about BI & A-controller relationship. This can also be rationalized by reading Rikhardsson & Yigitbasioglu (2018) research, where they point out this lack of research. Also, one notable problem about this topic, is the fact that BI & A can be defined in multiple ways and the scope can vary.

These most relevant articles and their insight is used to support our empirical part of the study. We are going to be able to compare the results of this study with former research through interviews with controllers and management. The topics covered in these studies will also be looked into in our interviews. This way we can compare the results and see whether we get similar- or contradicting results

3.2 Findings

This section describes some of the most relevant articles discovered. This is to give a quick look at the literature, and to gain an understanding of the underlying concepts. The main focus will be on the general findings about Business Intelligence and Analytics relationship with management accountants, which are described shortly below.

Brands (2014) points out in the article that BI tools cost a lot less than five years ago, so they are cost effective to implement. When it comes to management accountant reporting, the study includes that controllers should focus more on predictive analytics, as BI and A enable these predictive functions. It is clear that a traditional role cannot be effective anymore as management accountants have to adapt, or they will become useless to their organizations. (Brands 2014)

Rikhardsson and Yigitbasioglu (2018) claim that there is a clear linkage between management accountants and BI & A, as they tend to support decision making. Still, there is very little research about this topic, and therefore, they recommend the topic to be researched in the future. Only 19 studies between 2008 and 2018 had empirical evidence of the relationship between BI & A and management

accounting. While literature indicates that BI & A can have a significant impact on management accountants' functions, not enough research has been executed. Current understanding of the technological development in the area of management accounting is worrying. (Rikhardsson & Yigitbasioglu, 2018)

Reporting of historical information does not cover expectations from management accountants today. The demands for the management accountants have increased, and reports must mitigate decision making. One of the greatest challenges controllers are facing, is what information to present and when. There is a considerable risk of reports containing useless information. Furthermore, data analytics and managerial accounting are clearly vital functions of business intelligence, and they need to be investigated more. This can really benefit the profession of management accountants. (Appelbaum, Kogan, Vasarhelyi, Yan, 2017)

Kowalczyk & Buxmann (2015) point out that decision makers are usually not experts in analytics, which is problematic from BI & A point of view as it requires skillsets in analytics. Nonetheless, relying on intuition in managerial decision making is too risky, and analytical tools can support decision making processes. BI & A do not come without their problems and its users must be aware of it. There is a struggle between keeping the data quality stable and being able to do ad-hoc reports that require more modification. (Kowalczyk & Buxmann, 2015)

Brands & Holtzblatt (2015) point out that investing in analytical tools such as BI can bring competitive edge by better insight and decision making. Also, it is easy to justify the costs created by analytics-tools as they are not expensive nowadays. Thus, there is no excuse for organizations to start adapting these tools. These tools must be adopted by management accountants as well, because otherwise the role will be left behind by technological development. It is also suggested that analytics-tools should be reviewed annually due to quick development. (Brands & Holtzblatt, 2015)

Oesterreich & Teuteberg (2019) compare the technological developments in analytics and how management accountants keep up with the development. The conclusion is that there is a skill gap and controllers' need to step up their skills in BI & A. It should be noted that there are organizational differences and other aspects that correlate with the skill level. For example, some organizations can adapt IT faster than others, and this can also make controllers within that organization more adaptable. (Oesterreich & Teuteberg, 2019)

Spraakman, Sanchyez-Rodriguez & Tuck-Riggs (2020) point out that the role of a controller has not changed according to their findings, but it has become wider in terms of responsibilities. Management accountants have two roles. Firstly, they are responsible for preparing the data used for analysis. Secondly, they are to present the data and communicate information within their organization, which heavily involves business intelligence and analytics. In addition, BI & A enables better comprehension of financial numbers due to capability to drill down and analyze current trends (Spraakman, Sanchez-Rodriguez et al. 2020).

Lawson (2016) emphasizes the change in controller's role, as reporting requirements change. Traditional reports, such as, end of them month reports, financial statements and budgeting do not describe the role anymore. Moreover, even with modern technologies, manual processes and spreadsheets are still a part of controller's routine reporting. Controllers do much more than that. If controllers want to develop, they need to implement BI & A, to become key players in their organization. This would mean moving away from routine reports towards a business partner and partaking in strategical decision making. (Lawson, 2016)

4. What Finnish Managers and Controllers Think About the Changing Role of the Controller?

This chapter covers the empirical findings collected through interviews with the controllers and the management from the organizations where the interviewees are from. First, this section explains the research material and the selection process. Second, the research method is described. Lastly, this section describes the organizations where the interviewees are from, and the findings.

4.1 Method

This thesis is executed through a qualitative research method. When comparing Qualitative- and Quantitative research methods, a quantitative method enables observations, such as, how important a certain phenomenon is to the research subject. Qualitative research method is preferable when we require deepened information of how certain phenomenon effects the research subject. (Koskinen, Alasuutari & Peltonen, 2005. 16;24) Thus, qualitative research method is preferable due to the nature of this topic where we want to discover how BI & A impacts controller's reporting functions. There are social aspects into reporting as reports are viewed by, for example, the management. These kinds of phenomena have social aspects and concepts that can be taken into consideration through semi structured interviews.

This thesis uses interviews to gain insight about the role of the controller at the selected organizations. The interviews are semi-structured. This allows for follow-up questions if needed (Kvale, 1996). As a method, semi structured interviews have often been used when management accountants have been reviewed. It is a preferable method in studies where it is important to bring up the interpretations and ideas of the interviewees. (Hirsjärvi & Hurme 2008, 35) The interviews are conducted in two different formats, so that both the management and the controllers have their own interview structure. The Interview questions can be found from appendix 1 and appendix 2.

Semi structured interview enable the attendants to voice their opinion and bring their insight forward (Galletta & Cross 2013). Interviews enable us to describe social phenomena, such as, contradictions and conflicts. Quite often the social aspects can be challenging to take into account when using other research methods. (Ahrens & Dent 1998, 7–8; Ahrens & Chapman 2006, 834.) These social contacts, that occur in the workplace, can have a substantial impact on the findings, as we interview management and controllers.

4.2 Data

The primary research data is gathered by using semi-structured interviews where the questions used are created beforehand. Two different interview methods are used. One for the management, and one for the controllers. Interview forms can be found from the appendixes (appendix 1 and 2). The interview questions are strongly correlated with the research question and the sub questions to gather data from the topic in question. Managers partaking in the interviews are selected because of their close relationship with controllers. The interviews also aim to discover any potential differences between the viewpoints of managers' and controllers' when it comes to BI & A and reporting.

Controllers and managers selected to partake in the interviews were selected from multiple organizations. Therefore, a wider range of BI & A implementation is discovered. Where the selection criteria for controllers was quite wide, this was not the case with the managers. We wanted managers that work with controller's and know what their work entails. For example, two managers from a large Finnish company have been controllers before a promotion and they are still highly involved in controller functions. This is beneficial as they not only know the job functions, but also know how reporting has been executed in the past with less developed technology. These are appropriate respondents as their positions at their organizations entail that they have extensive knowledge and experience that can contribute to the research. Table 5 below presents the interviewees. It covers the tittle, educational background, work experience and the industry they are working in.

Table 5. Interviewees

Title	Educational background	Working experience	Industry	
Assistant Controller	Msc, Economics	2 years as an Assistant Controller	Financial services	Controller 1
CEO	Bsc, Economics	20 years of experience in financial management, accounting, and controllership.	Financial services	Controller 2
Controller	BBA, Financial administration	9 years of experience in accounting and controller work	Financial services	Controller 3
Vice president, pumps	Msc, Industrial engineering and management	7 years in SAP consulting, 10 years in finance and business control	Industrial Machinery	Manager 1
Director, Supply chain finance	Msc, Economics	25 years in different controller- and financial management functions	Industrial Machinery	Manager 2
Senior Vice President, M&A and Business Development	Msc, Economics	27 years in different financial management and controller job descriptions	Industrial Machinery	Manager 3
Controller	Msc, Industrial engineering and management	15 years as a controller	Electrical equipment	Controller 4
Director of finance & analytics	Msc, Economics	13 years as a controller	SaaS	Manager 4

4.3 Organizations

The organizations from where the controllers and manager come form, entail various industries. In total there are managers and controllers interviewed from four different companies and industries. All the organizations have been implementing BI & A into their businesses during the past five years.

Company 1 is an accounting company that offers controller and CFO services to their customers. Revenue in 2020 was over million euros and it has been steadily growing with implementation of modern accounting and financial management tools. Implementation of BI & A started in 2015 but the organization has always used the most modern tools available at the time. The main BI tool is 4straction, which has been in use for a while due to its excellent integration abilities with Finnish financial management software.

Company 2 is a large Finnish, publicly traded, company that functions in the industrial machinery and mining industry. They employ over 15 000 people globally and their headquarters are in Helsinki. Revenue in 2020 was 3,9 billion. Implementation of BI & A started in 2015-2016. Some processes have been automated and benefits of BI & A have been noticed. Still, due to the large size and constant changes in business environments arise an ongoing need for development. There is a vast number of BI-tools in use within the organization but main software are Power BI, SAP and HFM.

Company 3 is a Swedish-Swiss multinational corporation whose headquarters are in Switzerland. Revenue in 2020 was 5,8 billion and they employ over 20 000 people globally. In Finland there are over 5000 employees scattered around the country. Implementation of BI & A started approximately in 2015 and main BI-tools in is Power BI

Company 4 is a Finnish organization that is part of an international corporation. Main line of business is SaaS (software as a service), which focuses on ERPs including financial software. In 2019, their revenue was 60 million euros. The organization has been benefitting from BI & A since 2016. They use a combination of Alteryx and Tableau.

In the following chapter the interviewees are divided into two groups: managers and controllers. Controllers will be referred as controller 1, controller 2, controller 3 and controller 4. The managers will be referred as manager 1, manager 2, manager 3 and manager 4.

4.4 Results

This section of the research explores the conducted interviews. The interview questions can be found in appendix one and two This section is structured similarly to the format of the semi-structured interviews. First, this section explores the tools in use in the organizations interviewed. This enables us to compare different organizations, and their capabilities to utilize BI & A. Second, this section provides detailed insight to the interviews about the impact of BI & A on reporting. Third, the benefits of BI & A at the case organizations are described. Fourth, the impact of BI & A on the controllers' role is explored. Lastly, this section describes the technological challenges and future BI & A development at the organizations. This section uses direct quotes from the interviews to ensure that the meaning is not lost. It is important to understand that the direct quotes use informal language and may therefore be difficult to read at times.

4.4.1 Business intelligence software from the field

The interviews with controllers and management indicate that there is a vast number of different BI-tools in use in the field. Below is a chart that presents the software in use at the organizations interviewed.

Table 6. Companies' software

	Organization 1	Organization 2	Organization 3	Organization 4
Power BI	X	X	X	X
Tableau		X		X
SAP		X	X	
HFM		X		
Cognos		X		
QlikView		X		
Alteryx				X
AFE			X	
4Straction	X			

As seen from the Table, Power BI is used in all the four case organizations. Yet, depending on the need, different additional tools are used. These solutions are easy to procure and install. Therefore, there is no large barrier to try new tools. Manager 1 explains why their company has multiple tools in use:

> *"To be honest, we have so many different BI-tools in use that a better question would be: What solutions have never been used in the history of this organization? I think our management would be*

> *shocked to hear about all the software that has been sold to us at*
> *some point in time."*

There are several reasons why Power BI is in use in all the case organizations. Manager 1 and manager 2 give insight about the popularity of Power BI:

> *"What we mostly use is Power BI. I remember thinking that Power BI is a*
> *bad product and Microsoft is selling it just because they have to. I have to*
> *say that I was wrong and that it is a good tool. Also, it is very cheap for us*
> *and works well with SAP." (Manager1)*

> *"Controllers use Excel quite a bit and Power BI is made for people who*
> *know Excel. So, it is a natural transformation." (Manager 2)*

Manager 3 agrees with combining SAP and Power BI, and further explains that the process of implementing the benefits of BI & A is still ongoing:

> *"Our main tool is power BI. We do use Excel as well but the main goal is*
> *to transfer everything into Power BI. The idea is that Power BI is the main*
> *tool of the controllers when it comes to data visualizations and reports.*
> *And the data flows automatically there from SAP. This process is still*
> *ongoing and need to be improved, but we are getting there"*

HFM (Hyperion Financial Management) which is Oracle's BI-tool, is popular when basic reports are shared with management. It is not the main BI tool in any organization, but it is widely used at the organization 2. Managers 1 and 3 explain that HFM is one of their go-to software when information is shared with management:

> *"A backbone for our financial reporting is Oracle's HFM (Hyperion*
> *Financial Management). That's where we put the numbers in manually,*
> *unfortunately. Meaning, we get some sort of data out of SAP, and then*
> *manually drive them into HFM. Either the controllers do it completely*

manually or they have some kind of Excel macros that make the procedure a bit faster." (Manager 1)

We use HFM for management reporting. There we consolidate our numbers from different profit units. These would be basic reports like balance sheet and profit & loss statement. It is kind of a lower detailed reporting system. For drilling down into individual customers and such, one has to use SAP and power BI combination." (Manager 3)

Manager 1 describes the manual nature of HFM. Manager 3 explains why, for example, HFM is not the main tool in their daily functions. Furthermore, Manager 3 describes how QlikView is used to cover what HFM lacks:

"HFM does not have good enough reporting features, so we have implemented a QlikView for better visualizations and reports. Mind you that the data source for this is not SAP, but HFM. Meaning, we visualize data from HFM in QlikView for better visualizations. We do get ad-hoc needs as well. Those we cover with Power BI. This information is based on SAP data."

Some of the organizations do not have a huge arsenal of software at their disposal. It is pointed out that the controllers and managers only know what their teams in Finland use. It is important to understand that this does not mean that other profit units would not use other BI & A tools. Controller 4, who works for organization 3 explains what BI-tools they use:

"We actually use Power BI as our main BI-tool. So, we get data from SAP to AFE (Analysis for Excel), and from there we run the data to Power BI. But different units might have different preferences. We mostly use Power BI in my unit."

Company 4 has taken a different path in the implementation of BI & A, and they do not use Power BI. Reason for this is that when they started to use BI-tools,

they outsourced a consulting firm to find the best solution for them. Manager 4 explains:

> *"When we noticed that now is the time to figure out how we can benefit from this, we hired some consultants to do it of us. They recommended the combination of Alteryx and Tableau for us, and we have stayed on that path."*

There seems to be a trend of combining two software. One, that has great ability to combine data, and another where it is visualized. The market seems to be lacking a useful tool which is good at both. This can be pointed out from manager 4's explanation for two software:

> *"Tableau is where we visualize the data. Then we have our own sources of data that is gathered to Alteryx where we prep the data. There needs to be a layer before Tableau, as we have noticed that Tableau is not the best for combining data. That is why we prep it in Alteryx and visualize it in Tableau."*

Even though the companies vary in size, the BI- tools do not vary as much. This indicates that these tools are scalable, and size of the company does not really matter when considering the implementation of new BI technologies. It is important to note that BI & A software are usually a combination of multiple tools that cannot function without one another. This is mostly due to different software being better for certain functions than others. A good example is organization 4. Alteryx does have a visualization capability, but Tableau performs better. Therefore, the data is consolidated in Alteryx, and the visualization part of the reporting process is done in Tableau.

In conclusion, there is a wide variety of BI software in use on the field. It is worth mentioning that these software tend to have certain strengths and weaknesses, that have led organizations to use different tools for different situations, or a combination of tools to modify data. Most commonly the data is consolidated in one software and visualized in another. A large variety of tools has led to a

situation, where managers might not know all the BI-*software* in use in their organization. It is also worth mentioning that Excel is still extensively in use and works in the background of BI & A processes.

4.4.2 BI & A impact on reporting

BI & A´s impact on reporting is covered in the interviews. This topic enables a deeper look into the reporting tasks of the controllers, as well as a deeper look into how reporting has been developed, if it has been developed at all. This section will explore what kind of reports are being produced at the organizations, what is their importance, how much time do they require and what can be automated in reporting. Furthermore, the benefits of BI & A are covered to see how different reports benefit from technological developments.

All the interviewed organizations benefit from BI & A from reporting point of view. Particularly, BI & A helps in routine reports, such as, monthly closing of books. This includes, for example, balance sheet and profit & loss. Controller 1 talks about automating reports:

> *"We mostly use 4Straction as our reporting tool. Our customers receive monthly reports in that software and these reports are pretty much 100% automated. There is an API connection between the BI-software and the financial management software. This means that we get current data from the financial management software. This also makes monthly closing a lot quicker. Usually, it takes a day or two"*

Controller 1 points out that automating reports requires effort:

> *"Of course, it takes time to create these automated dashboards, but they can be duplicated, so once you have created formulas for a dashboard, you can copy it again and again. These dashboards include, for example, Turnover vs former year, ROI, revenue per worker, balance sheets etc.*

> *These can then be modified depending   on the business environment.*
> *But majority of our customers are fine with basic   KPIs"*

Manager 3 describes more in detail what kind of information his unit reports, and what they have been able to automate in organization 2.

> *"Basic reports that are easy to automate, are sales data and profit & loss statement. Those were to give you an example. But you have to remember that my controllers and I are supply chain controllers so it can be a little different. We as supply chain controllers, also have other KPIs that we report routinely. My main reporting task is monthly reporting of our factories to the management. I report productivity per kg, capacity cost, value added etc. We also make predictions."*
> *"We have been able to automate KPI (Key Performance Indicators) calculations and dashboards. Examples of KPI calculations could be profitability calculations of factories, purchase data, production effectiveness, etc. These have been successful BI projects, and I am pleased with the results."*

We wanted to get information about reports that are easy to automate and does not take a lot of controller time. Controller 2 explains what kind of reporting is easy to automate and does not require a lot of resources from controllers:

> *"Balance sheets, financial statements and such are easy to visualize automatically. We do spend time to manually create these. Before we might have calculated KPIs in Excel but now we can automate these kinds of reports, and there is no need to manually update or calculate them again and again."*

Modern tools do not ensure full automation of processes and reports in any of the interviewed organizations. Controller 3 points out that creating a budget is still a manual project in organization 1:

"Budgeting is still done in Google sheets and from there it is transferred to our BI Tools. From there we can compare the budget with actual data, which is coming from financial management systems automatically through an API. We can follow how our budget looks, and what has actually happened so far"

It seems clear that not everything can be automated, and certain elements in reporting create situations where manual work is required:

"I think we have been able to automate approximately 80% of our customers reports when it comes to monthly financials. Ad-hoc reports and special requests cannot be automated but basic financial data can be, and this is something we have been able to do. We have customers that get a monthly report and only thing we need to do is to check the correction of the data. No manual reports or manual visualizations are made." *(Controller 2)*

"Forecasting is also an aspect that is difficult to automate. Of course, it is easy to get historic data and to predict on that, but depending on the business environment, this is not always a good way to do it. Same thing with cash flow predictions. Cash-flow forecasts need manual work because we need predictions of sales from different business units. Also where is this data coming from? Perhaps from a CRM system that we have not connected to the BI-tools." *(Controller 3)*

Nonetheless, forecasting trends and changes in business environment appears to be a challenge for automation, Controller 3 mentions that it is very dependable on the business environment at hand:

"Forecasting reports also depends highly on the business environment. For example, I worked for multiple ears as a controller in a company that offered staffing services. The business was so volatile for change that we could only predict two months forward. The demand was very difficult to

know. Then you have some businesses where you get the historic data,
add 10% to the sales every month and you have a good prediction."

Manager 1 from organization 2 agrees with the fact that predictions benefit from
BI & A. Prior to BI & A implementations, forecasting was more based on a hunch.
Now accurate data and a larger amount of available data has enabled a more
data driven predictions:

"Forecasting sales is still difficult but it has changed as our BI-tools have
developed. Before, I would focus on the numbers from current month.
Then I might have had some conversations at the coffee table with my
colleagues. That gave me a hunch that sales are going to develop to a
certain direction. Now I have accurate data that I can base my forecasts
on. This is the truth even though it might sound funny"

The larger organization interviewed in this study face more challenges with the
complexity of their data. This was not the case in the organization 1 as they
mostly have smaller customers who outsource their financial management to
organization 1. Manager 1, who works in the organization 2 explains why it can
sometimes be difficult to automate reports due to the validity of data:

"One aspect that make this procedure manual is that the data that we have
in our ERP (SAP) is about 90%-95% correct. This is because of constant
organizational changes and developments. We can't keep up with it. I will
give you an example. One day a profit center might be called X and the
next day Y. Then we have a report that automatically reports the profit
center X, even though it does not exist anymore. These are the kind of
challenges we face, and this is why some aspects can't be automated."

Manager 1 explains that the quality of reporting has improved, and they have
been able to streamline processes and reports. This can sometimes entail that
there can be disinformation in the data, but it does not necessarily matter, if
conclusions and decisions can be made with it:

"If we talk about automated data flows, it is easy to visualize data from SAP to Power BI. Then we just must accept that the data is what it is, and that there can be flaws in it. Usually, these reports work quite well. When we have to consolidate this data between, for example, profit units, things get a lot more difficult. So, I would say that we have benefitted from automation and BI in general, but in a large company like us, with constant changes, it can never be fully automated."

"Our quality of reporting has improved. There are less steps and less of a risk for human error in our routine reports, as we have been able to automate data flows and reports. We have also gotten rid of unnecessary duplications that were made manually before. One thing that is also important is the validity of our data. If we get incorrect data, then all the data is incorrect in the same way. If humans are involved in the process, one might fix the problem and another controller will not fix the problem. Now we get correct data from one profit unit and incorrect from another. Sometimes this can be more harmful than getting the whole report wrong."

Manager 3 from organization 2 points out that it is not only financial data that can benefit from BI & A. He explains how his team collects important news online:

"We also collect vital news from our business environments. So, the usage of BI does not only limit to financial data or management accounting. We have broader insight as well. Another example is that we follow the gross domestic products of our business environments. Oh yeah, we also collect data from our suppliers. Things like production volume and sales development of our suppliers. This has never been and will never be only about monthly financials."

Controller 4 brings up an important topic of BI & A, which is the capability to interact with the reports. In a modern environment it is not beneficial to send dull reports to the management. It seems that BI & A brings more interaction ability for the management and other people who look at the reports:

"All the reports my team has created are interactive. So we create a report base into Power BI and the management can play with it as they want. I have actually spent quite a bit of time to teach the management to use it. The idea is that management can themselves take advantage of the data, so that they don't need my time to get basic reports. But of course, I create ad-hoc reports if there is a need but usually the management can do it themselves."

Controller 4 provides detailed insight on what can be automated, and what has already been automated in case organization 3. The same important point was made that the capability to automate can vary even within an organization if there many profit centers:

"All the routine reports can be automated with BI & A. When the reports become detailed and more ad hoc, we need to make them manually. With basic reporting I mean balance sheet, profit & loss, orders, sales etc. But remember that now I am only talking about Finnish level, when we go to global functions, it gets more complex and automating reports is not so easy."

A transformation in routine reporting seems evident. Manager 2 and Controller 4 think that they still give emphasis on routine reporting but the nature of it has changed. There is, indeed, a transformation when it comes to reporting:

"Back in the days we would have made a monthly report that had balance sheets and income statements in different forms. Now we get drill down data that is very detailed, and management can interact with the reports. Before, these kinds of reports would have been ad-hoc stuff." (Manager 2)
"I would say that we have moved to a different stage in the routine reporting. If before we were producing manually these reports, these days we just follow them. This means that we follow the correctness of the data but we do not touch it so much." (Controller 4)

To summarize, the reports that are easiest to automate are profit & loss, balance sheet and sales data. The interviewed organizations have also been able to automate the KPIs of their choosing, such as purchase data, production effectiveness and quick ratio. The interviews outline that all the organizations interviewed, have been able make monthly closing quicker. For example, organization 1 can close the month in two days, while it took a week before the implementation of BI & A. It is worth mentioning that automating reports is usually a time-consuming process but still worth the effort. What none of the interviewed organizations have been able to automate, are ad hoc reports, predictions, and budgets. These still need manual updating and fine tuning. Still, ad hoc reports, predictions and budgets are easier to produce due to easier access to the data and faster modification of the data. This was agreed by all the four organizations. Larger organizations, such as organization two and three, have more difficulties with validity of the data than the smaller organizations. This is due to a larger complexity of the data and fast changes in the profit units.

4.4.3 Benefits of BI & A

All the interviewees seem to agree that BI & A saves time in controller's general functions. For some, the reason is automated routine reports, and some emphasize effortless data digging. Still, it appears to be challenging to pinpoint exactly what is done with this time surplus. Where is the additional time used? Pointing out where the additional time is utilized, seems to be problematic for both management and controllers. Controller 1 talks about automating reports and exploiting the time saved:

> *"Because monthly financials are automated, I would say that most of my time goes to ad-hoc reporting and updating budgets. I also spend a lot of time on forecasting. We have more time to analyze the data and comment on it. With the help of BI & A historical data and current data is very easy to get. It is the forward-looking analytics that still require a lot of skill and effort. You have to be aware of the business environment and understand how it develops. I feel that BI & A has made it a lot easier to look into the*

mirror and collect that data. Also, if someone needs a basic sales report, it takes only a few minutes, and you get accurate, current information about sales."

Controller 1 continues to the topic of non-financial data. BI & A helps controllers to collect non-financial data, and some of the extra time is used to develop how the non-financial data is analyzed:

"Our BI-systems enable us to send questionaries to our employees, so we also measure so called soft data. For example, we ask weekly mood from the workers, and they get to interact with the dashboard and give a response. These questionnaires can be sent to their email or mobile phone. Then we are able to show different teams their weekly moods, if they have any sorrows or things like that"

Other interviewees also recognize that they have more time to do other tasks as BI & A spares them form manual and routine work. Even though it was difficult for them to say where the time was used, they explain what procedures were needed of them before implementation of BI & A:

"Difficult to say exactly where the extra time goes. We have never really had a situation in our company history where we would not have implemented BI & A, so it is a bit difficult to say. Perhaps it goes to value creation such as ad-hoc reports to our customers and maybe we give a bit of extra insight when we have more time to do so." (Controller 3)

"Instead of having an army of people filling Excels and sending them to another army of people who use Excels, we can create a report that shows accurately how much, for example, sales we have had during the month. It is faster and more effective. Also, everyone can look at these reports instead of someone sending these monthly. I can also get reports on my phone. These reports can be made by assistant controller's assistant. Before it had to be some sort of f a guru from Silicon Valley." (Manager 1)

"BI & A saves a lot of time from reporting. We use this time to develop our functions and KPIs. Can't say exactly where the time is used, but in general we have more time to develop. Now we have more time to look at what has happened and why. What is actually behind the numbers. Benefits are in time saving and the quality of reporting. As we have been able to automate data flows, the human error has been reduced, which increases the quality. Before if management needed some specific information, some controller would use about a week to dig the data needed for that report. Now we can get it pretty much instantly. It is a lot easier to do that data digging from our sources than it was before." (Manager 2)

One of the major benefits is the decrease in manual functions that are especially related to data transportation and finetuning of the data. This gives more time to analyze data, which enables new discoveries about the business environment:

"Before we dumbed stuff from SAP to Excel and made some pivots. That way we made most of the reports. Nowadays it is mostly just pressing refresh button and the data goes to AFE, and then press refresh again and the data runs into power BI." (Controller 4)

"We have been able to discover certain aspects from our business, that we have not been able to understand before. So, the quality of our reports has certainly improved. There is also a benefit of saving time because we don't have to play with Excel and pivots that much." (Manager 4)

Manager 4 continues to talk about how BI & A helps in combining data from various sources:

"When an organization has different accounting software in different units, the benefits of BI & A are more visible. It enables us to consolidate and visualize reports, even though the data would be coming from two different accounting systems."

The benefits of BI & A are not limited to data combination and decreased amount of manual work. BI & A gives an increased ability to predict more accurately into the future. This is due to the fact that it is easier to recognize trends from the data:

"We have been implementing these BI tools a couple of years now. Through BI & A, I we have been able to look into the future, which we couldn't do before. BI & A enables us to look at the trend data. This capability to forecast and look into the future will increase in the future and we want to improve our predictions." (Manager2)

According to manager 4, their organization has increased the quality in predictions, as they have implemented BI & A:

The ability to forecast our business has become a lot better through BI & A. These BI-tools do not really predict anything on their own. It is not about that. But the quality of data and the amount of data has enabled us to succeed in forecasting on a higher level.

Manager 4 continues about the importance of predicting the business environment, and how it is one of his most important tasks:

For me, forecasting is one of the most important functions. I have to be able to recognize the red flags and the green flags in our business and show them to the management. We produce prediction data weekly, so it is important.

Especially the speed of reporting has increased due to BI & A. For example, controllers and managers say that monthly closing is performed faster, and they are able to do it in few days. Furthermore, data can be reported and visualized in the middle of the month. This therefore saves time to focus on other projects, predictions, and analysis:

"Reporting has become more dynamic. We are able to create ad-hoc reports easily. Nowadays controllers can send reports in the middle of the month and we do not have to wait until end of the month. We get real time data. I can give you an example of the change: Back in the days I would have asked:" Hey Matti, when February is over, let me know how much

sales we have had since December." Now we can get sales data like this instantly. This kind of reporting has changed a lot." (Manager 1)

"Also, BI & A saves our controllers time which enables further analysis of our business environment. It is faster to fix the data and create reports." (Manager 1)

"Before we used a tremendous amount of time to figure out what has happened in the past month. Now we have transformed to a situation where we analyze data, comment it, and look behind the numbers. One of the major functions for controllers is predicting the changes in the business environment and communicating it to the management. Those are the biggest changes in the role." (manager 2)

"We still do spend time on closing the month, It takes about three days. So I don't want to give the impression that we have been able to get rid of routine reports. But it is not our focus or biggest part of our work." (Manager 4)

"We can clearly see that it makes routine reporting much easier and faster. Let's say that we would do these basic reports manually. It would take a lot of time and the risk for human error is greater. Also, we would need to focus on few reports. Now we can just check that our monthly data is correct and send the reports away. These "sanity checks" do not take much time. Sometimes we don't even do them ourselves and trust that the accountants check the validity of data." (Controller 1)

Monthly closing is not a dreaded task in any of the interviewed organizations. Before implementation of BI & A, monthly closing can take multiple days or even weeks. Now, monthly closing is simpler, and takes a few days. Controller 4 describes how effortless it is for them:

"We close the books within few days of starting a new month, so it doesn't take much time anymore. Same thing with quarterly reports. These aren't

a huge task anymore as they have been before. More time to do something else." (Controller 4)

A clear advantage of BI & A has been the capability to drill deeper into the data, and the ability to consolidate data sources. This is recognized by all the interviewed organizations. The information has been there all along, but only now it is used for the benefit of the management and decision making. Manager 3, manager 4 and controller 4 give insight about the subject of drilling into the data:

"So, different kind of ad hoc analysis can be done more often due to time saved with the help of BI & A. We can drill deeper into the data and it is easier than before. It is easier to combine information and find causality with BI & A." (Manager 3)

"Main differences between a time before BI & A and after BI & A is the amount of detail. Even in the early 2000s, the idea was to support management and develop the business, but these tools have taken it into another level. The data production is in totally new level. We are able to collect data in a versatile manner due to software being able to combine information from different sources. This ability to connect data as created massive opportunities. So, the benefits are not only in easy visualization of data. We are able to combine and analyze data in a whole new level." (Manager 4)

Manager 4 continues that he does not think that reporting financials is the main benefit of BI & A:

"I feel that the advantages of BI & A are more in the supportive functions of a business, not in reporting of financials that are required by law. It has more to do with management accounting. When one goes higher up in the management, perhaps then the benefits of BI can be seen in consolidated financial numbers. But all in all, the main strength of BI is that we are able analyze and support the business."

To conclude, all the interviewees recognized that their organizations benefit from BI & A. The main benefits of BI & A are the ability to automate routine reports and the ability to gather and modify data with less effort. All the organizations have been able to reduce manual processes from their reporting processes, in addition to the reduction in human error. Furthermore, interviewees feel that the level of forecast accuracy has increased significantly with the help of BI & A. When it comes to automating reports, it has certainly been done, but the organizations do not know precisely what has been automated. Only organization 1 was able to answer that about 80%-100% of the monthly financial reports have been automated. Rest of the organizations know that processes are faster, and reports have been automated, but they could not give percentages on reports that have been automated. Still, the automated reports release time for controllers to use into business analysis and developing processes to further improve reporting and business analysis.

4.4.4 BI & A and controller's role

The interviews are in line with the literature addressing controllers' role change and development. BI & A seems to support controllers' role as a change agent, as it is easier to support management decision making with modern tools that enable a deeper look into the data at hand. There are some indications that vast amounts of data make the validation process a larger part of the role. This indicates a minor step back towards the watchdog role. However, this is nothing new as literature recognizes a hybrid role being a likely outcome of software development.

> *"Even with fancy technological changes, we still have to check that the data is correct. Sometimes I notice that something is not right, or an accountant notice something. Then I must go and check it out. To validate the data. This can take quite a bit of time and is almost like police work. I also strongly believe that this aspect of checking out the data will never disappear as there is always a need for a human to validate the information." (Controller 1)*

Others agree that the validation of data is a part of the role that will most likely never disappear from a controller's role (for interview questions, see appendixes one and two). There always needs to be someone who understands the business to look where the numbers come from.

Sometimes you still have to find errors and figure out what is wrong. I feel like this old school aspect will never disappear. One always has to look that the information is correct. (Controller 3)

"Still, there is always the question why. Why are the numbers looking like this and what has caused this. The why question makes it impossible to take humans completely away from the process as we need to analyze our reports and find causality" (manager 2)

"It still takes time to validate the data. This is something that we always have to do. Even though there can't be a human error, it doesn't mean that the SAP data is always correct." (Controller 4)

Some did not see the validation aspect and policing the numbers as a backstep in controller's role. Manager 4 wants to point out that if we only have to validate automatically produced data, at least there is the aspect that it has not been manually produced, which is a step forward on its own:

"The validation part will never go away but I wouldn't say it's a backstep. Surely it is a step forward if we just validate the data, instead of producing manually the data, and then validating it." (Manager 4)

Manager 2 also continued about why there is a need for humans and validating numbers that have been produced through automation:

"We always try to automate our processes and reports. There is still a lot of work to do but we have been able to automate most of our routine reports. Still, there is always the question why. Why are the numbers

looking like this and what has caused this? The why question makes it impossible to take humans completely away from the process as we need to analyze our reports and find causality.”

Interesting insight was gained about controller's functions and daily routines, before the implementation of BI & A. Common realization was that before, the use of excel was even wider, and there were more manual steps in reporting processes. In addition, the interviewees talked about data warehouses and how they have developed. It was also clear that these BI-tools are cheaper than ever before.

“Well, back in the days we would use a lot more excel. Also, these BI-tools did exist, but they were expensive. I remember that we looked at a software called click view years back. The whole project of moving databases and implementing the tool would have cost us about 10 000 euros. Nowadays you can use tools such as Power-BI for free and data can be stored in clouds.”(Controller 2)

“Without these BI tools my role would be a lot different. I feel that I have quite a bit of time at hand to develop our reporting. Also, I spend a lot of time on forecasting, and following how the forecasts have succeeded so far. Without BI tools, such as 4straction, I would have a lot more manual work and fact checking of our data would take even more time. I would also spend a lot more time with excel and putting in the numbers to our software.” (controller 1)

Manager 3 brought a unique perspective to the conversation as he thought that it is not so much about reporting anymore. There is a surplus of time, and it needs to be used to something that benefits the organization. It seems that controller work has become project based:

“Where does the extra time go to? It is a bit difficult to say exactly. These is more time to do for example forecasting. But I don't think that this would be the main benefit. It is more about going through business cases as a

controller. An example of this could be a decision whether to enter certain markets or not. This is where a modern controller can actually create value. They can make calculations whether it would be beneficia to enter into new markets and how much would it cost us."

Manual processes were not the only aspect that has changed majorly. Managers 1-3 have had an exceptionally long careers as controllers and in financial management, which meant that they were able to give detailed insight on what the reporting was like in the 90s and early 2000s.

"10 years ago, we were fighting with problems like moving data from our business units to our ERP. Some of the units were so small that there was no point in implementing, for example, SAP to these small units. So what we did was that someone would manually put these numbers into our ERP, I think it was some sort of Cognos interface. Eventually it had about twenty columns, including small details like shoe size. Then we realize that it was too much data, and we could not run it. Our software was crashing. It was so disappointing as we had done so much work to consolidate our numbers. But the computational power was not there. Nowadays we have no limits like this." (Manager 1)

"In the old days, most of the time went in to creating reports in the profit units. Controller's would also send emails and such back and forth to validate the data with the management. Nowadays the main focus is in automating reports and visualizations. So manually producing reports to the management has moved to the background. Instead developing these reports and thinking what can be automated is in the scope of focus." (Manager 3)

Manager 3 gave an example of projects that controllers might have at hand. It was clear that these kinds of projects have become more common as there is more time at hand:

"For example, Last week I calculated ad hoc calculations related to profit per customer. I looked at the trend data on what our customers have purchased before, and why they have bought more of something. Or perhaps they have purchased less from us. Then I would start to figure out why. This is the kind of stuff we have a lot more time to look at." (Manager 3)

"Controller work is more project-based ass BI & A releases time from routine reports. So daily tasks entail certain software development projects, development of business and acquisition projects." (Manager 3)

Speed of processing data was pinpointed by multiple interviewees and how it has become a lot easier. It is clear that modern BI-tools enable quick processing of data and data consolidation:

"Also, processing data has gotten a lot faster. Nowadays if we run our data into a BI-tool it pretty much happens in an instant. Back in the days we would start running the data at 2am Finnish time, because it takes multiple hours to run the data in. If something went wrong or there were mistakes in the data, you would have to run it again. So, if you noticed that there were, for example, missing vouchers from the ERP, you would have to run it again and wait another 5 hours." (Manager 1)

"Nowadays you can get some reports out of the systems in like 15 minutes of downloading the software. Back in the days it would be a project that would last for months even before you get to play with the data." (Controller 2)

As literature suggests, technological requirements have, indeed, increased. All of the controllers and management recognized the increased need for IT skills. The role has changed in a way that accounting skills are secondary to IT skills.

"Analytical demands have increased. I couldn't imagine that a CFO or a controller could be hired, and they wouldn't know anything about analytical tools. The profile wanted from a controller has changed" (Manager 1)

"Nowadays you need skills in IT. Before it was more about accounting skills." (Controller 4)

These IT skills have also created a need to communicate with different within the organization. A need for communication skills were mentioned multiple times, as it has been recognized by literature as well. Manager 4 who has an extensive experience as a controller explains his vision of the role development:

"I feel like controllers are going towards a role, where they function kind of as a glue between different functions within our organization. Controllers need to connect management and financial management teams so that the information flows seamlessly. Another interface controller needs to deal with is IT-teams and financial management teams. Controllers need to understand where the data is coming from and how it can be used. Without this information they cannot be at their best."

This communicative role was recognized in organization 2 as well. It seems that controllers are required to have deep understanding of the data, so that they can verify it and communicate it forward. This is also due to IT being responsible for creating data connections, which often leads to a situation where there is no full understanding of the data. This is where management accountants come in:

"It is very important to understand the data used. Our IT tends to create models that have a mixture of data that just cannot work together from a combination perspective. The data just won't be correct. This is where as a controller, one must be capable of helping out and communicating what is wrong. The controller is the one who should know how the data works and what is behind it." (Manager 3)

"Creating the reports based on the data and visualizing the data is easy. But understanding where the data is coming from is more difficult. That is

*why controllers need to understand the business so that they can see if
the data they are digging is perhaps false."* (Manager 2)

*"IT does not understand what data needs to go where. They can create
models and interfaces, but ultimately it is up to the controller to know if it's
valid or not."* (Manager 1)

The literature strongly supports the change towards a change agent that
mitigates management decision making. An emphasis to analyzing the business
environments is one of the main functions of a controller. Controller 4 describes
the new demands of the trade:

*"If before it was really important to get the right reports to the management
at the end of the month, now they expect us to analyze and forecast the
business environment. It is self-evident for the management that basic
reports are in time and accurate. The emphasis has changed if you ask
me."*

This point of view was also shared by manager 4 who emphasized how BI & A
enables a better supportive role of a management accountant:

*"Supporting management is the main function nowadays. Maybe if
someone is purely a financial controller, they might be doing some sort of
reporting required by law and communicating with accountants. In general,
though, the main role is to support management and develop the
business."*

Manager 4 has worked as controller for over a decade and has a clear image of
a modern controller. He thinks that even the basic reporting has changed, and
the requirements for controller's involvement levels have changed as well:

*"Communication skills cannot be stressed enough. That kind of 90s
controller mentality is outdated. So, if a controller sends me a table with
monthly numbers to my mail, it is not enough. They should be able to
explain the numbers and communicate what has happened. Besides, this*

would not be effective use of our BI-tools, if I would get reports without any insight. Presentation and communication skills are key factors.”

In summary, BI & A supports controllers role development towards a business partner, which literature recognizes to be a business partner for the management. BI-tools enable larger amounts of data to be taken for valuation in reporting, which sometimes forces controllers to be watchdogs who validate the data. Therefore, a human is still needed to validate the data. Interviewees also recognize that stronger emphasis on project work has emerged in the controllers' line of work. Daily tasks will include, for example, software development projects and acquisition projects.

4.4.5 Technological challenges of BI & A

Evidently, fast development of business intelligence, analytical tools and IT in general can be challenging to controllers. There is a constant need for developing oneself to better utilize different software packages in daily work. Yet, the interviewees rank their controller teams and themselves rather high when asked about the technological competence within their organization (for the interview questions, see appendices one and two). The managers and controllers were asked to rank their IT-skills from zero to ten. Below are the results represented in a table.

Table 7. Controller's IT-skills ranked from 1-10

Controllers	IT-skills from 1-10	Managers	Controllers' IT skills from 1-10
Controller 1	7	Manager 1	8
Controller 2	9	Manager 2	9
Controller 3	7	Manager 3	8
Controller 4	8	Manager 4	9

Controllers score themselves slightly lower than their managers, who rank the controller teams as whole. This may be due to modesty, but also the fact that controllers know exactly where their flaws lie. It was pointed out that skill levels vary substantially within the controller teams. Explanation for poor IT skills in some teams was varying interest on developing one self's skillset. Furthermore, in some cases, old age has a correlation with poor IT skills. It seems that a good way to prevent a situation where some controllers cannot keep up with the technological developments, is to discover different roles within the team:

> *"The competence depends on the individual. Some are more interested about new IT developments than others. So, the competence level varies a lot. We try to tackle this problem by discovering different roles for different people. There is no denying that some would love to use the old tools (like Excel) until they retire. We try to support our older controllers by helping out. Some of us are more involved in the developmental side of*

BI-tools, which requires more knowledge about the software." (Controller 4)

"I would say we have a pretty good level of competence in our organization. Everyone is capable of using BI-tools and no one is objecting new technologies that we are adapting." (Controller 2)

"The competence of our controllers varies quite a bit. To be completely honest, nowadays if I am hiring a controller, I am not looking at their auditing skills or accounting degree. The technological demands have created different needs. I appreciate more if someone has been involved in development of reporting or certain kind of reporting projects. Knowing debet and kredit is great, but the demands are so different today than they were like 20 years ago." (Manager 1)

"We have tried to tackle this problem by mixing our controller teams with IT. So not everyone needs to be a guru in building interface and such. Some of the controllers are better in accounting information and some use most of their time building our BI & A systems. But of course, the skill levels vary, and some find it harder than others." (Manager 2)

It is important to have an open mindset and problem-solving skills when finding new ways of using BI-tools to improve reporting. Controller 1 describes how he finds ways to fix issues involving 4 straction:

Of course, there are situations where you have challenges with BI-software but we always find a way to solve them. Sometimes you even have to communicate with IT support of these BI-tools but there is always a way around these problems. I bet the IT support is really tired of me, as I always contact them with new ideas and problems I have with the software. You do not need to be god to use these tools, you know, just curious and adamant."

BI & A is not viewed as a threat by the management or controllers interviewed. They do not feel that it is an impossible task to follow with latest trends and developments.

> *"I would also like to stress once again that it is not very difficult to use these tools. Controllers can easily learn these. These kinds of plug and play solutions in the BI & A front, have enabled an easy-to-use experience. You do not have to be a master of IT or an excel guru to use them. I think this has enabled more controllers to learn these tools." (Controller 3)*

> *"if business is complex and different ERP systems change a lot, automating these processes and implementing BI & A is a lot harder. That's why it's kind difficult to say exactly how big of a challenge software development is. If you have to do data digging from a huge number of different solutions, it makes it more complex. Getting information from multiple solutions and collecting them under one BI tool can be technically difficult but not an impossible task."*

Manager 3 agrees with the fact that too many tools increase complexity which can be difficult to manage:

> *"It is challenging if there are too many analytical tools. This is why we try to focus on certain black forms. Sometimes we do make compromises. We know that there are tools that could be better in some aspects than Power BI, but it would make more damage to implement a new software. So, we work with what we got. Otherwise, we would need external consultants all the time."*

With the right mindset, technological demands can make the work of a controller more pleasant due to new interesting challenges. This is also recognized in the interviews:

> *"BI & A makes controller working environment a lot faster. Everything is done quicker, and it shows in a way that controllers work is more*

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challenging. But it also makes this job preferable as we have nonchallenges, we learn new IT tools, and we get to analyze more instead of doing routine functions." (Controller 4)

"These technological developments require controllers to be quite confident with computers and different software. If you don't follow the latest trends and don't try to develop your skills with BI-software, you are in trouble, but this is not necessary a bad thing. At least I enjoy that part of my work." (Controller 1)

Characteristical traits is a recurring topic in the interviews. It is evident that some controllers are more experimental than others. Therefore, management accountants experience technological developments and challenges differently. This characteristic aspect has been recognized by the literature from early on, and it is also a present theme in the interviews:

"I think that I have to give myself quite a bit of time to learn different software and especially new software. We get multiple new tools into our inventory every year and it requires effort to learnt all of them. But I would say that in general BI-software are quite easy to use. Like you do not have to be a wizard to learn how to create data visualizations and such. But I'm definitely the one who takes his time with new software." (Controller 2)

"I've always been kind of an ERP slash BI geek. I want to test new innovations and make sure that I use the latest tools. That's why I've never seen it as a threat. It is great that BI-tools nowadays are plug and play type of software, so you can start to use them pretty much immediately after installing. You can just throw away the manual and start doing things with it." (Controller 3)

This difference between personalities is tackled in organization 4 by mixing IT skills and controller skills within the team. Manager 4 explains how they have IT and controllers in the same team, and they are not even compared between each other:

"What is the skillset level of our controllers? It really depends on what you compare to. We have people in our controller teams that have purely worked with data for years now. If you compare us regular controllers with these guys, then I would say that there are some challenges. But is it really something we should compare to? I think not. So, in general, our controllers have very good capabilities to use BI-tools and other aspects of IT. We have created different roles in our analytics/controller team, so this is not a problem. We do learn something new, and our skills have developed, but all in all I am happy with our controller's skillsets"

The interviewees do not see technological development as a challenge for management accountants. All the organizations rank their controllers high when it comes to technological skills to use BI-tools. There are challenges within profit units and controller teams, but difficulties are tackled together, and controllers do not feel overpowered by technological developments. Controller teams tend to have a variety of skills within the group, which enables people with different talents to help each other. Furthermore, BI & A supports the move of controllers away from manual, repetitive work, which is viewed as a positive change my both the management and the controllers.

4.4.6 Future

Many of the interviewees characterize how controlling, and a controllers' work may look like in the future. In addition, the interviewees speculate what kind of technological developments we might face in the future. This section covers the interviewees' views about the future of controlling. Controller 1 thinks that predicting trends will become easier:

"In the future we can look more into the future and it will become easier to make these kind of forecast reports. One thing that I think won't disappear for a while is checking of the data. You always must make sure that the data is correct, and the APIs work okay. Quite often there are some errors

in the data that we must correct. This aspect, I feel like, won't disappear for a while."

Controllers 2 and 3 see an even further decrease in manual work. Additionally, it is still quite difficult to make accurate predictions, which will not be the case in the future:

"Manual collection of information will decrease in the future. I think it is still done a lot. Before it took a lot of time to collect the data. Now we are in a pretty good situation but in the future, I think it will develop even more." (Controller 2)

"I think it will be easier to make predictions based on the historical data in the future. For example, a monthly loan amortization will be recognized automatically in the prediction and you don't have to collect or add it manually into the system. A few years ago, we had to recognize seasonality within the business by manually making corrections. Now seasonality is recognized automatically due to historical data in our predictions." (Controller 3)

Manager 2 describes the role change in the future. As technology develops, so does the role. We have not reached the point where the idea of a modern controller is complete. There is also a risk of controllers becoming watch dogs again:

"The communicational skills will be highlighted even more. Shared service centers will probably become even more popular, meaning that all of our accounting processes and perhaps even IT might be in India. This requires communicational skills from the controllers as they need to get info from different partners. I am afraid that this might force controllers to become mistake hunters. A lot of their time goes into validating the data."

Manager 4 seems to have a clear view about the future. He does not think that machine learning or AI will take away human from management accounting processes:

> *"The automation level will be even higher in the future. Manual work will be marginalized. But I feel that we should relax with the mentality of automating everything is a must. It is not a big deal if a human being has to do something in between or we aren't able to automate everything."*

Controller 4 sees a future where software is even easier to use as AI develops and can be used in reporting. It was mentioned multiple times that BI software is not difficult to use, but controller 4 has more to say about the future:

> *"I think that, in the future, we can just give verbal commands to AI, and it will find us data and create reports. This means that you just need to know what you want to present to the management. These kinds of developments would be coo to see."*

All in all, the interviewees see that predicting the business environment will become easier and support of AI will increase the accuracy of the predictions. Even further decrease in manual work will be seen in the near future. Controllers will move more towards a business partner as data validation and manual processes will be reduced to minimal extent. Interviewees agree that there will still be a need for a human to execute controller functions.

4.5 Analysis

This section covers the most significant empirical findings and outlines how they are in line with the literature. In general, the findings of this study are in line with the previous findings in the field. However, there are discoveries that can be pinpointed with the empirical findings from this research.

The literature covering the role of the controller has a strong trend of emphasizing management accountants as more than just bean counters of their organization. Latest research has discovered that the role has become more diverse, and increased supplementary value is needed of controllers, especially from the management's point of view. The findings of this research indicate that BI & A helps controllers in mitigating decision making and giving insight of the business environment. Business Intelligence and Analytics does not drive this development on its own, but rather, supports the development of the role of the controller. Additional time at hand, quality of data and data consolidation are the strongest enabling elements of BI & A that supports the modern role of a management accountant.

From Partanen's (2001) modified figure we can indicate that, in our interview organizations, the controllers are in the interactive- & management role and future oriented roles. The bridge builder role is brought up in multiple interviews as management accountants need to communicate with management, IT-department and accountants. Furthermore, the co-driver role is highlighted because BI & A has improved controllers' ability to predict the business environment. Controllers can support the management by informing them what is going to happen, instead of what has happened. It is apparent that the traditional parts of the role are still needed. Especially, when it comes to data validation, the supervision role of controller's work can increase as BI & A enables the consolidation of multiple data sources.
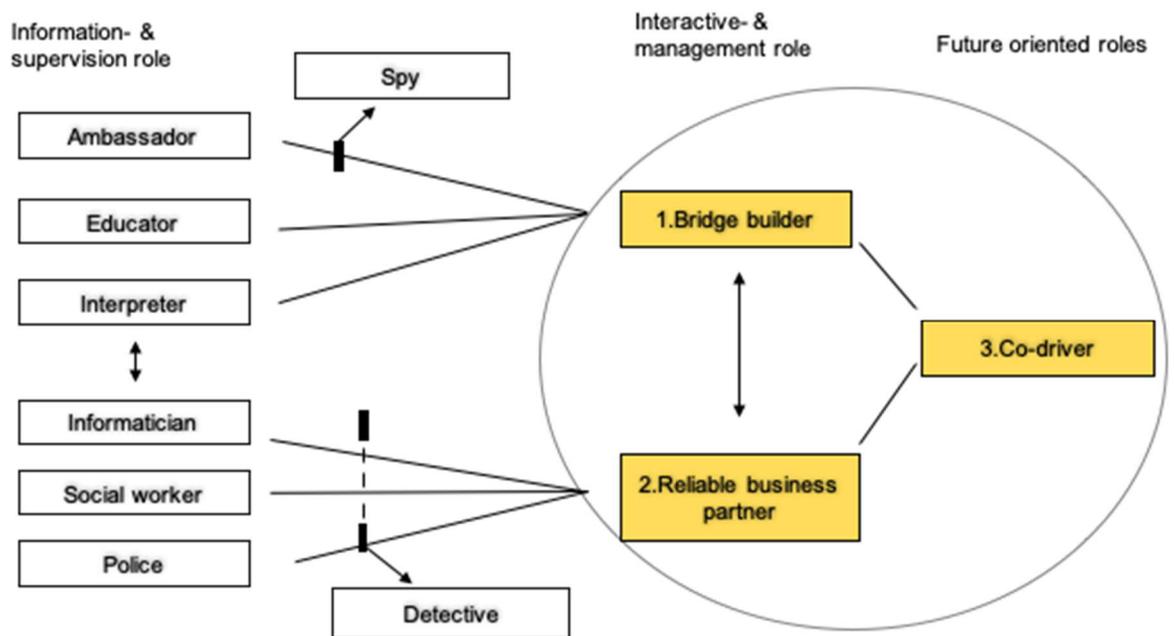
Figure 6. Partanen's role adaptations and their relationships (Modified from Partanen 2001, 176)

The literature supports the idea that controllers need to focus on creating added value both to their organization and management. Brands (2014) suggested that controllers should focus more on predictive analytics. BI & A enables a higher quality and accuracy of predictions by releasing time from routine functions. As Appelbaum et al. (2017) point out, reporting of historical information does not fulfill the expectations of a modern controller. Historical data and even current data can be drawn from systems in minutes, which has reduced the importance of this part of controller's role. In addition, the interviewees point out that the controller's work has become more project based, which means that the management accountants often have business development projects of some kind at their hand. Therefore, the added value does not only entail better or faster reports, but also, business development projects.

Oesterreich & Teuteberg (2019) suggest that management accountants cannot keep up with the technological developments. This is in contrary to what was discovered in the empirical part of this research. Both, the controllers, and the management are confident about the skillsets of the controllers in their organizations. It does not, however, mean that this is not a problem in general, as organizations and individuals vary. Ultimately, technological advancements

are not the problem. This is due to multiple reasons, the most significant being that BI-tools are quite intuitive, and not difficult to use. Furthermore, the interviewees were generally excited about BI & A and interested to learn these tools and take full advantage of them. Especially, organization 4 has been successful in combining the right people and the right roles into their finance teams. They have a combination of controllers and data analysists within the team. This combination has enabled the team to solve technological problems on their own, as they have knowledge of management accounting and more technical side of BI & A.

Data quality is in some cases a problem, as Kowalzyck & Buxmann (2015) found out. Especially, when the complexity of a business increases, there is a higher change for invalid data. This is not viewed as a significant problem by the interview organizations due to BI & A improving the quality of data in general. This is because the organizations can combine different data sources better than before the implementation of BI & A. However, larger organizations, such as organization two and three, have more difficulties with the validity of the data than the smaller organizations. This is due to a larger complexity of the data and fast changes in the profit units.

When it comes to automating reports, it has certainly been done, but the organizations do not know precisely what and how much has been automated. Only organization 1 was able to answer that about 80%-100% of the monthly financial reports have been automated. Rest of the organizations know that processes are faster, and reports have been automated, but they could not give percentages on reports that have been automated. The automated reports release time for controllers to use into business analysis and developing processes to further improve reporting and business analysis.

Controller's role in general is impacted by BI & A, as it supports the transformation towards a change agent, that has been recognized in the literature to be the modern role. There are still parts of the older controller role that come up in the controller's role discussion. For example, looking after the numbers and validating

them is still necessary, and this will most likely stay as part of the job description. In general, the findings are in line with the literature, but it must be said that BI & A is not viewed as a risk that forces management accountants to adapt. In these interviewed organizations BI & A is a welcomed quest that enables the controllers to make a greater impact on their organization.

5. Conclusions and Summary

This chapter covers the answers to the research questions provided in the theoretical part of this thesis. Furthermore, findings are summarized. The goal of this thesis was to get insight on BI & As effect on controller's job description when it comes to routine reporting. We also wanted to know if time is being saved through the implementation of BI and where the additional time is being used, if BI, indeed, deallocates time from routine reports. Our first research question was:

How does Business Intelligence and Analytics impact controller's job description in routine reporting?

Business Intelligence & Analytics has made the process of routine reporting faster. Managers do not have to wait until the end of the month to get balance sheets or sales reports. These can be produced right away, and in some cases does not even need the resources of a controller. Meaning that the controllers can create dash boards that are interactive and can be update in real time. Hence, the tasks of the controller are expanded from providing numbers to the management to providing a tool, such as, a dashboard, and ensuring that the management knows how to use it. By teaching the management on how to interact with the dashboard, managers can themselves find the right answers to their questions, not needing the controller. Routine reports can also be automated to a wide extent, and controllers tend to validate the data, but no manual processes are needed for basic reports to reach the hands of a manager. The focus has turned more into prediction-based reports and developmental projects.

Furthermore, as routine reports are automated, manual processes and thus human error has been reduced from these functions. This has increased the accuracy of reporting and controllers can focus on other work, such as ad-hoc reports and projects. Controllers also reported that monthly closing projects are significantly faster and less straining. In one of the organizations interviewed, monthly closing has been reduced from six workdays into two.

Our second research question was:

Does BI reduce the amount of time used by controllers on routine reporting? If so, in which parts of the process is the time reduced and by how much?

BI-tools reduce the time used in producing routine reporting. It is also important to mention that monthly and quarterly closing is faster and can be done in few days instead of a week or weeks. Time is being reduced because reports are being automated and combination of data from different sources has become considerably easier. In addition, data visualization is easier and different dash boards for management can be automated and are not required manual work routinely. More focus should be placed on where exactly the additional time is used. One of the case organizations has automated 80-100% of their financial reports, but others could not give estimations of their automated reports. All the controllers and management hold the view that more time can be used in analysis and business development projects.

Our third research question was:

How does the time spent on routine reports in controller's work change after the implementation of BI tools?

Before the implementation of BI & A, the organizations interviewed had difficulties drilling into the information available. Excel was widely used as the main tool and the entire process of turning data into information required time and manual work. Excel is still part of the processes, but it works in the background and BI-tools such as Power-BI and Tableau are the main tools. The implementation of BI & A increases the understanding of the business environment, ability to consolidate data, increased quality of data and increased ability to predict business environment. Time is still spent on validating the data and looking for possible flaws in the data.

Our fourth research question was:

If BI & A reduces controllers time spent on routine reporting, how do they utilize the additional time gained?

It was difficult for the interviewees to point out exactly where the extra time was being used but emphasis was on addition of value. This entailed further analysis and commenting of data, development and automation of reporting and creating predictions of the business environment. Furthermore, controller's job description had become more project based. All the controllers and managers were involved in some type of developmental project, which entailed software development or development of reporting. In addition, ad-hoc reports still require manual work and resources. Controllers use some time in producing these ad-hoc reports, but BI & A enables a fast collection of raw data, which is why management accounts did not feel that these kinds of reports take a vast amount of time from their resources.

Our fifth research question was:

What are the benefits of implementing BI & A in an organization?

The main benefits can be divided into three main aspects. Firstly, all the interviewed organizations have been able to analyze their business environment better than ever before due to accuracy and availability of data. Before the implementation of BI & A it seems to be difficult to drill into the data and find causality from it. Interviewees felt that this ability to accurately to drill into complicated data has improved significantly. Secondly, routine reports can function in the background and vital resources can be used into adding value. Thirdly, increased quality of predictions can be achieved due to the ability to drill deeper into the data and identify trends. It is worth mentioning that one of the controllers interviewed felt that the job had become more pleasant as routines reduced and the ability to impact increased.

5.1 Future research and validity

As mentioned before, this subject has not been widely studied. There are multiple reasons for this, with one being that BI & A is a rather fresh subject. Even the interviewed organizations started the implementation no earlier than 2015. Still, there is some valid literature of the subject which is line with our empirical findings. It is important to point out that this thesis is a qualitative study utilizing semi-structured interviews to gain in-depth insight of four controllers and four managers at four different Finnish companies. It is difficult to generalize the findings to cover different sectors, not to mention global scale. Still, the empirical part of this thesis entailed four different organizations all of which were from different sectors. Taken into consideration that their views on BI & A are consistent, some generalization can be made. In addition to this, most of the interviewees have extensive experience in management accounting, with some reaching to the 90s. This indicates that they do know what the role of a controller was like before the implementation of BI & A.

Due to the coronavirus pandemic, the interviews were executed via video call. This does not reduce the validity of our findings, as it comparable to face-to-face interview. Furthermore, the interviews were executed in a manner that encouraged open conversation. This supported the idea that everything was said by the interviewees that needed to be said.

In the future it would be interesting to execute a wide questionnaire involving more controllers and management. The interviewees were unable to provide specific percentages on the amount of automated reports in their organizations. Therefore, it is recommended for further research to examine the exact levels of automation in reporting. In addition, research on the topic could be widened into other countries, to see if there are differences from country to country. Different organizational factors may impact the benefits of BI. These factors can be organizational culture, skills of their controllers and willingness to introduce modern technologies. Furthermore, focus of this thesis was on business controllers, and financial controllers were not covered. There could be a research

executed with a sole focus on certain controllers, such as financial controllers, and whether they are as strongly impacted by BI & A as business controllers.

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Appendices

Appendix 1. Interview questions - management

Educational background, working experience

Job title and responsibilities

1. **Theme. BI & A tools and reporting**
   - What kind of BI- and analytics tools are in use in your organization?
   - When did your organization start implementing these tools?
   - What are some of the reports/tasks that benefit from BI? What are your goals of implementation?
   - What kind of BI- and analytics tools are in use in your team?
   - What percentage of analytics/reports have been automated?
   - Does BI & A reduce the time used to produce routine reports?
   - If yes, how and how is it measured? If no, why?
   - Do you have other ways of measuring how much of reporting has been automated due to BI tools?
   - What kind of benefits have you seen these tools create? How do you measure the benefits?

2. **Theme. Controllers and BI & A**
   - What is the competence level of controllers in your organization, when it comes to using BI tools?
   - How would you rank their skillset from a scale from 1 to 10?
   - Do you think the benefits of BI & A are more in time saving or in increased quality of reporting?

3. **Controller's role**
   - How has the role developed during your career?
   - How do you think BI & A impacts management accountants?

- Is there a skills gap between current skills controllers have and what is required of them?
- How important is the ability to give analytical, forward looking information as a controller?

Appendix 2. Interview questions - controller

Educational background, work experience

Job title and responsibilities

1. **Theme. BI & A**
- What kind of BI- and analytics tools are in use in your organization?
- When did your organization start implementing these tools?
- How do you measure the benefits of BI?

2. **Theme. BI & A and Controller Reporting**
- What are your main tasks as a controller (For example Budgeting, reporting of financials, ad-hoc-analysis)
- To whom do you report to?
- What are some of the reports/tasks that benefit from BI?
- Does BI & A reduce the time used to produce routine reports?
- If yes, how and how is it measured? If no, why?
- How much time is still spent on routine reports?
- Where is this extra time used if BI & A saves time?
- Can you give, for example, percentage of reports that have been automated?
- In which situations time cannot be saved and these tools do not help?
- In what ways has BI & A changed controller reporting?
- Do you think the benefits of BI & A are more in time saving or in increased quality of reporting?

3. BI & A and Controllers Role

- What is the competence level of controllers in your organization, when it comes to using BI tools?
- How would you rank your own skillset from a scale from 1 to 10?
- What kind of new skillsets does BI require from you?
- How important is the capability to produce more analytical information and predictions for management?
- Do BI tools change management accountant functions in general?
- If yes, why? If no, why?