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Integrated information systems: The influence on process performance in management accounting

Alexander Deneke

Otto Beisheim School of Management

Abstract

The main argument within management accounting for why integrated information systems create value has been that they increase process efficiency. However, the implementation of more sophisticated information systems also changes the relationship between the manager and the management accountant. The aim of this thesis is to determine if improved relationship quality between the manager and the management accountant is one mechanism by which integrated information systems improve the process performance in management accounting. I used structural equation modeling for a sample of 406 valid respondents consisting of management accountants from various industries. The analysis shows that integrated information systems indeed also create value through a better relationship quality between the manager and the management accountant.

Keywords: Integrated information systems, Management accounting, Process performance, Structural equation modelling

1. Introduction

With the development of more sophisticated IT systems, the business environment for organizations has become more competitive, as it gives organizations not only more possibilities but also new challenges (Pavlou and El Sawy (2006); Andersen (2005); Bettis and Hitt (1995)). These IT systems allow firms to implement new and more sophisticated integrated information systems. The enhancement of integrated information systems is driven by the fast innovation of new IT systems. Enhanced integrated information systems help management accountants to better perform their tasks (Rom and Rohde (2007)). In fact, the objective of integrated information systems is to connect the employees and the activities around them (Dechow et al. (2006)). Formerly, each department within an organization had its own information system and no access to the information systems of the other departments (Davenport (1998)). However, the development of systems such as enterprise-resource-planning (ERP)[1] has given organizations new opportunities. For example, new information systems enable organizations to have ad-hoc data from every department available for every position within the organization (Rom and Rohde (2007); Dechow et al. (2006)). This means that every division can have access to the information systems of every other department. Furthermore, the information is integrated into the systems automatically, and thus an automatization and standardization process is being enhanced within organizations.

Literature has shown that IT systems create value by increasing process efficiency (Granlund (2011); Fulk and DeSanctis (1995)). Nevertheless, the literature has mostly neglected that IT systems and thus more sophisticated integrated information systems enable management accountants to change their job tasks for the better (Rom and Rohde (2007)). Moreover, it makes them more powerful and allows them to take over more value creating tasks. Consequently, the goal of this thesis is to investigate whether integrated information systems also create value through a higher relationship quality between the management accountants and the managers. Furthermore, I have analyzed the direct and indirect influence of the relationship quality on process performance in management accounting.

The accounting literature has not incorporated enough on the importance of the evolving developments of IT systems for management accounting (Rom and Rohde (2007)). For too long, accounting researchers have given IT only a supporting role within management accounting (Granlund (2009)). Very little research has been done on the increasing

[1] ERP systems allow organizations to have an overview of all their business activities and customers (Davenport (1998))

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role change of management accountants towards business consultants, and how management acountants create value and influence performance (Hartmann and Maas (2011)). Thus, this thesis investigates the changing relationship quality between management accountants and managers and its effect on the process performance within management accounting. Furthermore, I will evaluate the influence of IT system sophistication on IT information quality, which both are latent variables[2]. Both variables are positively influenced by the developing IT systems. Furthermore, these variables describe the integrated information systems within my model. I will further elaborate on all variables in section 4.3.

In order to investigate my model, I made use of data from the WHU Controllerpanel 2015. The WHU Controllerpanel is summarized in section 4.1. The respondents within this data set are management accountants from various industries. Regarding my method, I will use of a structural equation modeling (SEM). This analysis helps me to identify the relationships between the variables within my model. SEM also allows me to investigate the effect of unobserved variables and to analyze indirect effects of variables on other variables, which are not directly connected. SEM will be explained in more detail in section 5.

This thesis is structured as follows. I will first provide a literature review about advanced IT systems and sophisticated information systems and their effect on management accounting, performance and the organization in general. Afterwards, I will develop my eight hypotheses, present my research model and explain the control variables used in my model. Next, I will present the method I used to analyze the data. Within that section, I will give an overview of how I conducted the data collection. In addition, I will give an overview of the sample and the responses. The last part of the method section describes how the variables in my model were measured. The section after that will give an overview of my results and consists of two parts, namely the measurement model and the structural model. In the section about the measurement model, I will explain how I prepared the data for the analysis. Within the structural model section, I will explain my analysis. Afterwards, I present my discussion and conclusion including managerial implications. Finally, I will point out the limitations of this thesis and give recommendations for future research.

2. Literature review

2.1. Introduction

In the following, I will give an overview about the current literature regarding the effects of enhanced IT systems and integrated information systems on management accounting. I structured the literature review as follows. First, I will give an overview of the enhanced development of IT systems and how this facilitates business competition between organizations. Second, I will briefly elaborate on integrated information systems. This will directly lead me to a short overview of big data and business intelligence (BI). Afterwards, I will elaborate on the current state of the literature on the impact of integrated information systems on performance measures within organizations. In a fourth step, I will summarize the current research about the effects of advanced integrated information systems on management accounting tools. In section 2.7, we will see that management accountants move towards the role of business consultants and I will give a short overview of this topic. This role change is adjacent to a culture change within organizations, which influences the relationship quality between managers and management accountants. I will discuss this topic in the following section. In section 2.9, I will discuss the current research regarding the risks that come along with implementing advanced IT systems within the organization. Finally, I will give a short overview of the actor network theory (ANT) and explain the link of the ANT to the enhancing IT systems and its impact on management accounting systems and moreover, on organizations in general.

2.2. Advanced IT systems drive business competition

First, it is important to understand why advanced IT systems are an important topic for organizations and why they need to manage advanced IT systems so intensively. In order to give an overview of this topic, I separated this section into three parts. First, I will elaborate on how the current business environment became more dynamic. Next, I will summarize what the current literature advises organizations to do in order to react to this development. Finally, I will examine a potential other direction of the relationship between IT Systems and performance measures.

2.2.1. The emerging of a more dynamic business environment

Organizations face a more dynamic and turbulent business landscape, which includes new challenges, but also new concepts (Pavlou and El Sawy (2006); Bettis and Hitt (1995)). The changing business environment gets increasingly competitive, which is largely driven by quickly developing IT systems (Andersen (2005)). The pace of the development of IT systems in the recent past has been astonishing (Granlund and Mouritsen (2003)).

From the late 19th century on, organizations have responded to this development by adopting their management accounting systems to the new IT systems (Bhimani and Willcocks (2014)). Organizations make more and more use of these IT systems in order to support their business processes. The quickly developing IT systems lead to an emerging need of more reliable and timely accounting tools. Moreover, IT systems are required to report more detailed information on an ad hoc basis (Prasad and Green (2015)). As many organizations implement new IT systems and thereby gain an advantage in timely and detailed information gathering, other

[2] A latent variable is not directly observed, but inferred from other indicators (Acock (2013)); indicators are directly observed variables (Acock (2013))

organizations need to follow. This fact enhances business competition, which increases the variance within the industries in which the organizations operate (Thomas (1996)). This variance is driven by the diverse pace of the implementation of new IT systems within the different organizations.

2.2.2. How to stay competitive as an organization

Organizations need to keep pace with the development of new IT systems in order to stay competitive. IT systems help organizations to gain competitive advantages by improving operational efficiency and reducing human errors leading to economic benefits and improved decision-making of managers and management accountants (Abu-Musa (2008)). To improve business efficiency, organizations need to provide timely and easily accessible accounting information through the accounting systems (Granlund (2011); Dechow et al. (2006)). As accounting systems store large quantities of information within an organization, they need to prove conformity with the underlying IT systems. In fact, technology is the mediator between information systems and accounting (Dechow et al. (2006)). Thus, organizations need to use information technology to align its management accounting systems with the changing business environment in order to stay competitive (Kloviene and Gimzauskiene (2014)). Aligning the management accounting systems with the changing business environment is one important part within a general alignment of the organization with its business environment (Powell (1992)). I will examine a cultural alignment that comes along with the integration of advanced IT systems within organizations in later sections. The next section reveals important insights about the proper implementation of integrated information systems, and thus further gives insights into how to stay competitive as an organization.

2.2.3. A possible two-direction road

So far I have only looked at the influence of IT systems and integrated information systems on management accounting. However, the relationship between IT systems and management accounting may be bidirectional. This means that increased sophistication in management accounting demanding for better IT systems could be the underlying driver for the observed performance rather than the mere advance in IT. In fact, changing demands of management accounting reports could demand a change in the IT systems (Rom and Rohde (2007)). Nevertheless, this change in direction creates tension, as, e.g., ERP systems are not easy to change (Davenport (1998)). Moreover, integrated information systems are difficult to change in general and thus this is the reason why the direction from IT systems towards management accounting is unidirectional (Granlund and Malmi (2002)).

Still, it is important to investigate the other direction of this relationship (Luft and Shields (2003)). This becomes especially important within the implementation phase of new IT systems and furthermore of new integrated information systems. As these systems are most easy to change during this phase, management accounting techniques and reporting needs should be considered when implementing them (Hyvönen et al. (2009)). This is also important, since the organizations buy and do not create the new software in order to implement new integrated information systems (Granlund (2011)). Thus, the organizations should prevent a state where the software vendors just assume the needs of the organization. This is critical as the implementation of new integrated information systems may define certain aspects of management accounting (Dechow and Mouritsen (2005)). These effects might not be visible for managers at first sight, but they bear large consequences and thus managers should give the implementation of new integrated information systems a high importance. Those arguments can get linked to a point already made earlier. As the business environment is getting more and more competitive and organizations need to implement systems already used by competitors, the compatibility of the integrated information systems becomes heavily important. The reason why many organizations have not yet implemented tools such as the Balanced Scorecard[3] is the lack of compatible integrated information systems (Rom and Rohde (2007)). The potential change in direction will not be part of my research and is open to be investigated by the research community.

2.3. Advanced information systems

After I have elaborated on the background of the developing IT systems and a more competitive business environment, I will now give an overview of integrated information systems and shortly define them. At the end of this section, I will briefly present the ERP as one important information system within organizations.

2.3.1. Information system quality

At this point, I want to single out the difference between IT systems and integrated information systems once again. The enhancement of information systems is due to the steady development of IT systems. In fact, IT systems are the technology behind integrated information systems and make them possible.

As enhanced information systems help organizations to stay competitive in the changing business environment, organizations need to enforce their development. Information system quality consists of the three components: system quality, information quality and service quality (Gorla et al. (2010)). Furthermore, Gorla et al. (2010) investigated the impact of these three components on the organization. Additionally, they determined the effect of system quality on information quality. The authors used survey data[4] to test their hypotheses. They used a confirmatory factor analysis (CFA)[5]

[3] A concept for measuring and controlling the activities of an organization with regards to the organization's strategy (Kaplan and Norton (1992))

[4] Survey data collection includes any way in which data can be collected for empirical research (Couper (2005))

[5] CFA is a certain version of the factor analysis (Acock (2013)); the factor analysis will be explained further in section 5.1

to examine the psychometric properties of their model. Additionally, they used PLS modeling in order to confirm the validity of the constructs system quality, information quality and service quality and organizational impact. In addition, PLS modeling[6] was used to test the hypotheses.

The research of Gorla et al. (2010) shows that service quality has the largest organizational impact among the three components. This impact is significant ($p<0.05$). System quality has a positive and significant impact on information quality. Furthermore, information quality has a positive and significant relation to organizational impact. Yet, this effect is lower than the one of service quality on the organizational impact (Gorla et al. (2010)). System quality only has an indirect effect on the organization through information quality. The results of their study can be seen in Figure 1.

Some literature suggests that the important factor for organizations is not the use of the information systems, but rather the impact they generate (Bradley et al. (2006)). The impact leads to real success and measurable results. Still, the actual use of the IT system is the important link between the design of the IT system and its impact (Den Hertog and Wielinga (1992)). When new implemented IT systems do not lead to a change in behavior and use, the implementation is useless (Rom and Rohde (2007)). However, employees can only be trained to a limited extent. They have to adapt the use and their behavior on their own. Thus, integrated information systems influence the behavior of employees within organizations. Nevertheless, the behavior of employees can also influence the information systems, especially in the implementation phase, as the success of the implementation of new integrated information systems not only depends on the technical conformity but also on the organization's people (Elbashir et al. (2011)). Furthermore, one needs to be careful when organizations announce to implement a new integrated information system, which will include the whole entity. The infrastructure of this new implementation and the scale and scope might not be as sophisticated as stated by the organization (Quattrone and Hopper (2005)). Once again, the actual use and impact the new implementations of IISs generate is the important piece. Additionally, this impact first comes into sight after a long learning phase following the implementation (Dechow et al. (2006)). Thus, organizations should not panic if the positive impact of the new information systems does not appear right away.

2.3.2. Various information systems of organizations

Organizations have various information systems such as the ERP (Rom and Rohde (2007)). The Balanced Scorecard, e.g., is implemented with the help of software such as Hyperion and QPR, whereas budgeting is backed by software such as Cognos (Granlund and Malmi (2002)). Consequently, information systems other than ERP should be incorporated in the list of information systems supporting management accounting as well (Rom and Rohde (2007)). However, ERP systems also facilitate the use of accounting tools such as the Balanced Scorecard activity based costing (ABC)[7] (Hyvönen (2003)). Another characteristic of information systems is how well these systems are integrated within the organization (Rom and Rohde (2007)). This is consistent with the findings of Gorla et al. (2010), who used this indicator of how well the information system is integrated to evaluate the variable system quality. I will go into deeper detail of how to measure information system quality and come back to the findings of Gorla et al. (2010) in section 4.3.

2.4. Big data and business intelligence

As this thesis deals with the enhancement of IT systems and integrated information systems, I will shortly elaborate on big data and BI systems. Big data and BI are two of the most relevant terms within times of enhanced information systems. Thus, I will briefly define them within this section and furthermore explain the importance of big data for management accounting. In the next step, I will elaborate on how BI helps organizations to make decisions. Afterwards, I will suggest how organizations successfully implement BI systems. Finally, I will explain the need for future research on the topic of BI systems.

2.4.1. The definition of big data

Big data describes "data sets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze" (Manyika et al. (2011), p. 1).

2.4.2. The definition of BI

BI has grown in importance for organizations considering the growing amount of data among the departments and in the business environment as well as the need of the organizations to make data-related decisions (Chen et al. (2012)). BI systems comprise tools for the transformation of raw data into useful data content that can be analyzed within the business (Rud (2009)). In fact, they leverage systems such as ERP. BI systems help organizations to implement strategies in order to gain a competitive advantage over competitors (Elbashir et al. (2008)). Organizations can analyze their accounting data with help of BI systems, which help to find important patterns within the data. Thus, BI systems are important for organizations in order to cope with the more dynamic business environment (Prasad and Green (2015)).

2.4.3. The importance of big data for management accounting

As new types and a larger amount of data emerges, big data is gaining in importance for the accounting functions (WWarren Jr et al. (2015)). The larger and broader amount of data will indeed help to improve the management accounting function and help managers to make better decisions. Moreover, this information can help organizations adapt to a

[6] PLS is a variance based method belonging to SEM (Acock (2013))

[7] An accounting technique classifying organizational activities and then assigning indirect costs to products (Turney (1992))

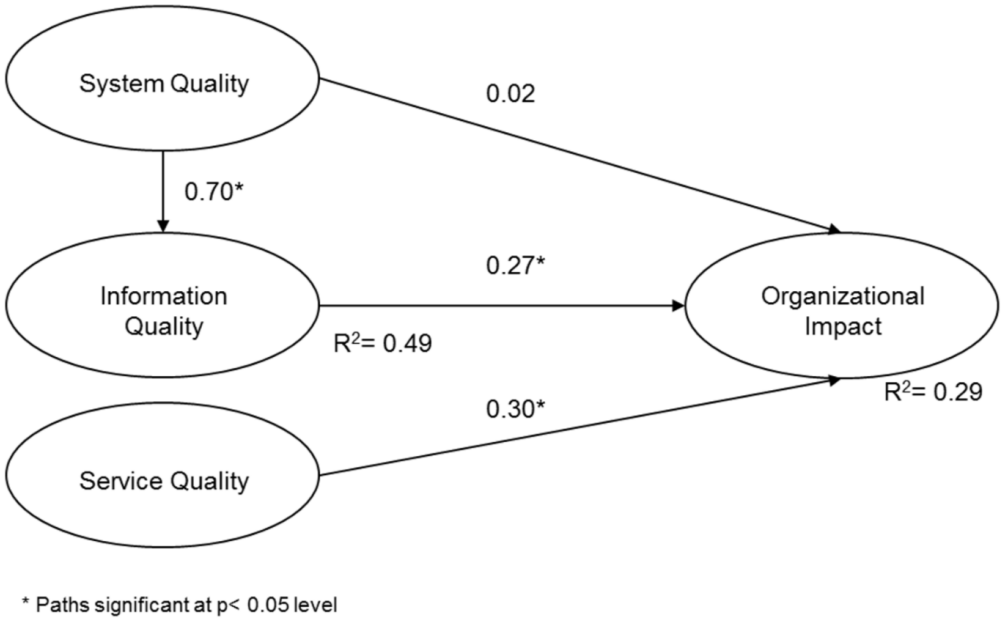

Figure 1: Path coefficients. Reprinted from Gorla et al. (2010).

more dynamic and competitive environment (Warren Jr et al. (2015)). Big data can create value for organizations in various ways (Manyika et al. (2011)). They make all the information transparent and store data already before the first production step. Furthermore, big data allows organizations to target specific customers more thoroughly, as it enables a narrower segmentation. Additionally, big data enhances the process of new product innovations, as it gives the possibility to store after-sales data by incorporating sensors into products. As big data will become one of the key issues in competition, organizations should take the topic of big data seriously (Manyika et al. (2011)).

2.4.4. How BI helps managers and management accountants to make decisions

Managers within organizations make strategy decisions on different bases. Many managers use their experience to make daily decisions and others try to find as much scientific data as possible in order to have a solid ground for decisions (Rousseau (2006)). The adhered question is how to decide on the right and fitting strategy for the organization. In the times of the digital revolution, more and more data gets produced, but at the same time solutions to deal with this amount of data and to compute existing data arise. BI solutions enhance the ability of companies to deal with its data and to compute it faster and better. This makes it easier for managers and management accountants to ground every-day decisions on real-time data, as the information is available on an ad hoc basis (Prasad and Green (2015)). This process is enhanced by the standardization and automatization process induced by the IT systems among the different departments as mentioned above (Rom and Rohde (2007)).

2.4.5. How to successfully implement BI systems

In order to create value, organizations need to concentrate on the assimilation of BI systems (Elbashir et al. (2013)). Additionally, it is important for organizations that both the strategic and the operational levels share their knowledge. In fact, this leads to a higher BI assimilation and thus to a higher organizational performance (Elbashir et al. (2013)). Furthermore, Elbashir et al. (2011) found that the ability of organizations to absorb and leverage new external data is a critical factor in order for the implemented IT systems and assimilated BI systems to have a positive organizational performance impact. The authors called the ability to absorb and leverage new external information absorptive capacity. Elbashir et al. (2011) showed that the absorptive capacity of the top management team (TMT) only plays an indirect role on the success of the BI deployment and furthermore is a function of the operational managers' absorptive capacity. Thus, Elbashir et al. (2011) show that the successful leveraging of the BI systems is bottom up driven. This is consistent with the argument made in section 2.2.3. Moreover, within the implementation of new IT systems and integrated information systems it is crucial to know the need of the future adopters and thus especially of the management accountants.

2.4.6. The need for future research

Although some research about BI exists, it seems that still a great potential for studying BI solutions and their impact on decision-making in general exists (Granlund (2011)). In fact, the current perceptiveness of these developments within the accounting research is rather narrow.

2.5. Performance gains through integrated information systems

Integrated information systems give organizations a competitive advantage, as you will see in the following subsections. I will first elaborate on performance gains in business processes. Afterwards, I will give an overview of how information systems can lead to economic performance gains and how they enable managers and management accountants to make better and faster decisions. Finally, I will briefly present the need for future research on the effects of integrated information systems on different parts of the organization, as researchers have given too little importance to this topic (Rom and Rohde (2007)).

2.5.1. Performance gains in business processes

Integrated information systems have an effect on processes within organizations (Huber (1990)). Literature shows that information systems enhance process efficiency (Granlund (2011)). IT enhances the development of automation and information processes by facilitating the development of technologies such as ERP. This changes the business processes of organizations (Dechow et al. (2006)). These findings are consistent with the results that information systems can decrease communication and coordination costs between middle managers and thus facilitate the organizational process efficiency (Huber (1990); Fulk and DeSanctis (1995)).

Furthermore, integrated information systems also allow shop floor workers to post within the stock and payables accounts (Quattrone and Hopper (2001)). Thus, at a transactional level management accounting is not only carried out by accountants anymore but also by non-accountants. The ledgers throughout the organizations and among different departments are updated automatically through information systems such as ERP (Rom and Rohde (2007)). Consequently, the integrated information systems enable line managers with accounting knowledge to have a real-time knowledge about their budget and current spending. Thus, information systems can decrease the costs of obtaining information about the activities of departments. This leads to a decentralization of control within organizations, which could lead to a state within organizations where everyone could exercise control (Quattrone and Hopper (2001)). Moreover, a decentralization of decisions can be more effective within the increasingly dynamic business environment, as it enables managers to react faster to environmental developments and thus to make faster and better decisions (Huber (1990)).

Organizations can improve their internal efficiency by leveraging their information systems in the right way (Gorla et al. (2010)). The reason for this is the fact that advanced information systems allow organizations to manage their internal resources more effectively and efficiently. Additionally, integrated information systems allow organizations to improve their customer service operations and thus to attain strategic advantages (Gorla et al. (2010)). Consequently, this shows again the importance of having high quality IT systems in order to stay competitive with the most sophisticated integrated information systems in place.

Literature states that investments in IT need to have a positive influence on business processes in order to have a positive effect on performance (Rom and Rohde (2007)). The increasing integration of information systems leads to a state of more sophisticated management accounting systems (Joseph et al. (1996)). Furthermore, literature shows that a dynamic accounting information systems (AIS) capability enhances the accounting process performance (Prasad and Green (2015)).

Weißenberger and Angelkort (2011) conducted a study, where they investigated if an increased level of integration of management accounting systems has a positive influence on controllership effectiveness. Furthermore, the authors studied if a direct relation exists or if they are related indirectly through an intermediated variable. You can see their research model including their results in Figure 2. Weißenberger and Angelkort (2011) have tested four relationships within their model. First, they evaluated if a direct effect from the level of integration of accounting systems on the output quality of controllership exists. Second, they analyzed if an indirect relation of the latter variables exists, in fact through the mediate variable Consistency of financial language. Finally, the authors investigated if Controllership output quality has an influence on the impact that controllers have on management decisions. Controllership effectiveness is considered as both Controllership output quality and the Controllership impact on management decisions. The authors made use of SEM in order to analyze their model. In terms of data collection, Weißenberger and Angelkort (2011) contacted 1269 companies. The authors adopted a didactic research design, meaning that they contacted managers and controllers in every company. Within this research design, the variable Integration level of accounting systems was assessed by controllers' answers. The remaining three variables Consistency of financial language, Controllership output quality and Controllership impact on management decisions were surveyed with the help of the managers of the respective companies.

As Figure 2 shows, no direct effect of the Integration level of accounting systems on Controllership output quality exists. However, an indirect relationship exists through the intermediating variable Consistency of financial language. The indirect effect amounts to 0.29 (0.43*0.67=0.29). This finding implies that the technical systems supporting the controllers' tasks do not directly influence the management's opinion about the controllership effectiveness. Rather, the effectiveness of controllers is perceived as higher when they are able to report a business model which proves to be consistent with the financial accounting model of the organization. Thus, the Consistency of financial language is the important link between advanced accounting systems and the effectiveness of controllers. At this point we can relate to the fact that more advanced integrated information systems improve the consistency of management accounting reports and will thus also improve the effectiveness of management accountants

(Granlund (2009); Rom and Rohde (2007)).

Furthermore, a direct and significant relation exists from Controllership output quality to Controllership impact on management decisions. Thus, a higher perceived controllership effectiveness has a larger impact on management decisions than a lower perceived controllership effectiveness. I will give an overview of the current literature about the impact of more advanced integrated information systems on decision-making within organizations in section 2.5.3.

The data of Weißenberger and Angelkort (2011) shows a good fit. The goodness-of-fit values largely exceed the critical values (e.g. RMSEA=0.00; critical value <0.08).

2.5.2. Economic performance gains

Advanced integrated information systems that are aligned with management accounting processes do not only improve accounting process performance but also stock market performance (Ittner et al. (2003)). In fact, Ittner et al. (2003) showed that organizations that make more use of both financial and non-financial measures have a higher accounting process and stock market performance than organizations with similar strategies and value drivers. Before the time of these findings, researchers were not able to find a significant positive relationship between investments in information systems and firm performance or market value (Rom and Rohde (2007)). This circumstance is known as the productivity paradox (Brynjolfsson (1993)). One possible reason for researchers to find no significant positive relationship between investments in information systems and performance can be the fact that the investments in information systems might have offset the gains from it for organizations. Nevertheless, another reason can be that the cost/value ratio for organizations implementing new information system decreases more than in the past, as the information systems become more and more sophisticated. Thus, organizations might not have had a benefit at the beginning of the development of information systems.

As a matter of fact, investments in information systems combined with a good management accounting in place leads to a better firm performance and thus a higher market value of the firm (Dos Santos et al. (1993); Hayes et al. (2001)). Right after Poston and Grabski (2001) found out that the implementation of ERP has no influence on firm performance, Hunton et al. (2003) found out that organizations that do not adopt ERP face decreasing firm performance in contrast to organizations adopting ERP. As a consequence of these findings, the research question has moved from whether investments in information systems lead to performance gains to the questions why and when they lead to performance gains (Dehning and Richardson (2002)). In fact, Dehning and Richardson (2002) contributed a literature review about this topic using data from the archives and performance measures such as accounting and market measures.

Furthermore, Barua et al. (1995) have come up with a model measuring the economic gains realized through the benefits of information systems. The authors tested this model empirically by concentrating on intermediate levels of analysis and using industry-specific and economy-wide exogenous[8] variables. By following this method, they found out that many of the information systems' impact happens at the lower level of the organization.

Moreover, the performance of an organization might have an impact on the relationship between integrated information systems and management accounting. It seems logical that better performing organizations can integrate new information systems easier than other organizations. They develop their management accounting accordingly. Again, the question of the direction of influence between information systems and management accounting comes into play here. However, as already mentioned above, I will concentrate on the influence of information systems on management accounting.

2.5.3. Better and faster decision-making

Information systems have a noticeable influence on decision-making within organizations (Huber (1990)). They are used to enhance the process of decision-making within organizations (Sutton (2000)). Integrated information systems play a major role in the decision-making process by providing the financial data of the organization. The positive performance effects of advanced management accounting systems include better strategic analyses and operational-level analyses as well as higher-quality decision-making by management (Sutton (2000)). In fact, better and more fitting strategic decisions can be made by the TMT when the amount and type of information they have improves (Dooley and Fryxell (1999)). This is particularly important as strategic decision-making can be very complex and thus requires a lot of information combined from the different departments. The strategic decisions are critical for the performance of the organization (Eisenhardt (1989)). In many organizations the TMT is reliant on the information provision of the middle managers or management accountants of the different departments (Raes et al. (2011)). Consequently, when the enhancement of the integrated information systems leads to a state where everyone within the organization can enter and access any data, no matter from which department or which country, the management can make better decisions (Sutton (2000)). The management might not have had access to such high quality data before the implementation of the more sophisticated information systems.

Furthermore, integrated information systems facilitate the pace of the decision- making process as managers have instantaneous access to all the relevant information they need for the decision-making process. This supersedes the process of formal approvals among the different hierarchical levels, where managers often see an overflow of information and thus need their time for decision-making (Andersen and Segars (2001)).

Organizations hope that the integrated information systems support its business strategy (Dechow et al. (2006)).

[8] An exogenous variable is a variable that affects other variables within a model without being affected by any variables (Pearl (2000))

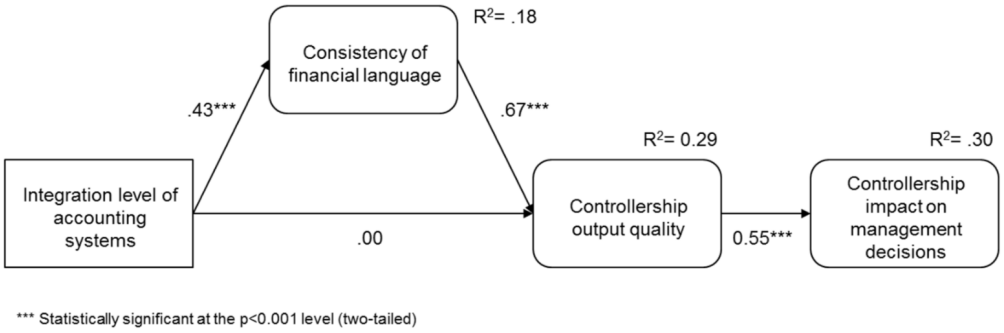

Figure 2: Standardized path coefficiencts. Reprinted from Weißenberger and Angelkort (2011).

The literature has come up with various stage maturity models, one of them is shown in Table 1. In the left column you can see the type of planning and the right column explains the interaction of the integrated information system. The goal of many organizations, namely the integrated planning, means that the planning of the information systems and the organization itself has become indistinguishable.

2.5.4. The need for future research

As seen in the previous chapters, organizations are increasingly dependent on integrated information systems. This leads to the fact that managers and management accountants more and more drive their attention towards the implementation of new integrated information systems and look out for the newest and most sophisticated IT systems in existence (Gorla et al. (2010)). Although IT has gained a lot of importance within organizations, and namely for accounting and control systems, researchers of accounting developments have not given it enough attention (Rom and Rohde (2007)). The reason is that accounting researchers see IT systems to have a supporting role within management accounting and take the relationship for granted, as management accounting and IT systems were related from their early days on (Granlund (2009); Granlund and Mouritsen (2003)). This comes from the fact that IT within organizations is often about storing the financial numbers and ensuring the reporting (Granlund and Mouritsen (2003)). Thus, researchers need to concentrate more on the important role of IT systems. Eventually, IT can generate a large amount of complex issues which no researcher has seen in the past or that ever existed (Chapman (2005)). Thus, accounting researchers should follow the fast development of IT systems and its impact on management accounting.

2.6. The effects of advanced integrated information systems on management accounting tools

In this section I will specifically give an overview of the influence of integrated information systems on management accounting tools. I separated this section into two parts. In the first part I will elaborate on the important determinants for integrated information systems to have a successful impact on management accounting tools. In the second part I will give a specific example of an integrated information system part, namely an ERP system.

2.6.1. The determinants for a successful impact of integrated information systems on management accounting tools

The positive performance impact of advanced information systems on the organization comes from detailed management accounting information. However, this management accounting information not only needs to be very accurate and timely but also consistent for the user (Weißenberger and Angelkort (2011)). Consequently, it is very important for organizations to standardize the information systems across its various departments. Additionally, literature shows that the successful integration of advanced management accounting systems is dependent on both technical and social aspects within the organization (Elbashir et al. (2011)). Thus, the culture and the relationship between management accountants and managers grow in importance. Moreover, the successful performance impact of advanced management accounting systems is not achieved by just acquiring the “state-of-the-art” software, but rather by aligning the organization’s culture and developing the skills of both management accountants and operational level managers. Consequently, the technology-driven systems’ success is driven from the bottom-up by the operational managers within organizations (Elbashir et al. (2011)). This makes sense, since it is the operational managers who enter a lot of data into the system. This data, of course, is the foundation of the management decisions.

2.6.2. A specific example of integrated information systems: The integration of ERP systems

ERP systems reflect one of the most advanced IT solutions for corporate administration at this time (Granlund and Malmi (2002)). The goal of ERP systems is to integrate all corporate information into one central database. Furthermore, they allow many organizational positions to access all the data within this database (Dechow and Mouritsen (2005)). Namely, ERP systems are module-based in-

Table 1: A five-stage maturity model for strategic alignment. Reprinted from Synnott (1987)

1	No planning	No formal planning either for the business or for the information system
2	Stand-alone planning	The company may have either a business plan or an information systems plan, but not both
3	Reactive planning	A business plan is prepared and the information systems function reacts to it. This is a traditional passive systems role
4	Linked planning	Business planning is interfaced with information systems planning. Systems resources are matched against business needs
5	Integrated planning	Business and information systems planning have become indistinguishable. Both occur simultaneously and interactively

tegrated software packages which control several variables such as material, personnel, monetary and information flows of a company (Davenport (1998)). In fact, Granlund and Malmi (2002) looked at a specific example in their study and showed evidence that management accountants need to acquire new additional skills. They tested if the implementation of ERP systems has led to changes within management accounting and control methods in the companies they have studied (Figure 3).

Regarding the method, Granlund and Malmi (2002) have collected their data through interviews and written documents. The authors have undertaken interviews with accounting professionals, project managers and IT managers of large SAP R/3 adopters, since R/3 has been the market leader in the Finnish ERP systems market during the time of the authors' research. The empirical results of Granlund and Malmi (2002) show that ERP systems neither have a major direct or indirect impact on management accounting or management control systems. The main impact of new integrated information systems for accounting is the possibility of mass processing of documents. When evaluating the impact of the implemented ERP systems it is important to be aware of the fact that it is crucial for the adopters of the systems to understand the basics of the technology (Dechow and Mouritsen (2005)).

The findings of Granlund and Malmi (2002) show that the implementation of ERP systems within organizations has put the emphasis to the management accounting processes, the automation of internal transactions, the redesign of information documents, analyses of information needs and the implementation of new and enhanced information systems. The development and implementation of new information systems is based on the fact that not all management accounting systems are operated within the ERP systems. Consequently, management accountants not only have to get familiar with new information systems and work on their developments but also work on the interfaces between the several accounting tools (Granlund and Malmi (2002)).

Moreover, the authors noticed that the tasks of management accountants within the companies of the data set varied from bean counters to business consultants. Thus, it seems that some management accountants will still be responsible for information collection and aggregation in the near future (Granlund and Malmi (2002)). Nevertheless, the ERP systems have facilitated the work shift towards more analytical work for management accountants. Furthermore, ERP systems enable management accountants to concentrate on more value-adding tasks and more decision-making. The relatively small impact of ERP systems on management accounting in total, which was revealed in the study of Granlund and Malmi (2002), can be explained through a time lag, meaning that it takes time until the new integrated information systems turn out in performance impacts. In fact, organizations implementing ERP systems most often go through a learning curve before gaining an advantage from the new ERP system (Ross and Vitale (2000)).

A part of the literature suggests the huge potential of ERP systems, which have the possibility to take over all the calculations and governance issues of the organization (Dechow and Mouritsen (2005)). Moreover, Cooper and Kaplan (1998) predict thorough effects for management accounting. Yet, only a small amount of literature has come up with empirical evidence for these predictions. In fact, two parts of the literature exist that each predict a different future impact of ERP systems (Dechow and Mouritsen (2005)). As already hinted above, Granlund and Malmi (2002) expect a more moderate impact from ERP systems since they are not constructed together with a change in mind regarding the use of them. They would just use the structure of the already existing systems (Dechow and Mouritsen (2005)). The other part of the literature states that ERP systems are juggernauts which are extremely powerful (Hanseth et al. (2001)). This part of the literature even goes a step further, as the authors say that these systems could be different to control and that they could work in the wrong direction (Hanseth et al. (2001)). Furthermore, the authors warn of possible disruptive effects induced by integrated information systems, which would lead to disintegration.

Organizations can decide between different levels of advancements when implementing an ERP system. Three different scenarios can be seen in Table 2. The first column shows the specific configuration an organization might want to undertake. For every specific configuration, you can see what it makes possible for the organization. The second column shows the most basic level of the three scenarios. An advanced level can be seen in the third column. The fourth column shows the most advanced level, namely Multiple Systems. The complexity of the different scenarios increases

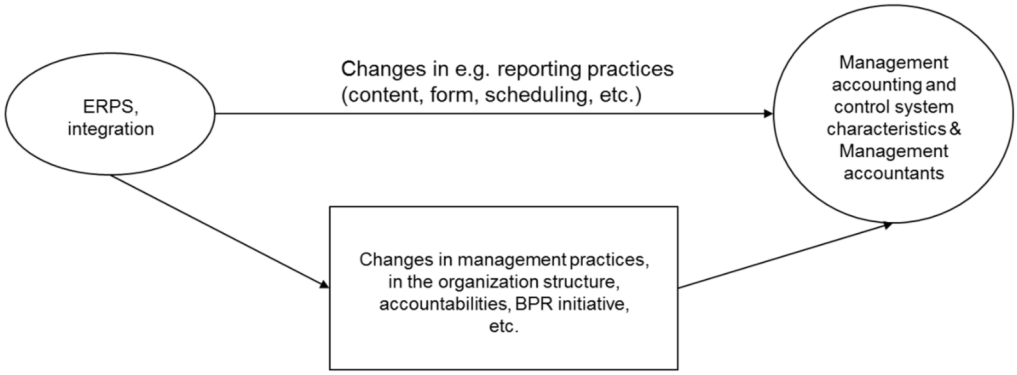

Figure 3: Changes through ERPS integration. Reprinted from Granlund and Malmi (2002).

from the left to the right. Thus, a higher IT investment is required for the Multiple Systems (Dechow and Mouritsen (2005)). However, the scenario of Multiple Systems also enables a maximum level of system and management control flexibility. The basic scenario enables a maximum level of data integration, as Table 2 reveals.

2.7. Management accountants become business consultants

One of the most important drivers of the changing relationship quality between managers and management accountants is the new evolving role of management accountants, namely they move towards the role of a business consultant. This section consists out of five parts. First, I will elaborate on the role of the management accountants today and in the past. Afterwards, I will give an overview of the ongoing role change of management accountants induced by IT systems and integrated information systems. In the third section I will deal with the new tasks that evolve out of this circumstance for management accountants. Afterwards, I will explain what the literature has reported about the evolving dual responsibility of management accountants, which is also caused by their role change. Finally, I will give a short overview of the need for future research regarding the role change of management accountants.

2.7.1. The role of management accountants today and in the past

As already mentioned, controllers are currently moving towards the role of business consultants. In the past, collecting and aggregating data and providing this data to managers has been one of the main tasks of controllers (Weißenberger and Angelkort (2011)). In fact, the role of controllers could be described as a watchdog (Pierce and O'Dea (2003)).

Nevertheless, controllers pursue the management accounting function. This is especially the case in German-speaking countries (Weber and Schäffer (2008)). This means that responsibilities such as administrating tax issues or managing investor relations are being handled by other departments, e.g. financial accounting. Controllers, especially in Germany, undertake tasks within the processes of planning and budgeting. They are also involved in preparing and analyzing performance reports (Ewert and Wagenhofer (2006)). Management accountants work with the Management Accounting System. This system contains all numbers regarding the different departments. Thus, management accountants have quite a powerful position within organizations (Wagenhofer (2006)). Controllers have been referred to as management accountants in the literature in the past (Ahrens (1996)). Within this thesis, I will also refer to controllers when speaking of management accountants out of the prior reasons. In the following, I will elaborate on the ongoing role change of management accountants.

2.7.2. Advanced information systems lead to an ongoing role change for management accountants

The role and tasks of management accountants have changed. The literature shows that IT systems influence the relationships between people and organizational entities within companies (Dechow et al. (2006)). As the IT systems within organizations enable automatic processes within the accounting systems, the role of the management accountant has changed towards the role of a business consultant (Rom and Rohde (2007)). This means that management accountants now analyze data and come up with solutions for current challenges rather than just collect data. This also includes making recommendations to management for the future strategy of the organization.

The developments and enhancements of IT systems and furthermore information systems regarding automatization processes facilitate the role change of management accountants towards business consultants (Dechow et al. (2006)). As many information systems already automatically calculate important measures, management accountants often do not need to collect or aggregate the data anymore. They rather analyze them with regards to the organization's strategy. Additionally, tasks of management accountants increasingly include internal analyses and risk management activities (Elbashir et al. (2011)). Furthermore, the enhancement of IT systems moves management accountants towards the responsibility of taking outsourcing decisions. They need to be able to determine which tasks can be done in- house and which parts can be outsourced (Feussler, Jarvis, Lin & Nord-

Table 2: Three different technology levels at the first of five ERP configuration scenarios. Reprinted from Dechow and Mouritsen (2005); & SAP (1997) - CA- Consultants handbook

Control Configuration	**Basic** One system set up for 1 company	**Advanced** One system set up for X companies	**Multiple Systems** One enterprise with X company systems
Logistical integration	Within location of business	Focussed at the level of strategic business units across legal entities	Only to a limited extent across business units and enteprise
Technologies and process	Standardized to a large degree	Different in various business units	Different in various business units Markets
Markets	Uniform by structure	Varying by structure	Varying by structure
Internal Transactions	No internal pricing	Transfer pricing	Market based customer/ vendor relationships
Operational control	Standard reporting	Independent operative and strategic control	Full BU autonomy: system master data, open items management and controlling
General reporting	Reports for external rendering of accounts	Autonomous SBU's in relation to profitability and cost reporting	Independent
New business	Legal entities should not be planned in short term	Legal entities planable in medium term	Legal entities planable "anytime"

man, 2013). These tasks reflect the role change of management accountants.

2.7.3. Management accountants need to acquire new skills

In order to successfully fulfill the new tasks management accountants need to develop various new skills. These include overlapping knowledge across departments, interpersonal skills as well as a more detailed understanding of the organization's strategy (Elbashir et al. (2011)). In fact, management accountants will not need to develop their skills within data aggregation but need to understand the impact of these data numbers on the organization's strategy and its implications for the financial intelligence (Bhimani and Willcocks (2014)). At the same time they need to be taught about consequent risks of a technologizing business world and be informed about the dangers that might come along and how to successfully face them. One of these challenges is the increased velocity of new information coming into the accounting systems as well as the extreme velocity of IT systems enhancement in general (Bhimani and Willcocks (2014)). Management accountants need to keep an overview of more accessible data within the information systems. This specific point will be especially challenging for the management accounting community, as in the past the literature has argued that the practices of management accounting are slow to change (Granlund (2001)).

Furthermore, management accountants need to be aware of the fact that decision-makers need their support for formulating strategies (Stambaugh and Carpenter (1992)). Consequently, it is important for management accountants to understand the various decision processes of executives used for different types of decisions.

2.7.4. The developing dual responsibility of management accountants

The enhancing development of integrated information systems also leads to the fact, that management accountants within organizations face a dual responsibility, namely a local responsibility and a functional responsibility (Maas and Matejka (2009)). Literature states that organizations can improve their financial reporting quality when the responsibility of management accountants moves towards a functional role (Indjejikian and Matejka (2006)). Indjejikian and Matejka (2006) claim that management accountants increasingly prevent data misreporting and enhance corporate control when their role moves more towards a functional responsibility. However, Maas and Matejka (2009) used a survey study in order to show that an increased functional responsibility leads to both role ambiguity and role conflict for management accountants. The authors made use of a data size of 134 business unit (BU) controllers working in large- and medium-sized companies located in the Netherlands. The authors showed that role ambiguity as well as role conflict are related to data misreporting at the BU level. This result is consistent with empirical findings that these variables lead to dysfunctional behavior (Grover and Hui (1994); Grover (1993)). Moreover, this means that BU controllers cannot prevent themselves from the negative effects of Role Conflict (Maas and Matejka (2009)). This is very critical since one of the tasks of BU controllers is to prevent misreport-

ing. Although no direct relation exists from Functional Responsibility to Data Misreporting, an indirect relation exists through the mediating variables Role Conflict and Role Ambiguity. The finding that Functional Responsibility is not directly related to Data Misreporting is in contrast to the findings of Indjejikian and Matejka (2006). Additionally, Maas and Matejka (2009) find evidence in their study that an increased Functional Responsibility of controllers compromises their ability to support the local decision-making within the organization.

The research model of Maas and Matejka (2009) including the path estimates can be seen in Figure 4. The authors have also found a good fit for their model (e.g. RMSEA = 0.03; critical value: <0.08).

Consequently, Maas and Matejka (2009) contrast with the prior literature that suggests that a greater functional responsibility of BU controllers leads to an improved quality of financial reporting. Moreover, the authors found out that the respondents of their survey see their responsibility to support local decision-making as the primary one. Nevertheless, when coping with functional duties it becomes more difficult for them to fulfill the job duties of both, as the study has shown.

2.7.5. The need for future research

Although a substantial amount of research has been conducted in the field of the role change of management accountants, little research exists about the link between the role of management accountants and performance at various levels within the organization. In the future, research is needed on the impact of the changing role of management accountants as business consultants on organizational performance, and how exactly they create value (Hartmann and Maas (2011)).

2.8. The effect of advanced information systems on the organization's culture and the relationship quality between management accountants and managers

In this section I will specifically give an overview of the existing literature about the influence of integrated information systems on the relationship quality between managers and management accountants. In fact, I will elaborate on the cultural and relationship change within the organization induced by new integrated information systems. Finally, I will discuss the need for further research on this topic.

2.8.1. A cultural and relationship change within organizations with integrated information systems

The underlying role change of the management accountants leads to a cultural change within organizations (Rom and Rohde (2007)). This finding is enhanced by the fact that knowledge is power and that this knowledge is generated by information systems (Granlund (2011)). Thus, management accountants within organizations could gain power by managing and mastering the different types of integrated information systems. Yet, this depends on how the management accountants use the information systems (Rom and Rohde (2007)). Management accountants can add a lot of value by mastering the integrated information systems. They could be able to go through huge amounts of data and to find certain patterns, which could influence the organizational goals (Sutton (2006)). This again illustrates the connection to the fact mentioned in section 2.7, that management accountants are moving towards the role of business consultants.

However, a change in power after implementations of new information systems does not always take place within organizations. No power changes are solely due to a cultural fit between the integrated information systems and the social structure and values in place within the organization (Rom and Rohde (2007)). In fact, the future role of management accountants depends on themselves, as they can choose if they want to take charge of the new information systems or to transfer that responsibility to someone else (Rom and Rohde (2007)). This power gain also goes along with a higher responsibility and higher pressure within the organization, as many people in the organization are dependent upon the integrated information systems working properly and to have access to all the information needed (Caglio (2003)). Management accountants need to be aware of the fact that groups such as information system professionals could also be interested in taking charge of these (Sangster (1996)). Thus, management accountants should act determinant when they want to take charge of the new integrated information systems within organizations.

In particular, enterprise systems facilitate the ongoing change within the business environment and within the organizational environment (Sutton (2006)). The increasing influence of IT systems on accounting leads to more complex organizations. Only those who have access to all kinds of information and calculations are able to control these complex organizations (Dechow et al. (2006)). This potential power shift enhances the cultural change within companies. The new importance of information systems and the role change of management accountants makes it very important to clarify the roles and tasks of experts within organizations. This will not be easy for organizations as a complex relation exists between accounting, control and integrated information systems (Granlund (2011)).

2.8.2. The need for future research

Moreover, research is needed on the link between management accountant roles and enactment with performance at various levels, as currently there is a scarcity of research done on this topic (Hartmann and Maas (2011)).

2.9. Risks of advanced information systems

The literature has not found only positive impacts of the increasing amount of more sophisticated integrated information systems, but also warns of some risks. This part consists out of two sub-sections. First, I elaborate on the risks with regards to the fact that professionals within the organization need to acquire new skills. The second section deals with the

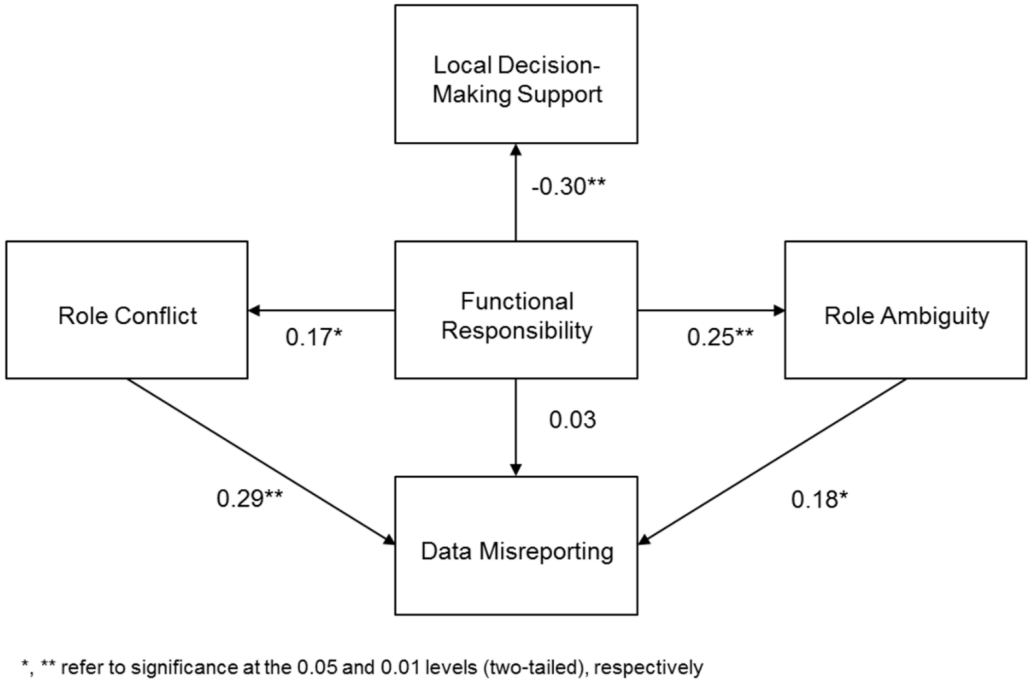

Figure 4: Path coefficients. Reprinted from Maas and Matejka (2009).

risks of the automatization and standardization process enhanced by the implementation of new integrated information systems.

2.9.1. Professionals within the organization need to acquire new skills

Advanced integrated information systems do not only lead to positive outcomes, but also bear some risks (Granlund (2011)). As mentioned, management accountants need to be prepared for these risks. Moreover, both managers and management accountants need to be prepared for the fact that the volume of information will increase rapidly. Their role in interpreting the new mass of data will be increasingly important in the future (Granlund (2011)). This importance is enhanced by the fact that IT systems might also misinterpret the goals of managers and the actual realized outcomes (Granlund (2011)).

As discussed, management accountants and operational managers need to acquire new skills when a new system such as ERP is being implemented (Granlund and Malmi (2002); Elbashir et al. (2011)). The design of new management accounting tools, due to the enhancement of technical tools, bears the risk of not integrating the operational managers into the process (Van der Veeken and Wouters (2002)). However, operational managers are essential for the success of the new technical systems within the organization as explained earlier (Elbashir et al. (2011)). Van der Veeken and Wouters (2002) show in their case study that new information systems will be of lower use when operational managers do not understand them thoroughly. Thus, the implementation of new management accounting tools should be driven by an accurate understanding of the strategies of operational managers regarding fulfilling the financial goals and how they make use of the information systems within this process (Van der Veeken and Wouters (2002)).

2.9.2. The risks of automation and standardization

The enhancing and developing information systems also bear another risk. As IT systems enhance the standardization processes of management accounting tools, these processes remain unchallenged by management accounting professionals (Hyvönen et al. (2006)). This fact is very critical since information systems are among the most important information carriers within organizations (Hyvönen et al. (2006)). Still, no management accounting professional or manager questions these processes, as they are not willing to open up the highly technical IT processes that stand behind the standardization processes (Granlund (2009)). Consequently, a potential flaw will remain unseen when it is present in the process and be repeated over and over again. Moreover, wrong output data can lead to wrong strategy decisions. Thus, it is very important for organizations to consequently question their management accounting processes as they are being standardized and automated among the several departments within the organization (Rom and Rohde (2007)).

Furthermore, the fact that every position within the organization can access the data of every other department leads to the risk of fraud and privacy violations (Abu- Musa, 2008;Anandarajan and Wen (1999)). In fact, managers of other departments, which might want to show that they provide better numbers than the other managers, might try to use other departments' information for their own advantage.

However, this circumstance of transparency should lead to a higher motivation of the managers to perform well and to learn from best practices. On the other hand, the decentralization of decision-making, made possible through the implementation of new integrated information systems, may lead to higher agency costs if the middle managers use this circumstance to operate in greater disharmony with the corporate owners of the organization than the TMT does (Andersen (2005)). Organizations need to be aware of these risks when implementing new integrated information systems.

As already stated in section 2.6.2, some researchers suggest that integrated information systems and in detail ERP systems could possibly lead to disruptive effects, which would lead to disintegration (Hanseth et al. (2001)). Nevertheless, another division of the researchers also suggest that ERP systems can have a positive impact on management accounting (Granlund and Malmi (2002)). Organizations need to be aware of the warnings of some researchers when implementing new integrated information systems and in detail ERP systems.

2.10. The ANT

The last section of my literature review deals with the ANT. I will first define the theory and then elaborate on the connection between it and IT systems.

2.10.1. The definition of the ANT

The last risk from section 2.9.2 can be connected to the ANT. The ANT states that nothing is either purely human or purely technical, but rather always a combination of both (Latour (1999)). Consequently, it is important for organizations to understand how their people and IT systems interact with each other and influence one another (Dechow and Mouritsen (2005)). Moreover, the people (e.g. professionals) and IT systems build networks out of humans and non-humans, which either facilitate or constrain the development of new innovations. In fact, no action takes place outside these networks (Callon (1990)). Thus, IT system can facilitate or constrain their own development.

2.10.2. The connection between the ANT and IT systems

Following the argumentation of section 2.10.1, IT systems can be seen as non-human actors (Dechow and Mouritsen (2005)). As non-human actors within organizations and between organizations, IT systems influence the information flow, management accounting and decision-making within organizations. Following, the ANT is able to explain how IT mediates management accounting within and between organizations (Granlund (2009)). Hence, it can be seen again that IT systems have a fundamental influence on organizational practices. Furthermore, the developing ERP systems can become actors given the current technological trends (Dechow and Mouritsen (2005)). As already seen in section 2.6.2, ERP systems will play an important role within the organization and in management accounting.

However, Dechow and Mouritsen (2005) show, that IT and information systems configuration already have an impact on management accounting. Thus, the impact begins with the time of implementation of these system. Nevertheless, these effects are not always recognizable for managers and management accountants. Consequently, the outcome of their choices during the time of implementation is not always clear to them (Granlund (2011)). For this reason, managers and management accountants should pay close attention to the implementation of new integrated information systems. This supports an earlier argument stating that managers and management accountants need to consider the exact needs of management accounting for the new information systems so that they can be adopted to the exact needs of the organization and processes (Hyvönen et al. (2009)).

3. Research model and hypothesis development

3.1. Hypothesis development

As seen in the literature review, research has shown that integrated information systems create value because they increase process efficiency (Granlund (2011); Fulk and DeSanctis (1995)). The literature has also shown that management accountants are increasingly moving towards the role of a business consultant (Elbashir et al. (2011); Rom and Rohde (2007); Dechow et al. (2006)). Further, management accountants can gain power within organizations by mastering the information systems. These factors change the relationship between the manager and the management accountant (Granlund (2011); Rom and Rohde (2007)). However, only few studies exist about the value creation through a better relationship between the management accountant and the manager (Hartmann and Maas (2011)). Consequently, I will investigate if IT systems, and in more detail integrated information systems, increase process performance/ satisfaction through the variable relationship quality.

The first hypothesis of my model relates to integrated information systems. In fact, I have looked at the IT systems behind these integrated information systems as they make the implementation possible. Furthermore, I have separated the variable belonging to IT systems into the variables IT system sophistication and IT information quality. They describe the integrated information systems within my model. I will further elaborate on my variables in section 4.3. I have separated IT systems into two variables for two reasons. First, as stated in the literature review, Gorla et al. (2010) have found a positive and significant relationship between system quality and information quality. Second, my factor analysis, which I will describe in more detail in section 5.1, proposes splitting the variable IT Systems. Consequently, I hypothesize:

> H1: An increased level of IT system sophistication leads to a facilitated level of IT information quality.

My second and third hypotheses relate to the fact that IT Systems enhance process efficiency (Granlund (2011); Fulk and

DeSanctis (1995)). Moreover, IT enhances the automation, standardization and information processes within organizations and facilitates the development of tools such as ERP systems (Dechow et al. (2006)). This means that information across all departments is available on an ad hoc basis. Furthermore, a change within the business processes is seen as a necessary condition by research to observe an impact of investments in IT on process performance (Rom and Rohde (2007)). Consequently, my hypotheses are:

> H2: An increased level of IT system sophistication leads to a higher level of process efficiency.

> H3: An increased level of IT information quality leads to a higher level of process efficiency.

The literature shows that the relationship between management accountants and managers is changing (Rom and Rohde (2007)). There are two main reasons for this, first, enhancing information systems lead to a changing relationship since they facilitate automation processes and generate a lot of information (Granlund (2011)). Nevertheless, the management accountant can decide himself how much use he makes of the enhanced information systems, and thus influence how much power he has and how much this changes his relationship with the manager (Rom and Rohde (2007)). Management accountants who have access to all kinds of information and calculations are able to take on more control within organizations (Dechow et al. (2006)). The second major reason for the relationship change is that management accountants move towards the role of a business consultant and thus do more tasks related to data interpretation than data collection (Rom and Rohde (2007)). Thus, I argue that information systems lead to a more effective and efficient relationship between management accountants and managers. I equate this with a better relationship. Consequently, my next hypotheses are:

> H4: An increased level of IT system sophistication leads to a better relationship quality between management accountants and managers.

> H5: An increased level of IT information quality leads to a better relationship quality between management accountants and managers.

As enhanced information systems should improve both process efficiency and relationship quality I further investigate whether the latter variable also has a positive effect on process efficiency. A better relationship quality between the manager and the management accountant should make many internal processes easier and thus increase process efficiency, as a better relationship quality should lead to a higher trust within the other position. This fact should facilitate the pace of the decision- making process and thus enhance process efficiency. Consequently, I hypothesize:

> H6: A better relationship quality between management accountants and managers leads to a higher level of process efficiency.

As I want to investigate whether a better relationship quality between management accountants and managers leads to value creation beside the effect through process efficiency, I will also look at the impact of an improved relationship on process performance/ satisfaction. In fact, I check this for each of the three processes reporting, budgeting and forecasting, as these are three of the main processes of management accountants (Merchant and Van der Stede (2007)).

Consequently, my next hypothesis is:

> H7: A better relationship quality between management accountants and managers leads to increased process performance/ satisfaction.

As already stated above, enhanced information systems create value through an increased process efficiency. It is only logical that a higher level of process efficiency in reporting, budgeting and forecasting leads to an increased satisfaction of managers with those three process and thus to a higher level of process performance/ satisfaction. Thus, my final hypothesis is:

> H8: A higher level of process efficiency leads to increased process performance/ satisfaction.

3.2. Control variables

The research model includes seven control variables. Four control variables relate to controller tasks and three to time since implementation. I will check the impact of controller tasks on relationship quality and thus check for the implication it has on my model. The connection of this control variable is towards relationship quality since the literature states that the role of a management accountant as a business consultant improves the relationship between him and the manager (Rom and Rohde (2007)). Additionally, I will evaluate the effect of controller tasks on process efficiency, as the more value creating tasks of management accountants might lead to a better efficiency of the process. A management accountant is more efficient when interpreting data rather than collecting it. I included the control variables as observations within my model. I will explain the exact control variables and their measurements in section 4.3.

The time since implementation asks for the time passed since the current IT and accounting tools within the three processes reporting, budgeting and forecasting are implemented. In fact, the time since implementation for the tools in each process represents one control variable. The positive performance effects from the integration of IT systems first come into sight after a long learning phase following the implementation time (Dechow et al. (2006); Granlund and Malmi (2002)). Hence, the effect of the control variables stemming from time since implementation are evaluated on the variable process performance/ satisfaction.

The resultant research model is depicted in Figure 5. The latent variables are marked with a rectangle, whereas the control variables are marked with ovals. This research model

allows me to test whether IT systems and furthermore integrated information systems create value through creating a better relationship between the manager and the management accountant.

4. Method

4.1. Procedure of data collection

I used a sample of the data collected in the WHU-Controllerpanel 2015 to test my hypotheses. The WHU-Controllerpanel was founded as an initiative of the Institute of Management Accounting and Control of WHU (IMC) together with the International Controlling Association (ICV)[9] in 2007. The aim of the panel is to determine benchmarks and best practices. The panel regularly undertakes longitudinal research surveys in order to track the development of important controlling issues within the DACH region (WHU).

The survey was designed by the WHU-Controllerpanel team and I was provided with the data in the format of a Stata[10] file. As data preparation was necessary for further data analysis, I will next describe how data preparation and consecutively data analysis were conducted.

4.2. Sample and responses

The survey was sent out to participants of the WHU Controllerpanel 2015 via E-Mail with a link to the survey, which was conducted with the help of Unipark[11] .The respondents are management accountants from various industries. Thus, all indicators and furthermore latent variables capture the perspective of management accountants within the organizations. No survey participant works as a financial accountant, hence, no participant works for an audit firm. The survey language was German. I worked with the German version when analyzing the data and translated the outcomes into English. You can find the original version of the survey in Appendix A.

The survey was sent out to 931 people and resulted in 451 responses. This equals a response rate of 48%. However, I have dropped the observations of the consultants as they do not directly work in the management accounting field and thus could falsify the survey. After subtracting two consultants the remaining number of responses is 449. Still, Unipark counts every observation with at least one response. Thus, I dropped all the observations which did not answer questions for at least two variables. Consequently, 43 responses were dropped which resulted in 406 valid responses. This equals a response rate of 44%. This response rate is close to the average rate of 55% in other empirical management accounting surveys (Van der Stede et al. (2006)). However, the response rate is higher than for similar studies (e.g. Weißenberger and Angelkort (2011); Gorla et al. (2010)).

After dropping the not feasible observations I converted the format of my variables which still had a “text value” (string value) into “numeric values”. This is necessary, since Stata can only calculate with numeric values (Acock (2013)). Nevertheless, the data file I have received contained “text values”. In the next step, I replaced the blank responses through missing values. Stata recognizes these missing values and correspondently considers them in calculations.

As Likert scales have been used for variable measurement, I checked if the numbers of the Likert scale corresponded to the respective answer possibilities of the survey to avoid mistakes in my data analysis. I will further explain the variable measurement in section 4.3. To gain a better understanding, you can see an overview of the Likert scales of my variables in Tables 3 – 7. The left column shows the question for the respective indicator of the latent variable. The second column states the variable code used for that specific indicator in my data set in Stata. In the right column, you can see the answer options and the corresponding numbers of the Likert scale. The control variables do not have a Likert scale, but the respondents were asked to insert the specific numbers by themselves. I will go into further detail about the variable measurement in the next section.

Finally, I did a final check of my data to ensure that no string variables still exist in my data.

4.3. Variable measurement

All five latent variables in my model have been measured either with self-developed questions drawn from the relevant literature or by scales that already have been developed within the existing literature. The same procedure was used for the control variables in my model. For the four latent variables IT system sophistication, IT information quality, process efficiency and process performance/ satisfaction a five- point Likert scale was used as depicted in Tables 3 – 5 and Table 7. A seven-point Likert scale was used for the latent variable relationship quality as it is shown in Table 6.

Latent variables can be adopted by formative and reflective measurement (Diamantopoulos et al. (2008)). Reflective measurement assumes that the indicators are dependent on the latent variable. Hence, any changes of the latent variable would lead to changes within the indicators. Formative measurement argues the opposite. Namely, the latent variable is dependent on the indicators and influenced by any changes of the indicators (Diamantopoulos and Winklhofer (2001)). A main requirement for formative constructs is completeness, meaning that my model would assume, e.g., that the three processes reporting, budgeting and forecasting are the only processes within an organization (Diamantopoulos (2008)). However, more processes exist alone within management accounting such as strategic planning (Rom and Rohde (2007)). Thus, my model is reflective.

Moreover, the latent variables of my model are reflectively measured, as their indicators are directly depended on them. E.g. as the indicators of process efficiency directly ask for the level of efficiency in reporting, budgeting and forecasting, any change in the level of process efficiency would

[9] The ICV is an international network of controllers acting in the DACH region.

[10] Stata is a statistical tool enabling statistical and graphical functions and is offered by Stata Corp.

[11] Unipark is an online-survey tool offered by Questback GmbH

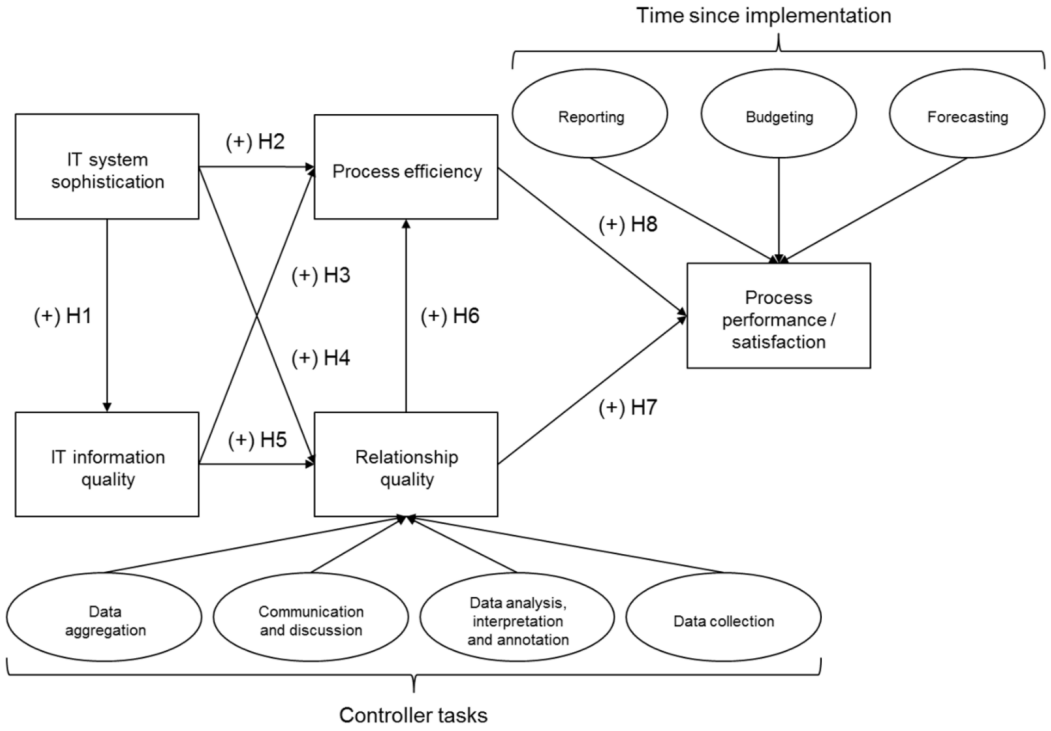

Figure 5: Research model. Note: For illustrative purposes, only the latent and control variables of this model are displayed. All indicators can be obtained from Tables 3 – 7.

Table 3: Likert scale overview of IT system sophistication

Question	Variable Code	Likert scale				
To what extent do you agree with the following statements: Our IT systems …		1	2	3	4	5
… are fully integrated.	citsystsopha_152	Strongly Disagree				Strongly Agree
… are user-firendly.	citsystsophb_152	Strongly Disagree				Strongly Agree
… are well documented (handbook, search function or similar).	citsystsophc_152	Strongly Disagree				Strongly Agree
… have short response times for on-line enquiry.	citsystsophd_152	Strongly Disagree				Strongly Agree
… fully operate on the basis of real-time data.	citsystsophe_152	Strongly Disagree				Strongly Agree

Table 4: Likert scale overview of IT information quality

Question	Variable Code	Likert scale				
To what extent do you agree with the following statements: The information outputs of our IT systems are …		1	2	3	4	5
… accurate.	citinfquala_152	Strongly Disagree				Strongly Agree
… complete.	citinfqualb_152	Strongly Disagree				Strongly Agree
… consistent.	citinfqualc_152	Strongly Disagree				Strongly Agree
… useful in our daily jobs.	citinfquald_152	Strongly Disagree				Strongly Agree
… relevant for decision-making.	citinfquale_152	Strongly Disagree				Strongly Agree

Table 5: Likert scale overview of process efficiency

Question	Variable Code	Likert scale				
To what extent do you agree with the following statements: The information outputs of our IT systems are …		1	2	3	4	5
… accurate.	citinfquala_152	Strongly Disagree				Strongly Agree
… complete.	citinfqualb_152	Strongly Disagree				Strongly Agree
… consistent.	citinfqualc_152	Strongly Disagree				Strongly Agree
… useful in our daily jobs.	citinfquald_152	Strongly Disagree				Strongly Agree
… relevant for decision-making.	citinfquale_152	Strongly Disagree				Strongly Agree

Table 6: Likert scale overview of relationship quality

Question	Variable Code	Likert scale				
To what extent do you agree with the following statements: The information outputs of our IT systems are …		1	2	3	4	5
… accurate.	citinfquala_152	Strongly Disagree				Strongly Agree
… complete.	citinfqualb_152	Strongly Disagree				Strongly Agree
… consistent.	citinfqualc_152	Strongly Disagree				Strongly Agree
… useful in our daily jobs.	citinfquald_152	Strongly Disagree				Strongly Agree
… relevant for decision-making.	citinfquale_152	Strongly Disagree				Strongly Agree

Table 7: Likert scale overview of process performance/ satisfaction

Question	Variable Code	Likert scale				
To what extent do you agree with the following statements: The information outputs of our IT systems are …		1	2	3	4	5
… accurate.	citinfquala_152	Strongly Disagree				Strongly Agree
… complete.	citinfqualb_152	Strongly Disagree				Strongly Agree
… consistent.	citinfqualc_152	Strongly Disagree				Strongly Agree
… useful in our daily jobs.	citinfquald_152	Strongly Disagree				Strongly Agree
… relevant for decision-making.	citinfquale_152	Strongly Disagree				Strongly Agree

change the answer to these questions. As I will outline in section 5, I am going to undertake a covariance-based SEM. Reflective measurement is applicable with this method (Diamantopoulos and Winklhofer (2001)).

As a matter of fact, formative measurement is rarely used within the empirical literature (Diamantopoulos (2008); Diamantopoulos et al. (2008)). This is due to the fact that many of its properties, advantages, disadvantages and limitations are not yet clear to the research community. However, in the near past it has gained more attention from researches (Diamantopoulos (2008); Diamantopoulos et al. (2008)).

In the beginning, six indicators in total measure the exogenous variable within my model, namely IT system sophistication. Yet, after having conducted a factor analysis, only five indicators measure my exogenous variable. I will explain in deeper detail my statistical analyses in the next section. For the latent variable IT system sophistication, the six-item measure for System Sophistication used by Gorla et al. (2010) was adopted to measure this variable. System Sophistication is the description of certain indicators belonging to the variable System Quality within the study of Gorla et al. (2010). The questions for the particular indicators can be seen in Table 9.

The four other variables in my model, namely IT information quality, process efficiency, relationship quality and Process Performance are all endogenous[12] variables. The endogenous latent variable IT information quality is measured by five items. The five-item measurement for Information Content used again by Gorla et al. (2010) was undertaken to measure IT information quality. Information Content is the description of specific indicators belonging to the variable Information Quality within the study of Gorla et al. (2010). The questions for the particular indicators can be seen in Table 10.

[12]An endogenous variable is generated within a model and influenced by other variables (Pearl (2000))

Three indicators measure process efficiency. These indicators ask for the degree of process efficiency within the processes of reporting, budgeting and forecasting. The questions for the particular indicators can be seen in Table 11.

Eleven indicators measure relationship quality. This underlying latent variable is built on two constructs, namely cognitive flexibility (Martin and Rubin (1995)) and integrative bargaining (Rahim (1983)). Cognitive flexibility refers to three main points. First, it describes the ability of a person to recognize multiple options to a given situation. Second, it refers to the ability of a person to act flexibly in a given situation. Third, it refers to the self-confidence of a person in being flexible (Martin and Rubin (1995)). Integrative bargaining refers to the ability of a person to handle conflict. Furthermore, it describes a strategy in negotiations which tries to achieve a win-win situation for both parties (Rahim (1983)). The eleven-item measurement for relationship quality is adopted from Martin and Rubin (1995) and modified with items from Rahim (1983). As an improved relationship between the manager and management accountant should be a state where the management accountant has a high cognitive flexibility and where integrative bargaining should be at a high level, due to more possibilities induced by the integrated information systems, this construct was chosen for the variable measurement of relationship quality. The questions for the particular indicators can be seen in Table 12.

I use a three-item measurement for the endogenous and latent variable process performance/ satisfaction. These three indicators are separated into satisfaction with the reporting, budgeting and forecasting. The type of question for each process is equal. The questions are adopted from the measurement of firm's satisfaction done by Ittner et al. (2003). The questions for the particular indicators can be seen in Table 13.

The model is influenced by seven control variables, which relate to controller tasks and the time since implementation.

The first control variable asks for the time since implementation of the currently used IT systems and accounting tools in reporting in years. The same measure applies for the two other control variables, for the time since implementation in budgeting and forecasting. These three control variables control for process performance/ satisfaction, as the benefits of a higher IT system quality often materialize after a long learning phase following the implementation (Dechow et al. (2006); Granlund and Malmi (2002)).

As described in an earlier section, the management accountant's role is moving towards a business consultant. Hence, I have integrated controller tasks as a control variable and analyzed its effect on relationship quality. I have used four control variables for this effect. The respondents were asked what percent of their time they use for first Data Collection, second Data Aggregation, third Data Analysis Interpretation and Annotation and fourth the Communication and Discussion of results. The respondents had to enter a percentage number. With the role of a business consultant, the management accountant should use most of his time for the Data Analysis and the Communication and Discussion of the results. Furthermore, this should positively influence the relationship quality between him and the management (Rom and Rohde (2007)).

In addition, two company size measures are included within the data, namely the number of employees within the whole organization of the respondent and the sales volume of the entire organization. Table 8 shows the summary statistics of the company size measures. It depicts the number of respondents, which provided their corresponding company size data. Additionally, Table 8 states the mean of the company size measures as well as its standard deviation. The lower quartile, the median and the upper quartile provide an even better understanding of the distribution of the company size measures. Moreover, when comparing the mean and the median of both measures it becomes clear that some respondents must come from large organizations, since the mean is much higher than the median. Furthermore, the standard deviation has a high value for both company size variables and thus the variation around the mean is quite large, which also supports the argument that some respondents must come from large organizations.

Figure 6 provides an even better overview of the distribution of the company sizes regarding sales volume of the 62 valid respondents, who provided information about this number. In fact, most of the respondents work for large companies with a sales volume of more than one billion Euros. Regarding information systems, large companies often have higher investment opportunities to implement best practices in order to compete for the market lead. Consequently, the profile of the respondents suggests that the survey is representative for my researched topic of how integrated information systems influence process performance/ satisfaction. The number of respondents providing sales figures is rather low (approx. 15%); however, it was assumed that a large amount of the remaining 344 respondents work for organizations with similar sales figures.

Furthermore, Figure 7 shows the distribution of the positions of the valid respondents within the organizations. Almost half of the valid participants are in a leading controlling position or another leading position in finance for either a whole organization or a BU. Consequently, the majority of the valid respondents are management accounting or finance specialists at a high hierarchy level within the organization. Thus, it can be concluded that the respondents have a very deep knowledge within their field of work. This validates their answers and makes them trustworthy for research.

The summary statistics for IT system sophistication can be seen in Table 9. The results indicate a medium distinctive IT system sophistication within the organizations of the valid respondents. This is indicated by a mean of around three and a median of three for all variables and the relative frequency distribution.

As for all summary statistic tables, the first column defines the indicators (questions) of the respective latent variable. The second column displays the variable code, as I have used it in my Stata file. The column right next to it states the number of observations. The difference in this number occurs because respondents might not have answered all questions for the respective variables. The next column describes the mean of the respective indicator. The fifth column shows the median. The column right after gives out the standard deviation of the certain indicator. To the right of this column, you can see the relative frequency distributions of the indicators. The numbers each belong to a Likert-scale, as described at the beginning of this section.

Table 10 shows the summary statistics for the latent variable IT information quality. The valid respondents rate for the level of IT information quality is higher than for IT system sophistication.

Table 11 shows the summary statistics of process efficiency. As for the variable IT system sophistication, the valid respondents rate the efficiency medium, as the mean lies around the value of three and the median is three for each of the three indicators.

The summary statistics for the latent variable relationship quality is depicted in Table 12. It can be concluded that the relationship quality between the manager and the management accountants within the organizations of the valid respondents is rather good, as the mean of every indicator beside one is above the value of five and the median for every indicator amounts to either five or six.

Table 13 shows the summary statistics of the latent variable process performance/ satisfaction. It indicates that most of the valid respondents rate this variable between medium and high, as the mean of all three indicators is higher than three and the median for the first indicator is four and for the other two indicators three.

Furthermore, the summary statistics for the control variables belonging to controller tasks can be seen in Table 14. The mean and median indicate that the distribution between the four types of tasks is quite equal for the respondents. Still, a small concentration lies on Data Analysis, Interpretation and Annotation. This is consistent with the argument that

Table 8: Summary statistics on company size measures

Variable	n	Mean	Std. Dev.	Lower quartile	Median	Upper quartile
Number of Employees	69	37,544	78,810	1,400	7,000	25,000
Sales (€)	62	1,210,000,000	9,530,000,000	280	2,100	8,700

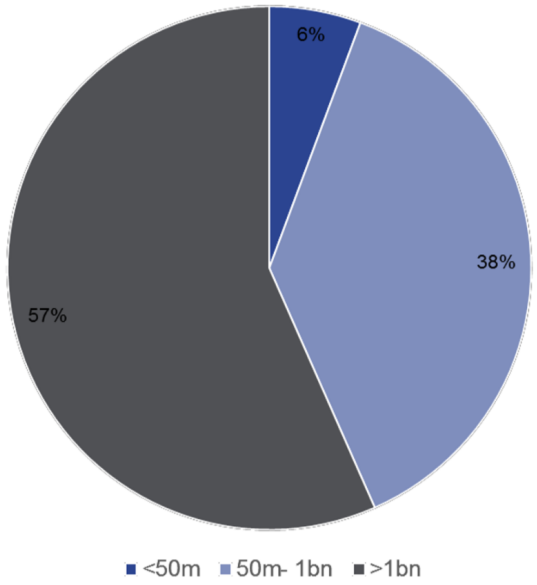

Figure 6: Sales volume of the organizations (in €).

Figure 7: Positions of the valid respondents (N = 205). Note: Due to rounding, the whole percentages do not sum up to 100%.

management accountants move towards the role of a business consultant (Rom and Rohde (2007)). However, it seems that most of the management accountants spend the lowest amount of time on the communication and discussion of the results compared to the other three tasks. This is indicated by the lowest mean (21.47%) of Communication and Discussion of Results compared to the three other control variables within controller tasks.

Table 15 shows the summary statistics for the control variables belonging to time since implementation. On average, the existing IT tools within the organizations of the respondents have been in place for almost eight years within the processes of reporting and budgeting. The median for both is six years. Within the process of forecasting, the average time amounts up to almost seven years and the median is five years.

Table 9: Summary statistics on IT system sophistication

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
To what extent do you agree with the following statements: Our IT systems ...						1	2	3	4	5
... are fully integrated.	citsystsopha_152	400	3.04	3	1.09	9.00%	22.75%	32.00%	28.25%	8.00%
... are user-firendly.	citsystsophb_152	398	3.07	3	0.85	1.51%	25.38%	39.70%	30.90%	2.51%
... are well documented (handbook, search function or similar).	citsystsophc_152	399	2.73	3	1.01	10.03%	34.84%	30.83%	21.05%	3.26%
... have short response times for on-line enquiry.	citsystsophd_152	399	3.19	3	0.96	4.26%	18.80%	36.59%	34.09%	6.27%
... fully operate on the basis of real-time data.	citsystsophe_152	397	2.61	3	1.25	23.68%	25.94%	22.92%	20.15%	7.30%

In the next chapter, I will explain my analyses and discuss the results I obtained.

5. Results

In order to test my hypotheses, I used Stata version 14.1 for a covariance-based SEM and made use of the maximum-likelihood (ML) estimation (e.g. Jöreskog and Sörbom (1982)). The maximum-likelihood estimation is among the most used methods of SEM (Hox and Bechger (1998)). It assumes multivariate normal data and a sample size of about 200 observations (Byrne (2013); Hox and Bechger (1998)). However, various simulation studies have suggested that the ML estimation is very robust against the violation of the normality assumption (Lei and Lomax (2005); Boomsma and Hoogland (2001)). In fact, the simulations have only led to very lightly biased estimates of the parameter.

SEM offers several advantages (Smith and Langfield-Smith (2004)). One exemplary and most important advantage I make use of for my analysis is that SEM provides measures of fit to assess whole models (Smith and Langfield-Smith (2004)). Beside this advantage, I used SEM to conduct my analysis for two other reasons. First, the variables within the model are latent and measured with several indicators (Henri (2007)). Second, SEM is able to estimate the various mediated relationships between the variables of my model simultaneously (Henri (2007)). Due to these advantages, more management accounting papers should use SEM for their analyses. Management accounting research lags behind in using this method compared to related disciplines (Smith and Langfield-Smith (2004)).

Still, SEM adopters should use this technique properly by complying with some key suggestions for employing and reporting SEM. Additionally, SEM adopters should be aware of typical flaws regarding SEM. These flaws include problems with respect to small sample sizes, model fit and handling non-normal data (Smith and Langfield-Smith (2004)). Furthermore, the accounting literature states some general restrictions with respect to using survey data. Moreover, they include poor response rates and an inadequate use of econometric methods (Ittner and Larcker (2001); Zimmerman (2001)). These facts are considered within this thesis.

5.1. Measurement model

Before running the SEM analysis, I conducted a factor analysis/ correlation for each latent variable. A principal-component factor analysis (PCF) was performed. This means that I assume the indicator reliabilities (communalities) to have a value of one. This analysis allows me to check, if I can use the designated indicators to measure the latent variables. This analysis is the starting point for assessing the reliability and validity of my model.

Moreover, reliability indicates that small measurement errors might exist within the indicators and thus tests for these. Measuring reliability is essential for measurement validity, which characterizes its conceptual accuracy. It is currently one of the main concepts in psychometrics (Schäffer (2007)). Both of these concepts can only be applied to reflective models (Bagozzi (1994)). As my model is reflective, I can apply these concepts.

I evaluated my measurement model with the help of PCF and Cronbach's alpha. Cronbach's alpha evaluates the internal validity of the variables (Cortina (1993)). It measures how related the questions measuring the variable are. Thus, I make use of it for analyzing how related the indicators of the respective latent variables are.

The criteria Cronbach's alpha and item to total-correlation are being grouped into the reliability criteria of the first generation. Moreover, both criteria have a few shortcomings, e.g. Cronbach's alpha positively correlates with the number of items (Malhotra and Birks (2003)). Thus, I added second-generation criteria. I evaluated these with the help of CFA. CFA allows me to simultaneously analyze the internal structure of the latent variables within my model and to assess the variables' overall model fit. Compared to first-generation criteria, second-generation criteria offer the advantage to exactly estimate the errors of measurement, as CFA allows each indicator to have its own unique variance.

All of my criteria for reliability and validity are depicted in Table 16 together with their critical values as already mentioned above. The first column of the table shows the respective criterion. The column to the right of it shows the critical value. The third column states the reference for the critical value of the respective criterion. In order to have a good reliability and validity, the value for the respective criterion must be in the range of the critical value. The assessment of my

Table 10: Summary statistics on IT information quality

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
To what extent do you agree with the following statements: The information outputs of our IT systems are ...						1	2	3	4	5
... accurate.	citinfquala_152	400	3.87	4	0.94	1.00%	8.25%	20.75%	43.25%	26.75%
... complete.	citinfqualb_152	398	3.68	4	1.01	2.01%	11.81%	24.62%	38.94%	22.61%
... consistent.	citinfqualc_152	397	3.68	4	0.99	1.51%	12.09%	24.69%	40.30%	21.41%
... useful in our daily jobs.	citinfquald_152	400	3.85	4	0.88	1.25%	5.75%	22.50%	48.25%	22.25%
... relevant for decision-making.	citinfquale_152	398	3.80	4	0.89	1.26%	6.78%	23.87%	47.49%	20.60%

Table 11: Summary statistics on process efficiency

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
Please assess the efficiency of the following processes. Please only think of the process itself and not the result.						1	2	3	4	5
Reporting	citeffizber_152	397	3.37	3	0.99	3.78%	14.61%	33.25%	37.28%	11.08%
Budgeting	citeffizbudg_152	394	3.01	3	0.91	3.55%	26.65%	38.58%	27.66%	3.55%
Forecasting	citeffizforec_152	389	2.98	3	0.97	5.91%	25.45%	37.53%	26.48%	4.63%

Table 12: Summary statistics on relationship quality

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution						
How would you describe the relationship between your manager and yourself in general? The manager and I ...						1	2	3	4	5	6	7
... can communicate ideas in many different ways.	citinteracta_152	383	5.53	6	1.28	0.52%	2.61%	6.27%	6.79%	23.50%	38.12%	22.19%
... are willing to deal with new and unusual situations.	citinteractb_152	380	5.71	6	1.20	0.79%	1.32%	3.95%	7.89%	17.63%	42.63%	25.79%
... have the feeling that we get to making decsions.	citinteractc_152	383	5.56	6	1.17	1.04%	1.31%	3.39%	9.66%	22.19%	44.13%	18.28%
... are able to find workable solutions to seemingly unsolvable problems.	citinteractd_152	382	5.28	5	1.19	0.52%	2.36%	4.45%	15.18%	28.53%	36.39%	12.57%
... often have choices when deciding how to deal with duties.	citinteracte_152	380	4.92	5	1.33	1.05%	5.53%	6.84%	20.79%	26.05%	32.37%	7.37%
... are willing to work at creative solutions to problems.	citinteractf_152	383	5.54	6	1.21	0.52%	1.83%	4.96%	9.40%	23.24%	39.43%	20.63%
... are able to act appropriately in any given situation.	citinteractg_152	382	5.66	6	1.08	0.00%	1.57%	3.14%	8.12%	21.73%	45.55%	19.90%
... act on the basis of conscious decision process.	citinteracth_152	383	5.28	6	1.25	0.78%	2.09%	6.53%	14.10%	25.33%	37.60%	13.58%
... find it easy to apply our expert knowledge on managerial problems.	citinteracti_152	380	5.29	6	1.2	0.26%	3.16%	5.26%	12.11%	28.42%	38.95%	11.84%
... are willing to listen to each other and to consider different alternatives for dealing with problems.	citinteractj_152	380	5.62	6	1.23	0.26%	2.63%	4.21%	8.68%	19.74%	41.05%	23.42%
... have the self-confidence necessary to try new procedures.	citinteractk_152	382	5.70	6	1.16	0.26%	1.57%	4.71%	6.54%	19.37%	43.72%	23.82%

Table 13: Summary statistics on process performance/ satisfaction

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
Please assess the following statements:						1	2	3	4	5
How satisfied is the management with the reporting in general?	citzufrberc_152	397	3.55	4	0.73	0.50%	7.56%	33.00%	54.16%	4.79%
How satisfied is the management with the budgeting in general?	citzufrbudgc_152	389	3.38	3	0.84	2.06%	12.08%	37.02%	43.70%	5.14%
How satisfied is the management with the forecasting in general?	citzufrforecc_152	385	3.37	3	0.88	1.56%	15.58%	34.03%	42.34%	6.49%

structural model will be part of section 5.2.

The conducted factor analysis suggested me to separate IT system quality into two variables as two eigenvalues were above one (Acock (2013)). These reflect the increasing sophistication of integrated information systems. IT system quality summarizes the latent variables IT system sophistication and IT information quality. Moreover, I undertook the factor analysis for all indicators of IT system sophistication and IT information quality once to approve my procedure of using two variables for the enhancements of IT Systems and information systems (IT system quality). The results are depicted in Table 17. The tables of my factor analysis show the respective factor in the first column. One factor stands for one indicator. The next four columns show the eigenvalue, the difference, the proportion and the cumulative number in this stated order. At the top of the table, the method of

Table 14: Summary statistics on the control variables belonging to controller tasks

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
What proportion of your time in the reporting process do you spend in controlling on the following tasks?						<20%	>20% and <40%	>40% and <60%	>60% and <80%	>80%
Data Collection	citanteilbera_152_1	396	27.27%	25%	17.99%	32.07%	42.42%	18.19%	5.3%	2.02%
Data Aggregation	citanteilberb_152_1	393	25.53%	20%	15.67%	28.75%	50.64%	41.35%	2.04%	1.27%
Data Analysis, Interpretation and annotation	citanteilberc_152_1	399	32.15%	30%	17.42%	17.04%	50.63%	24.31%	5.01%	3.01%
Communication and Discussion of Results	citanteilberd_152_1	396	21.47%	20%	15.02%	41.92%	48.23%	6.31%	2.28%	1.26%

Table 15: Summary statistics on the control variables belonging to time since implementation

Question	Variable Code	n	Mean	Median	Std. Dev.	Relative frequency distribution				
Since when are the currently used IT tools in the following process in place?						1-5	6-10	11-20	21-30	31-50
Reporting	cittoolsberoff_152	406	7.77	6	6.12	46.31%	31.03%	20.44%	1.97%	0.25%
Budgeting	cittoolsbudgoff_152	406	7.78	6	5.99	45.81%	29.81%	22.66%	1.72%	0.00%
Forecasting	cittoolsforecoff_152	406	6.64	5	5.72	55.91%	25.37%	17.49%	1.23%	0.00%

Table 16: Reliability and validity: Critical values

Criterion	Critical Value	Reference
Cronbach's alpha	>0.7	Nunnally (1978)
Item to total-correlation	≥0.5	Bearden et al. (1989)
Uniqueness	≤0.6	Bagozzi & Baumgartner (1994)
CFI	>0.90	Hair et al. (2006)
x^2/df	≤2.0	Byrne (1989)
RMSEA	<0.08	MacCallum et al. (1996)
SRMR	<0.08	Hu & Bentler (1999)

the underlying analysis is stated again together with the type of rotation and the number of observations. The different number of observations for different variables occurs as the respondents did not answer every question. Additionally, the number of retained factors and the number of parameters is stated at the top of the table. The number of retained factors gives a hint if one should divide the respective variable up. For the specific example of IT system quality (Table 17), I have two retained factors, meaning that I should use two variables instead of one. I will go into further detail about the respective parameters within this section.

With the help of the literature and my indicators, I separated IT system quality into IT system sophistication and IT information quality as already stated in the section Hypothesis development. In order to check the two new latent variables IT system sophistication and IT information quality, I have conducted a factor analysis for both of them. The results can be seen in Table 18 and Table 19. Additionally, this analysis gives out the unique variances for the indicators. As it can be seen in Table 20, the values for all indicators are under the critical value of 0.6, except citsystsophf. Consequently, this indicator was removed. In addition, the uniqueness of the last indicator lies over the critical value (0.66≥0.6). We can also argue the other way and say that the indicator reliability of the last indicator is too low (0.34≤0.4). In fact, 1- uniqueness equals the indicator reliability. Thus, I only kept five indicators for the variable IT system sophistication. Regarding Table 20 and all tables showing the factor loadings and unique variances, the first column shows the variable code of the respective indicator. In the second column, the factor loading and right next to it on the right the respective value for the unique variance of that indicator are shown.

The uniqueness values for IT information quality are all under the critical value of 0.6, as it can be seen in Table 21. Thus, I will use all the five indicators for this latent variable.

In the next step, I estimated the rotated factor loadings (RFL) and evaluated the correlation of the factors as a check. As both latent variables IT system sophistication and IT information quality only have one retained factor each, this analysis is not needed. One factor will always fully correlate with itself. Furthermore, it means that I do not have to create another variable but can use the underlying one.

As mentioned, I also used first-generation data in order to check the reliability of my variables. Consequently, I used Cronbach's alpha. For both IT system sophistication and IT information quality Cronbach's alpha is above the critical value of 0.7. Additionally, Cronbach's alpha for all the used indicators of both latent variables is either above 0.7 or equal to this critical value. In addition, the item to total-correlation for each of the indicators of both latent variables is above the critical value of 0.5. Consequently, I can use both variables in my model with their indicators. An overview of Cronbach's alpha for both variables is given in Table 22 and Table 23. In fact, the tables showing the results for Cronbach's alpha are structured as follows. The first column shows the variable code of the respective indicator. Right next to this column, you can find the number of observations for this specific indicator. Again, we see that respondents answered a dif-

Table 17: Factor analysis/ correlation for IT system quality

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	5.10182	3.73034	0.4638	0.4638
Factor2	1.37148	0.43576	0.1247	0.5885
Factor3	0.93572	0.24179	0.0851	0.6735
Factor4	0.69393	0.01946	0.0631	0.7366
Factor5	0.67447	0.06431	0.0613	0.7979
Factor6	0.61016	0.08770	0.0555	0.8534
Factor7	0.52246	0.17377	0.0475	0.9009
Factor8	0.34869	0.08010	0.0317	0.9326
Factor9	0.26859	0.01869	0.0244	0.9570
Factor10	0.24990	0.02710	0.0227	0.9797
Factor11	0.22280	-	0.0203	1.0000

Table 18: Factor analysis/ correlation for IT system sophistication

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.92116	2.04582	0.4869	0.4869
Factor2	0.87534	0.14011	0.1459	0.6328
Factor3	0.73523	0.12612	0.1225	0.7553
Factor4	0.60912	0.08697	0.1015	0.8568
Factor5	0.52214	0.18513	0.0870	0.9438
Factor6	0.33701	-	0.0562	1.0000

Table 19: Factor analysis/ correlation for IT information quality

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	3.50004	2.76025	0.7000	0.7000
Factor2	0.73979	0.46383	0.1480	0.8480
Factor3	0.27596	0.02239	0.0552	0.9032
Factor4	0.25356	0.02291	0.0507	0.9539
Factor5	0.23065	-	0.0461	1.0000

Table 20: Factor loadings (pattern matrix) and unique variances for IT system sophistication

Variable	Factor1	Uniqueness
citsystsopha_152	0.7224	0.4782
citsystsophb_152	0.8355	0.3020
citsystsophc_152	0.7021	0.5070
citsystsophd_152	0.6822	0.5346
citsystsophe_152	0.6355	0.5961
citsystsophf_152	0.5823	0.6610

Table 21: Factor loadings (pattern matrix) and unique variances for IT information quality

Variable	Factor1	Uniqueness
citinfquala_152	0.8580	0.2638
citinfqualb_152	0.8476	0.2816
citinfqualc_152	0.8743	0.2356
citinfquald_152	0.8076	0.3478
citinfquale_152	0.7930	0.3711

ferent amount of questions for the different indicators. The third column shows the item to total-correlation. Finally, the fourth column contains Cronbach's alpha for the respective indicator. In the last row, you can find Cronbach's alpha for the entire test scale.

In the next step, I undertook the described method from above (three steps) to evaluate the reliability and validity of the latent variable process efficiency. The three steps can be summarized as follows. First, I have checked the factor analysis/ correlation. Second, I have evaluated the unique variances. Third, I have checked Cronbach's alpha. For process efficiency I have one retained factor, meaning that I can use all of the three indicators mentioned as it can be seen in Table 24. Regarding the unique variances, all values of the three

Table 22: Cronbach's alpha analysis for IT system sophistication

Variable	Observations	Item to total-correlation	Cronbach's alpha
citsystsopha_152	400	0.75	0.71
citsystsophb_152	398	0.77	0.70
citsystsophc_152	399	0.72	0.72
citsystsophd_152	399	0.68	0.74
citsystsophe_152	397	0.71	0.76
Test Scale			**0.77**

Table 23: Cronbach's alpha analysis for IT information quality

Variable	Observations	Item to total-correlation	Cronbach's alpha
citinfquala_152	400	0.86	0.86
citinfqualb_152	398	0.85	0.87
citinfqualc_152	397	0.88	0.86
citinfquald_152	400	0.81	0.88
citinfquale_152	398	0.79	0.88
Test Scale			**0.89**

indicators of process efficiency are under the critical value of 0.6, as shown in Table 25.

As we have one retained factor for this variable once again, RFL is not necessary. Cronbach's Alpha for process efficiency is 0.74 and thus over the critical value of 0.7 as it is depicted in Table 26. Yet, for two indicators of this variable, Cronbach's alpha is below 0.7. This is not optimal, but the underlying indicators can still be used to describe the variable process efficiency, as the item to total-correlation is above the critical value of 0.5 and Cronbach's alpha for the test scale is above 0.7. Consequently, I kept the variable as it is.

The factor analysis for the latent variable relationship quality again only yields one eigenvalue above one and thus only has one retained factor. Consequently, all eleven indicators can be used to describe this variable. Furthermore, every unique variance for each of the eleven indicators is below the critical value of 0.6. An overview of these values can be seen in Tables 27 and 28.

With one retained factor, the rotation gives out a correlation of one once again for the variable relationship quality. Cronbach's alpha for this latent variable has a high value of 0.94 and thus clearly is above the critical value of 0.9. Also, Cronbach's alpha for every single indicator of relationship quality has a value of above 0.93, as shown in Table 29. Additionally, the item to total-correlation of every indicator is above the critical value of 0.5. These analyses indicate that the used indicators are very appropriate in order to measure this latent variable.

Regarding the latent variable process performance/ satisfaction, the factor analysis gives out only one eigenvalue above one, as shown in Table 30. Thus, I can use all three indicators in order to describe this variable. The unique variance for each indicator of this latent variable is below the critical value of 0.6, as it can be seen in Table 31. As for the other latent variables, one retained factor exists for this variable and consequently the rotation gives out a correlation of one.

Cronbach's alpha for process performance/ satisfaction is 0.79 and thus higher than the critical value of 0.7. In addition, Cronbach's alpha for two of the indicators is also above 0.7. These indicators reflect reporting and forecasting (citzufrberc_152 and citzufrforecc_152). For the indicator reflecting the performance of the budgeting process (citzufrbudgc_152) Cronbach's alpha is 0.7 and thus still acceptable, although it should be over the critical value of 0.7. Additionally, the item to total-correlation is above the critical value of 0.5 for each of the indicators. The values are shown in Table 32. As a result of these analyses, I can use all three indicators for the latent variable process performance/ satisfaction within my model.

5.2. Structural model

When running the SEM analysis, 305 observations were used. The reason, why Stata does not use the other variables is that they include too many missing values for a valid analysis. After running the SEM analysis for the first time, I conducted an estimate for modification indices in order to see potential improvements that I can apply to my model (Acock (2013)). The indices suggest potential correlations between the error terms of the indicators, which will reduce the chi-square. This gave me two major improvements to my model. Namely, Stata suggested to include a covariance between the error terms of the indicators process efficiency and process performance/ satisfaction. This means that a covariance exists between the efficiency in reporting and the satisfaction of the management with the process of reporting and accordingly for the indicators regarding budgeting and forecasting. These covariances are useful and make sense,

Table 24: Factor analysis/ correlation for process efficiency

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.00023	1.39758	0.6667	0.6667
Factor2	0.60265	0.20553	0.2009	0.8676
Factor3	0.39712	-	0.1324	1.0000

LR test: independent vs. saturated: chi2 (3) = 282.27 Prob>chi2 = 0.0000

Table 25: Factor loadings (pattern matrix) and unique variances for process efficiency

Variable	Factor1	Uniqueness
citeffizber_152	0.7543	0.4311
citeffizbudg_152	0.8485	0.2801
citeffizforec_152	0.8434	0.2886

Table 26: Cronbach's alpha analysis for process efficiency

Variable	Observations	Item to total-correlation	Cronbach's alpha
citeffizber_152	397	0.78	0.75
citeffizbudg_152	394	0.83	0.61
citeffizforec_152	389	0.84	0.61
Test Scale			**0.74**

Table 27: Factor analysis/ correlation for relationship quality

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	7.10686	6.45617	0.6461	0.6461
Factor2	0.65069	0.02356	0.0592	0.7052
Factor3	0.62713	0.10733	0.0570	0.7622
Factor4	0.51981	0.06420	0.0473	0.8095
Factor5	0.45561	0.07657	0.0414	0.8509
Factor6	0.37904	0.05922	0.0345	0.8854
Factor7	0.31981	0.03352	0.0291	0.9144
Factor8	0.28630	0.02568	0.0260	0.9405
Factor9	0.26061	0.05660	0.0237	0.9642
Factor10	0.20401	0.01388	0.0185	0.9827
Factor11	0.19013	-	0.0173	1.0000

LR test: independent vs. saturated: chi2 (55) = 2903.32 Prob>chi2 = 0.0000

since it is very logical that a strong correlation exists between the efficiency and the performance within each of the three processes of reporting, budgeting and forecasting. The second major improvement to my model refers to IT information quality. In fact, Stata suggested to include a covariance between the indicators citinfquald_152 and citinfquale_152. It is also useful to integrate this covariance into my model, since it is only logical that when the information outputs of IT systems are useful in the daily jobs of management accountants and managers, these information outputs are also relevant for decision-making. As managers and management accountants have to make important decisions every day, decision-making is a daily task for them.

I conducted an estimate for modification indices twice, meaning that I first included the covariance between two of the indicators of IT information quality and then undertook this analysis again. This procedure prevents the risk that an included covariance might change the new optimization suggestions of Stata (Acock (2013)). After I had included the covariances between the indicators of process efficiency and process performance/ satisfaction, I ran the conduced an estimate for modification indices again. However, the improvement suggestions did not make logical sense and did not fit to the model. Thus, I had a final SEM model, that could be analyzed. To provide a better overview, I included the updated

Table 28: Factor loadings (pattern matrix) and unique variances for relationship quality

Variable	Factor1	Uniqueness
citinteracta_152	0.7850	0.3838
citinteractb_152	0.8389	0.2963
citinteractc_152	0.8275	0.3153
citinteractd_152	0.8323	0.3073
citinteracte_152	0.6948	0.5173
citinteractf_152	0.8136	0.3381
citinteractg_152	0.8324	0.3072
citinteracth_152	0.7890	0.3775
citinteracti_152	0.7322	0.4639
citinteractj_152	0.8501	0.2773
citinteractk_152	0.8312	0.3092

Table 29: Cronbach's alpha analysis for relationship quality

Variable	Observations	Item to total-correlation	Cronbach's alpha
citinteracta_152	383	0.79	0.94
citinteractb_152	380	0.84	0.94
citinteractc_152	383	0.83	0.94
citinteractd_152	382	0.83	0.94
citinteracte_152	380	0.70	0.94
citinteractf_152	383	0.81	0.94
citinteractg_152	382	0.84	0.94
citinteracth_152	383	0.79	0.94
citinteracti_152	380	0.75	0.94
citinteractj_152	380	0.84	0.94
citinteractk_152	382	0.83	0.94
Test Scale			**0.94**

Table 30: Factor analysis/ correlation for process performance/ satisfaction

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.12099	1.65753	0.7070	0.7070
Factor2	0.46346	0.04791	0.1545	0.8615
Factor3	0.41555	-	0.1385	1.0000

LR test: independent vs. saturated: chi2 (3) = 334.10 Prob>chi2 = 0.0000

Table 31: Factor loadings (pattern matrix) and unique variances for process performance/ satisfaction

Variable	Factor1	Uniqueness
citzufrberc_152	0.8335	0.3053
citzufrbudgc_152	0.8525	0.2733
citzufrforecc_152	0.8364	0.3004

research model including the indicators with covariances in Figure 8. As already stated, this research model allows me to investigate whether the development of IT systems and furthermore more sophisticated integrated information systems not only create value through process efficiency, but also through a better relationship quality between the manager and the management accountant.

In order to assess the structural model, I made use of different criteria. In fact, I analyzed the goodness-of-fit mea-

Table 32: Cronbach's alpha analysis for process performance/ satisfaction

Variable	Observations	Item to total-correlation	Cronbach's alpha
citzufrberc_152	397	0.81	0.73
citzufrbudgc_152	389	0.85	0.70
citzufrforecc_152	385	0.85	0.70
Test Scale			**0.79**

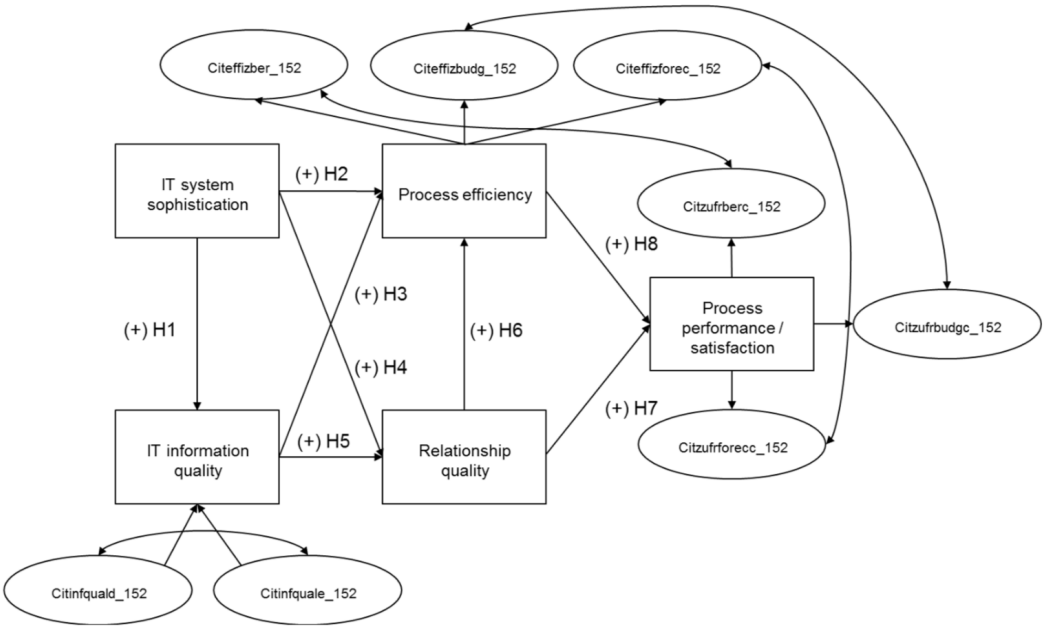

Figure 8: Final SEM model with covariances. Note: For illustrative purposes, only the latent variables of this model and only the indicators which errors have correlations are displayed. Control variables can be obtained from Table 37 and all indicators can be obtained from Tables 9 – 13.

sures[13] for my model. As incremental indices I used the comparative fit index (CFI) (Bentler (1990)) and the x^2/df ratio. Regarding the CFI, values greater than 0.90 can be considered a good fit for the model (Hair et al. (2006)). With respect to the x^2/df ratio, a value lower than or equal to 2.0 indicates a good fit (Byrne (2012)). Chi-squared is depicted by x^2 and the degrees of freedom by df. Furthermore, I made use of the root mean square error of approximation (RMSEA) and the standardized root mean square error of residuals (SRMR) for my absolute fit indices. Regarding RMSEA, values below 0.08 can be interpreted as a good fit (MacCallum and Browne (1993)). With respect to SRMR, values less than 0.08 are recognized as a good fit (Hu and Bentler (1999)). Table 33 shows the goodness-of-fit measures of the run SEM Model stated in Figure 8. Table 33 shows the respective criterion of my goodness-of-fit-measures in the first column. The second column states the value for each specific criterion. The third column shows the general critical value and the fourth column states the reference for the critical value. As shown in Table 33, my model provides a good fit.

In addition to these measures, the p value[14] assesses the significance of a relation between two variables. Three levels of significance exist within my model, namely $p<0.001$, $p<0.01$ and $p<0.05$. They respectively indicate either a very strong ($p<0.001$), strong ($p<0.01$) or moderate level of significance. Values above 0.05 do not indicate any significance between the two variables (Acock (2013)).

The SEM analysis gave me the following results. As predicted by H1, an increased level of IT system sophistication leads to a facilitated level of IT information quality (0.68; $p<0.001$). In addition, an increased level of IT system sophistication also leads to a higher level of process efficiency (0.46; $p<0.001$) and thus H2 is also supported. However,

[13] A goodness-of-fit measure evaluates how well a statistical model is able to explain a certain amount of observations (Acock (2013))

[14] All p values are based on two-tailed tests

Table 33: Assessment of the structural model

Criterion	Value	Critical Value	Reference
CFI	0.913	>0,90	Hair et al. (2006)
x^2/df	1.885	≤2.0	Byrne (1989)
RMSEA	0.054	<0.08	MacCallum et al. (1996)
SRMR	0.077	<0.08	Hu & Bentler (1999)

H3 is not supported as an increased level of IT information quality has no significant effect on process efficiency (0.13; n.s.). In addition, an increased level of IT system sophistication does not directly lead to a better relationship quality between management accountants and managers (0.01; n.s.) and thus H4 is not supported. Nevertheless, H5 is supported as an increased level of IT information quality leads to a better relationship quality between management accountants and managers (0.26; p<0.01). Furthermore, a better relationship quality between management accountants and managers leads to a higher level of process efficiency (0.16; p<0.05) and thus H6 is supported by this analysis. In addition, a better relationship quality between management accountants and managers also leads to increased process performance/ satisfaction (0.14; p<0.05) and thus H7 is supported. As already predicted by the literature, a higher level of process efficiency leads to increased process performance/ satisfaction (0.51; p<0.001) and thus H8 is also supported.

Immediately after running the SEM for my model, I evaluated the variances that can be explained (R2). The variance of the endogenous and latent variable IT information quality that can be explained by IT system sophistication, amounts to 46%. You can calculate this value by squaring the direct effect of IT system sophistication on IT information quality (0.68^2=0.46). Nevertheless, instead of manually calculating the amount of variance that can be explained by the respective indicators, I again made use of Stata for the analysis. Furthermore, the variance that can be explained for process efficiency is 37%. The respective value for process performance/ satisfaction amounts to 34%. However, only nine percent of the variance of relationship quality can be explained. The results of the direct affects for the SEM analysis of the model can be seen in Figure 9. Additionally, the overall variance that can be explained, amounts to 86%, which also represents a very good fit. The overall variance is also known as the coefficient of determination (Acock (2013)). In fact, this means that 86% of the variance of the dependent variables in my model can be

Still, as I have also included covariances within my model, I show the results of my model with the included covariances again in Figure 10. As it can be seen, the standardized covariances for the respective indicators are quite representative. This fact and the representative validity and reliability of my model described above support the including of the respective covariances.

5.3. Indirect and total effects

As the model includes mediating variables, I identified the indirect and total affects with the help of the Stata. The overviews of the standardized direct, indirect and total effects are shown in Table 34, Table 35 and Table 36. The first column shows the independent variable. The columns to the right of this show the dependent variables with the respective standardized indirect, direct, indirect or total effects. IT information quality mediates the relation between IT system sophistication and relationship quality. As almost no direct effect exists, the indirect effect through IT information quality is 0.18 with a high significance (p<0.01). You can calculate this effect by multiplying the direct effect of IT system sophistication on IT information quality (0.68) with the direct effect of IT information quality on relationship quality (0.26). IT information quality and relationship quality each mediate the relation between IT system sophistication and process efficiency. Although the direct effect is already very strong and significant (0.46; p<0.001), the total effect is even higher (0.58; p<0.001). Indeed, the mediating effect of relationship quality on the relationship between IT information quality and process efficiency helps a little to improve the influence (from 0.13 to 0.17). However, the impact is still not significant. Furthermore, process efficiency mediates the relation between relationship quality and process performance/ satisfaction. The direct effect of relationship quality on process performance/ satisfaction is 0.14 (p<0.05). Yet, the total effect is 0.21 (p<0.01). The indirect effect of relationship quality on process performance/ satisfaction is 0.08 (p<0.05).

Additionally, it is of high relevance to see the total effects of both IT system sophistication and IT information quality on process performance/ satisfaction. Namely, IT system sophistication has a total effect of 0.32 (p<0.001) on process performance/ satisfaction. The total effect of IT information quality amounts to 0.12 (p<0.05). The mediating variables for IT system sophistication are IT information quality, relationship quality and process efficiency. For IT information quality, the mediating variables are relationship quality and process efficiency. In brief, relationship quality and process efficiency can be viewed as the “links” between integrated information systems and process performance/ satisfaction.

5.4. Control variables

I included two types of control variables as explained earlier. Moreover, I checked the effect of four control variables belonging to controller tasks on relationship quality and

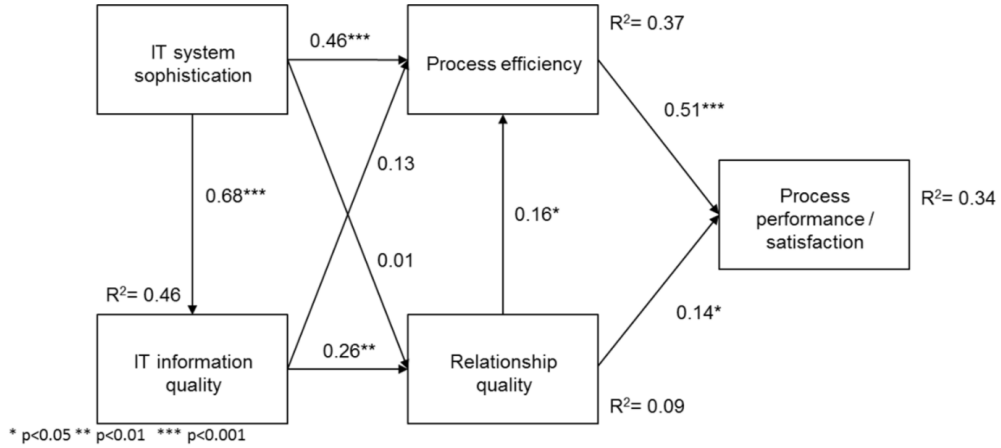

Figure 9: Empirical SEM results of the research model (standardized path coefficients). Note: For illustrative purposes, only the latent variables of this model are displayed. Control variables can be obtained from Table 37 and all indicators can be obtained from Tables 9 – 13.

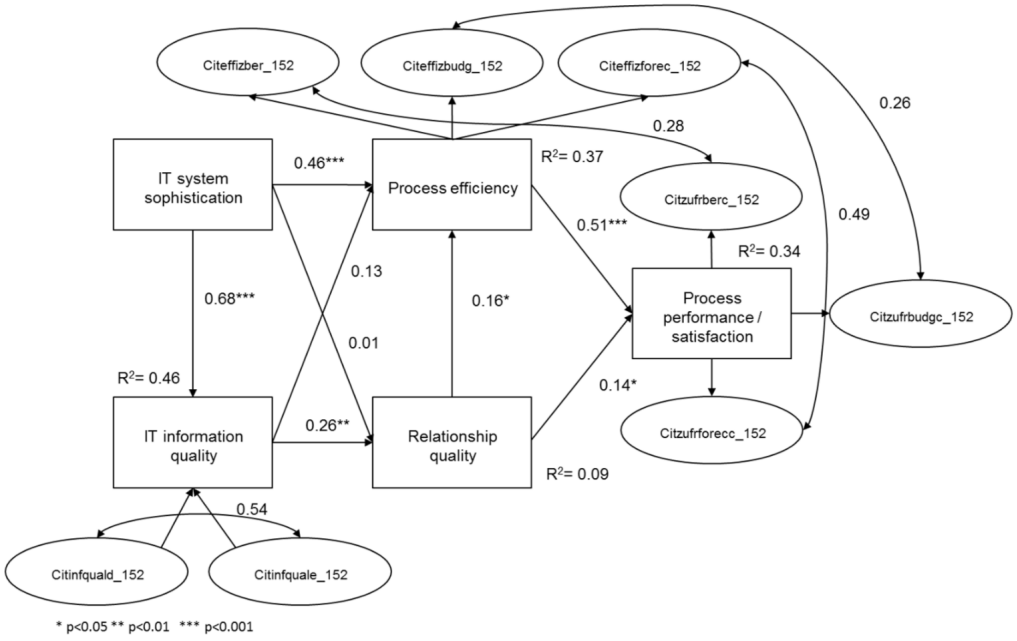

Figure 10: Empirical SEM results of the research model (standardized path coefficients). Note: For illustrative purposes, only the latent variables of this model are displayed. Control variables can be obtained from Table 37 and all indicators can be obtained from Tables 9 – 13.

three control variables belonging to time since implementation on process performance/ satisfaction. In addition, I included the effect of controller tasks on process efficiency. However, no control variable showed a significant result as is shown in Table 37. Thus, the model is robust against these control variables, which means three things. First, information systems that are implemented for a longer time than others have no significant increasing positive effect on the process performance/ satisfaction. Second, the changing role of management consultants towards a business consultant and in particular the consequential changing tasks (controller tasks) do not significantly influence the relationship quality between the management accountant and the manager. Third, controller tasks also have no effect on process efficiency.

Table 37 is structured as follows. The first column shows the respective control variable. The second column states the dependent variable, which is used to investigate the effect of the respective control variable on it. The estimation value can be found in the third column. The fourth column shows the specific p value for the relation of the respective control variable and dependent variable.

Table 34: Standardized direct effects

Independent variables	**Dependent Variables**			
	Direct effects			
	IT Information Quality	Process Efficiency	Relationship Quality	Process Performance/ Satisfaction
IT System Sophistication	0.68***	0.46***	0.01	
IT Information Quality		0.13	0.26**	
Process Efficiency				0.51***
Relationship Quality		0.16*		0.14*
Process Performance/ Satisfaction				

* p<0.05
** p<0.01
*** p<0.001

Table 35: Standardized indirect effects

Independent variables	**Dependent Variables**			
	Indirect Effects			
	IT Information Quality	Process Efficiency	Relationship Quality	Process Performance/ Satisfaction
IT System Sophistication		0.12	0.18**	0.32***
IT Information Quality		0.04**		0.12*
Process Efficiency				
Relationship Quality				0.08*
Process Performance/ Satisfaction				

* p<0.05
** p<0.01
*** p<0.001

Table 36: Standardized total effects

Independent variables	**Dependent Variables**			
	Total Effects			
	IT Information Quality	Process Efficiency	Relationship Quality	Process Performance/ Satisfaction
IT System Sophistication	0.68***	0.58***	0.19**	0.32***
IT Information Quality		0.17	0.26**	0.12*
Process Efficiency				0.51***
Relationship Quality		0.16*		0.21**
Process Performance/ Satisfaction				

* p<0.05
** p<0.01
*** p<0.001

Table 37: Estimated coefficient of the used control variables

Control Variable	Dependent Variable	Estimate	p-Value (two-tailed)
Time since implementation in reporting	Process Performance/ Satisfaction	0.08	0.24
Time since implementation in budgeting	Process Performance/ Satisfaction	0.08	0.38
Time since implementation in forecasting	Process Performance/ Satisfaction	0.03	0.75
Controller task: Data collection	Relationship Quality	-0.01	0.88
Controller task: Data aggregation	Relationship Quality	-0.06	0.29
Controller task: Data analysis	Relationship Quality	0.11	0.13
Controller task: Interpretation and annotation	Relationship Quality	0.01	0.89
Controller task: Data collection	Process Efficiency	0.00	0.88
Controller task: Data aggregation	Process Efficiency	-0.01	0.34
Controller task: Data analysis	Process Efficiency	0.02	0.20
Controller task: Interpretation and annotation	Process Efficiency	0.00	0.89

6. Discussion, conclusion and managerial implications

6.1. Discussion and conclusion

The aim of this thesis was to show that more sophisticated integrated information systems do not only create value by increasing process efficiency but also through a better relationship quality between management accountants and managers. The analyses performed in this thesis show that this is in fact the case. The relationship quality between the manager and the management accountant plays an important role within the implementation of new integrated information systems. It enhances process performance/ satisfaction both directly and indirectly through a positive and statistically significant relationship with process efficiency. The changing relationship quality evolves from the implementation of new information systems within the organization. In fact, this effect occurs for two reasons. First, since enhancing information systems facilitate automation processes within the organization and generate a very large amount of data, management accountants gain a lot of power when having a lot of knowledge about these systems (Granlund (2011)). Moreover, having access to all kinds of data and calculations and understanding the meaning and interpretation behind it gives management accountants more control and power (Dechow et al. (2006)). Second, the management accountants are more moving towards the role of business consultants meaning that they spend a larger amount of time with interpreting existing data rather than collecting this data. (Rom and Rohde (2007)). These two circumstances lead to a more effective and efficient relationship between management accountants and managers.

In order to measure the enhancement of integrated information systems within organizations, I included two variables, namely IT system sophistication and IT information quality. I chose this composition in order to investigate the effect of IT system sophistication on IT information quality, as Gorla et al. (2010) have already found a positive and significant relationship between system quality and information quality. Additionally, the factor analysis within my method suggested to use these two latent variables in order to measure for the enhancement of information systems. The exogenous and latent variable IT system sophistication was measured by five indicators. The endogenous variable IT information quality was measured by five indicators as well. I measured the influence of these two variables on both process efficiency and relationship quality. The endogenous and latent variable process efficiency was measured by three indicators. Each of these indicators refers to one of the following management accounting processes: reporting, budgeting and forecasting. Relationship quality is also a latent and endogenous variable and measured by eleven indicators. Little research exists on the value creation through a better relationship quality between management accountants and managers (Hartmann and Maas (2011)). However, findings about the positive influence of enhanced information systems on process efficiency already exist (Granlund (2011); Fulk and DeSanctis (1995)). Hence, I also investigated the effect of relationship quality on process efficiency. The last variable of my model is process performance/ satisfaction. This latent and endogenous variable is measured by three indicators. As for the variable process efficiency, each of the three indicators of process performance/ satisfaction refers to one of the following management accounting processes: reporting, budgeting and forecasting. I measured the effect of both variables, namely process efficiency and relationship quality, on process performance/ satisfaction in order to support the aim of this thesis.

I have found that IT system sophistication has a positive and significant impact on IT information quality. Thus, my results are consistent with those of Gorla et al. (2010), who have also observed this relationship. In terms of process efficiency, I have shown that IT system sophistication has a positive and significant impact on it. This finding is consistent with the literature suggesting that enhanced IT systems facilitate process efficiency (Granlund (2011); Fulk and DeSanctis (1995)). However, my analysis shows that IT information quality has no significant direct effect on process efficiency. Thus, it is only IT system sophistication that enhances process efficiency within the implementation of new and more sophisticated information systems within an organization. This seems logical, as the quality of information should be less related to efficiency than the sophistication of a tool.

Regarding relationship quality, I found that only IT information quality is positively and significantly directly associ-

ated with it. IT system sophistication, however, has no direct significant impact on it. Still, a positive and significant total effect through the mediating variable IT information quality exists between IT system sophistication and relationship quality. In addition, I showed that an improved relationship quality has a positive and significant impact on process efficiency. Consequently, IT information quality has indeed no significant direct effect on process efficiency; however, one might expect an indirect effect through the mediating variable relationship quality. Yet, IT information quality has no total significant relationship to process efficiency. Furthermore, I confirmed my hypotheses that both process efficiency and relationship quality have a positive and significant influence on process performance/ satisfaction.

As this thesis deals with the effect of integrated information systems on process performance within management accounting, it is very interesting to observe the total effects of IT system sophistication and IT information quality on process performance/ satisfaction. Moreover, both variables, IT system sophistication and IT information quality, have a positive and significant total relationship to process performance/ satisfaction. Consequently, it can be said that integrated information systems do not only create value in management accounting by increasing process efficiency as already reported in the literature, but also via an improved relationship quality between the management accountant and the manager.

In order to test my model for robustness, I included seven control variables. Namely, four control variables relate to controller tasks and three to time since implementation. I included the control variables as observations in my model. The observed variables belonging to the category controller tasks describe the amount of time management accountants within the survey spend on first data collection, second data aggregation, third data analysis, interpretation and annotation and fourth for the communication and discussion of results. The idea behind this was that the tasks of management accountants should have moved towards the latter ones and thus reflect their role change towards business consultants. The observed variables belonging to time since implementation describe the amount of time since the currently used IT and accounting tools within the management accounting processes reporting, budgeting and forecasting are in place. Each control variable stands for one of these processes, hence, three control variables belong to the category time since implementation.

In fact, I tested the effect of the control variables belonging to controller tasks on the relationship quality and process efficiency. The link towards relationship quality is caused by the fact that the literature suggests that the role of a management accountant as a business consultant improves the relationship quality between him and the manager (Rom and Rohde (2007)). The reason for linking the control variables belonging to controller tasks towards process efficiency is that management accountants change their area of responsibilities into a more efficient and effective one such as interpreting data (Rom and Rohde (2007)). The three control variables belonging to the category time since implementation are linked to process performance/ satisfaction because the positive implications of more sophisticated IT and accounting systems often first materialize after a learning phase following the implementation phase (Dechow et al. (2006); Granlund and Malmi (2002)). The analysis showed no significant impact of any control variable on the model. Consequently, my model is robust against these control variables. The tasks of management accountants do not have an impact on either the relationship quality nor the process efficiency. Additionally, the time since certain IT and accounting tools are implemented within the departments of the organization do not influence process performance/ satisfaction. Furthermore, this means that neither the tasks of the management accountants nor the time since IT tools are implemented within the organization have an impact on my model.

6.2. Managerial implications

My findings have various managerial implications for management accounting within organizations. First, it can be said that organizations should enhance the development of implementing state-of-the art information systems. The main reason for this is a higher process performance at the end of the day. Of course, organizations have to find the right balance in the speed of new implementations, as the employees first have to get used to the new systems. At the same time, organizations face competition from other organizations, which are also implementing new IT tools on a regular basis. Consequently, in order not to lose market share, they need to be up to date with the most current information systems. For organizations, this means investments into new information systems but also investments into teaching courses about these new information systems for employees. The implemented information systems are useless when employees are not able to properly use them.

Another important point for the implementation of new information systems is the fact that the current needs of the management accounting department should be considered, as information systems can be configured differently. However, after these information systems are implemented, it would be very difficult to undertake changes in these systems. This is especially the case for ERP (Davenport (1998)). Thus, management accountants and managers need to make sure that the information systems are being implemented in accordance with the technical, cultural and social needs of the organization (Elbashir et al. (2011)). These arguments also refer to the point made above that organizations need to find the right balance in the speed of the implementations. As integrated information systems might define some aspects of management accounting, managers need to thoroughly discuss the right implementation with management accountants. The success of the implementation of new integrated information systems does not only depend on the technical conformity but also on the organization's people (Elbashir et al. (2011)).

As already stated before, the roles and tasks of the management accountants are changing through the implemen-

tation of enhanced information systems (Rom and Rohde (2007)). Thus, organizations need to be aware of this role change and also offer teaching courses for the new tasks of management accountants. In addition, the job requirements for new management accountants will be different and more complex. Consequently, organizations should also prepare their managers for this cultural change, as managers from the "old generation" might not be used to already getting suggestions for strategy decisions from management accountants. Furthermore, organizations should ideally try to take action at an earlier stage. As students from university enter the organization as management accountants, organizations should try to start a dialogue with the education community and try to organize workshops. The question that needs to be answered is what the students need to learn regarding management accounting in the future (Granlund (2011)).

Another major implication is the availability of any data throughout the whole organization on an ad hoc basis. E.g., when an organization has a plant in China and a plant in Germany, the plant manager in Germany can access the most recent data of the plant in China. This increase in efficiency and transparency has positive and negative outcomes. The fact that managers have a recent budget and spending overview of their department at any time is one of the positive outcomes. Additionally, this makes it easier for managers and management accountants to make daily decisions, as no data has to be collected. Nevertheless, the transparency effect might also put pressure on managers when the numbers of their departments do not meet the goals. This might lead to the risk that managers try to fulfill short-term goals and make decisions which might not be advantageous in the long term. However, this transparency can also lead to an additional motivation of line managers to perform better within their departments. Organizations need to be aware of the possible risk of an increased transparency.

The availability of any data throughout the organization on an ad hoc basis also has another result. Organizations need to decide who is allowed to make which kind of decisions. As employees on much lower levels than high-level managers might also have access to all kinds of data, organizations may want to find the right balance of who should undertake decisions within the organization. As already mentioned in section 2.4.4, managers sometimes build decisions on own experiences. As the managers closest to their own departments might have the best experience regarding their departments, they should undertake decisions which only affect their department. Yet, since higher-level managers often have more all-around experience, they should make decisions which affect more parts of the organization. With the help of new implemented information systems, they do not even have to ask the respective department managers for the data but can just look into the information systems and thus make more efficient decisions, even though the department managers might have more detailed knowledge about their departments. However, organizations need to be aware of a risk evolving out of this fact. Namely, higher level managers might lose the contact to lower-level managers as they just need to look into the integrated information systems in order to have an overview of the most recent numbers. This could bear the risk of too few communications between the higher-level and lower- level managers. This lack of communication could lead to the state that higher-level managers are not aware of current developments, opportunities and risks of several departments and do not consider these for decisions made on an organizational wide basis.

To sum up the managerial implications, it can be said that organizations have to be aware of several things. They need to actively consider the needs of management accounting within the implementation phase of new information systems. Additionally, they need to invest in teaching courses to educate their employees about the new information systems and to help the management accountants acquire new and needed skills. Still, organizations also need to be aware of the risks when implementing new information systems such as risks of increased transparency and new decision circumstances for managers and management accountants.

7. Limitations

It is important to state several limitations. First, my model concentrates on the management accounting function and as management accounting provides all the data for the organizations, specific decision-making problems within other functions might not be solved with high-quality information from the integrated information systems, but rather through practical experience of the specific line managers. Thus, management accountants cannot relax due to a higher information quality but must keep on interpreting the numbers right and reporting these in a steady manner. They might want to hear the opinions of the respective line managers before undertaking decisions or discussing with managers about potential problems.

Furthermore, all of my variables are measured by the perspective of management accountants within the organizations. As the relationship quality is two sided, the perspective of the manager might also play a role for this variable. However, this thesis concentrated on the perspective of the management accountant and I was provided with a data set from the WHU Controllerpanel and thus data from managers were not available.

Company size measures such as sales volume or number of employees are not included as control variables. The reason for this is that less than 20% of the valid respondents reported this data. In order not to falsify my model due to a high amount of missing data, I excluded this figure.

Two other measures, which could serve as control variables but which I could not include into my model are power and politics as well as the environment. Regarding power and politics, I have already mentioned the meaning of power in earlier sections. Management accountants can gain power with new information systems being implemented (Granlund (2011); Rom and Rohde (2007)). Yet, at this stage I mean the current power relations in place. In fact, as companies often are very political, and people within the organization

fight for power, this circumstance might have an effect on the analyzed model. Regarding the environment, I did not check for potential mediating effects of environmental uncertainty which might mediate or moderate the relationship between integrated information systems and management accounting (Chong and Chong (1997)).

Although the effect of the variable IT information quality on relationship quality is slightly positive (0.26) and significant ($p<0.01$), only nine percent of the variance of relationship quality is explained. Furthermore, the direct effect of IT system sophistication on relationship quality is almost non-existent (0.01) and not significant. This leaves room for research to investigate further factors that have an influence on this variable.

As already stated earlier, this thesis concentrates on the direction from information systems on management accounting. However, the other direction probably exists as well. Regarding my model, it also seems plausible that a higher process performance/ satisfaction leads to a higher rate of investment into new information systems as the managers see the positive effect (Rom and Rohde (2007)).

8. Recommendations for future research

First of all, further research on the relationship between information systems and management accounting in general is warranted, since this relationship has been taken for granted for a long period of time and researchers have not given enough importance to integrated information systems within management accounting (Granlund (2009); Granlund and Mouritsen (2003)).

The literature review and the results of my analysis still leave room for future research. As stated earlier, little research exists about the link between the role of management accountants and performance at various levels within the organization. My model only indirectly takes into account the specific tasks of the management accountants through the latent and endogenous variable relationship quality and the control variables belonging to the category controller tasks. Thus, researchers need to investigate the exact impact of the role change of management accountants on performance and how they create value. This specific call for research has already been made by Hartmann and Maas (2011).

As stated in the prior section, literature should investigate further effects having an influence on relationship quality, as only nine percent of this variable is explained within my model. Furthermore, the effects of variables such as power and the environmental uncertainty on the relationship between information systems and performance should be assessed. It is also of interest for future research to investigate the relationship from management accounting towards integrated information systems as stated above (Luft and Shields (2003)). Additionally, future research should investigate whether if there is a difference in use of integrated information systems between different managerial hierarchical levels (Rom and Rohde (2007)).

Findings about the positive influence of information systems on firm performance exist (Ittner et al. (2003); Rom and Rohde (2007)). Indeed, it was found that sophisticated information systems together with a good management accounting in place lead to a higher market value of the firm (Dos Santos et al. (1993); Hayes et al. (2001)). However, future research should concentrate more on management accounting as an intermediate variable within this field as little research exists about this specific constellation.

Another topic that has not directly been covered within this thesis is the relation between integrated information systems and organizational design. As information systems change the decision-making process and enable management accountants to undertake more effective and efficient tasks within the organizations, the organizational design might change. Although some research about this topic already exists, researchers should give more importance to this relation. In fact, researchers should concentrate on both the social and the technical aspects when investigating the effects regarding the implementation of new integrated information systems. The reason for this is that the success of the implementation is not only dependent on the conformity with the technical aspects but also on the organization's people (Elbashir et al. (2011)).

Finally, researchers should also concentrate more on the actor-network theory as this theory could further explain the mediation of IT between management accounting and organizational networks, which consist of human and non-human actors as explained in section 2.10.1 and 2.10.2.

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