From Detecting Deviations to Preventing Shocks: The Value of IT for Management Controls

Abstract

Information technology (IT) has a tremendous impact on management control through new ways of retrieving and processing information about performance deviations and control effectiveness. This paper explores the role of IT-enabled management controls on the example of information systems for Governance, Risk Management, and Compliance (GRC IS). We apply a grounded theory approach to structure value drivers of GRC IS into a framework. We relate the value drivers to existing theories to understand the impact of IT on management controls. We argue that IT serves as catalyzer for more effective management controls by enabling managers to exploit and explore richer data about performance deviations and potential shocks. We structure the catalyzing effects as value drivers of IT in a balanced control model. This paper uses the lens of management theories on GRC IS and establishes a research agenda for understanding the catalyzing function of IT for management controls by suggesting links between previously separate theories.

1 Introduction

Information technology (IT) has a tremendous impact on the discipline of accounting (e.g. Chapman and Kihn 2009). IT is seen as the catalyzing element of transforming the accounting discipline from pure information provision to a knowledge services profession (Sutton 2010). Especially in the context of management control systems, IT changed the underlying situation for designing and managing management controls. On the one hand, information systems such as Enterprise Resource Planning (ERP) systems integrate financial with non-financial data and therefore enable better financial accounting. On the other hand, they provide new capabilities for management control as "data become accurate, shareable, and available to many different parties but does hardly create the panoptic dream of visibility and action at a distance" (Dechow and Mouritsen 2005, p. 729).

Nonetheless, management accounting literature lacks an integrated understanding of the impact of IT (Dechow et al. 2006; Woods 2009). Although studies report on the relevance and value propositions of IT for accounting (Chapman and Kihn 2009), there has hardly been any research on the impact of IT on management control (Granlund 2009). A literature review by Efendi et al. (2006) within the top accounting journals provides evidence that confirms this statement. As a result of regulatory changes, first contributions in this regard are emerging from the practitioner literature. Practitioners argue that IT can help cope with accounting complexity (Fisher 2007). Furthermore, organizations can use IT for cost minimization of accounting (Dittmar 2007), establishing an integrated control overview (Chan 2002), measuring control effectiveness (Ashbaugh-Skaife et al. 2008), and supporting decision makers (Beneish et al. 2008). Thus, we argue it is useful to explore and understand the benefits and constraints of using IT for management control as perceived by practitioners.

With the aim of understanding the impact of IT on management control, this research focuses on empirical findings that support the understanding of information systems for Governance, Risk Management, and Compliance (GRC IS), which belong to the category of accounting information

systems. Accounting information systems (AIS) focus on collecting, gathering, processing, storing, and reporting data and transactions to provide stakeholders with the information they need to plan, control, and operative their business (Romney and Steinbart 2006), GRC IS are understood as information systems to collect and store data for processing into information used by decision makers (Hagerty and Kraus 2009).

Since the purpose of this paper is to appraise the impact of IT on management control by understanding value drivers of accounting information systems such as GRC IS, our research question is: *What are value drivers of GRC IS and how can they be structured?* We apply a grounded theory approach to identify and structure value drivers of GRC IS. With the intent to understand the impact of IT on management controls and its implications to management theory, we develop a theoretical framework and relate our empirical findings to theories from management literature. The framework shows that IT offers new opportunities for control design strategies by balancing the exploitation and exploration of richer data about performance deviations and potential shocks.

In the next section, we summarize practical and academic perspectives on accounting information systems. We then proceed by reporting on a grounded theory approach to reveal the value driver of GRC IS. In section 4, we give an overview over different perspectives on GRC IS in practice and their value drivers. In section 5, we discuss our findings, develop an integrated framework, and link it to existing theory. As a next step, we outline implications for research and practice. In section 6, conclusions are drawn.

2 Background

2.1 The Role of Management Control within the Organization

The understanding of management control varies, depending on in the different research streams in management, organizational, Information Systems, and marketing literature (Cardinal et al. 2010;

Lange 2008; Merchant and Otley 2006). Management controls help an organization "to deliver the key results desired by stakeholder groups […] and to protect against the threats to achievement of good performance." (Merchant and Otley 2006). Control aims at enabling idiosyncratic behavior and compliance with the organization's strategic plan and is therefore fundamental for any organization (Lange 2008). However, control design and management are cost-intensive and requires intensive organizational resources (Committee of Sponsoring Organizations of the Treadway Commission 2004). Thus, the main challenge in management control research is to understand the benefits, managers derive from using control systems to attain organizational goals (Simons 1994).

2.2 Research on IT in Management Controls

Researchers discuss the integration of IT and accounting in case studies (e.g. Butler and McGovern 2009), solutions for IT departments (Bonazzi et al. 2010) and regulations (Volonino et al. 2004). Although there are research results on the business value of IT from accounting perspective, literature rarely discusses the value drivers of IT on management control (Granlund 2009). Academic literature lacks the integration of theory concerning both IT and management accounting (Efendi et al. 2006; Sutton 2010), with some notable exceptions. For instance, Woods (2009) builds theory from case studies by revealing the "critical role played by good information systems as tools to support the control process itself" (Woods 2009), but further pointing out that "there is still a lot of research to be done on risk management systems and the interface between risk management, internal control and governance" (Woods 2009). Other research (Wiesche et al. 2011) has suggested a collection of potential value driver, but did not present an integrated perspective on value drivers of IT in management controls.

Although literature criticizes failing internal control systems (ICS) (Jensen 1993) and demonstrates awareness of the impact of IT on accounting (Rom 2008; Sutton 2010), effects of IT on developing better controls have not been investigated yet. This is speculated to be due to the vicissitude of developments of IT and a lack of interest in both disciplines for the respective other discipline

(Dechow et al. 2006). The exception is research on management control in information systems development projects (e.g. Kirsch et al. 2002). Although there are research results on the different perspectives (Tiwana and Keil 2009), this perspective is limited to software projects and misses the perspective on the organization as a whole. Despite the possible benefits of IT in management control systems, the specific effects of IT on the purpose and design strategies of management controls within the organization are still poorly understood.

2.3 Current State of IT-enabled Management Control in Practice

The Sarbanes-Oxley Act (SOX) in 2002 caused the development of new accounting information systems which can be summarized with the label of GRC IS, which today are certainly prominent in practice (Hagerty and Kraus 2009; Volonino et al. 2004). The most common platforms include *BWise*, focusing on quantitative and qualitative risk and compliance management, *SAP GRC*, providing an integrated platform for role management, process control, and risk management, and *Thompson Reuter's eGRC*, providing advanced audit services such as regulatory content services, change and policy management and regulatory tracking services. Although there have been efforts to formulate a standard definition (Racz et al. 2010), there is still no common understanding of GRC. A prominent definition by practitioners defines GRC as a "system of people, processes, and technology that enables an organization to understand and prioritize stakeholder expectations, set business objectives that are congruent with values and risks, achieve objectives while optimizing risk profile and protecting value, operate within legal, contractual, internal, social, and ethical boundaries, provide relevant, reliable, and timely information to appropriate stakeholders, and enable the measurement of the performance and effectiveness of the system." (Mitchell and Switzer 2009). Various concepts, models, and frameworks for GRC exist, whose structure depends on the author's perspective on this broad topic (Hagerty and Kraus 2009; Racz et al. 2010). Based on the different understandings of GRC, GRC IS differ in terms of results and impact. GRC IS provide a variety of control mechanisms ranging from segregation of duties and process monitoring to risk management (Teubner and Feller 2008).

Practitioners report different underpinning strategic reasoning and subsequently different value drivers for introducing particular features of GRC IS: Auditors and consultants focus on control deficiencies and the effects on the financial outcome (Ashbaugh-Skaife et al. 2008). Governance experts include the IT-business alignment and adequate and efficient coordination of tasks (Chan 2002). Compliance experts concentrate on effective controls, cost reduction, and the integrity of IT (Ramakrishnan 2008). Software vendors focus on segregation of duty and process control (Hagerty and Kraus 2009). IT practitioners focus on frameworks for the design of GRC IS (Beneish et al. 2008).

3 Research methodology

With the intent of scrutinizing the impact of IT on management control, we conducted an exploratory study on GRC IS using the methodology of grounded theory as proposed by Glaser and Strauss (2001). This research methodology allows building theories of "process, sequence, and change pertaining to organizations, positions, and social interaction" (Glaser and Strauss 2001). It is an inductive and theory building methodology, which ensures grounding the theory in empirical observations or data (Lee et al. 2006). This approach can be considered particularly appropriate, since there has been hardly any research on GRC IS as the integration of management controls and IT.

Since this research builds upon practitioners' broad understanding of GRC IS value drivers, the focus of the selection of comparison groups for theory building was on maximizing diversity (Glaser and Strauss 2001). Maximizing diversity increases the possibility of finding different and varying data belonging to one sample. These differences support category building and summing up the data. This research shares GRC IS as a common unit of analysis, but uses different organizational settings as contexts. We conducted qualitative data analysis (Glaser and Strauss 2001) on 21 expert interviews. We conducted two cycles of analysis to ensure theoretical saturation (Lee et al. 2006). In this paper, we report on the second cycle of analysis. In addition to the first cycle reported in (Wiesche et al.

2011), we included interviews with experts that were responsible for GRC IS initiatives in organizations that had public compliance or fraud scandals.

3.1 Sampling and Data Collection

In order to achieve the highest diversity possible, we chose a broad view on GRC, including all perspectives that relate to IT-enabled controls within organizations (Table 1). The professions and disciplines relevant for this research included audit, consulting, governance, compliance, risk management, IT, and managers in terms of GRC IS (cf. section 2.3 for further details).

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Since the different perspectives on GRC provide different focal points, we interviewed three experts from each perspective using convenience sampling. We met experts on GRC workshops in Germany and used professional discussion groups and blogs to identify potential respondents. All experts had between 3 and 25 years of experience in their profession; the average experience was more than 11 years. Although the experts all had different backgrounds, we grouped their perspectives according to their current job description. We conducted the interviews using guidelines with semi-structured questions, including questions about the experts' GRC understanding, the integration of the three G, R & C silos, GRC systems, and the catalyzing function of GRC systems as well as questions regarding the developed influencing factors on GRC. We tailored the interview guidelines to understand the value drivers of GRC IS and continuously substantiated the questions using the material from former interviewees. After interviewing and analyzing two experts from each perspective, we condensed our results into four value drivers (Wiesche et al. 2011). After discussing our results at conferences and with practitioners, we integrated seven further interviewees, focusing explicitly on experts who were involved in huge compliance scandals in the past. For example, we included experts who were directly

involved in the biggest German privacy scandal in the past and talked to consultants, working in projects on large fraud cases. As expected, these experts had broad experience with compliance initiatives and spent time and efforts in assuring compliance with regulations. They confirmed the developed concepts but indicated a differentiation between control performance and control measurability, dividing the value drivers between cost optimizing and efficiency. This additional data led to a re-analysis of the existing data as a second round of data analysis (Glaser and Strauss 2001). All other concepts remained stable. Further, these new perspectives helped identify the two underlying organizational goals, as discussed in section 5.1.

3.2 Data Analysis Procedure

After conducting the tape-recorded interviews, we transcribed and anonymized each, and started analyzing the results in order to both, build theory and provide questions for further interviews. We integrated the each transcript into a hermeneutic unit, in total comprising 84,461 words and 74 pages of text using the software ATLAS.ti. The coding procedure was conducted following Glaser and Strauss' (2001) guidelines. Firstly, the first author read and coded the interview transcripts line-by-line, using phrases from the transcripts that describe the phenomenon (open coding), and tagging similar phenomena with the same phrase. Following that, the second author likewise coded the transcripts independently. This resulted in a list of 139 codings and 687 phrases. We discussed and agreed on the differing codes. Furthermore, we conducted a second open coding step to consolidate the established categories. We put the derived concepts in coherence and then aggregated them into value driver categories.

4 Results

A first look at the interview data revealed high diversity regarding the elements of GRC IS. The interviewees stated various understandings ranging from IT products to management philosophy.

Experts called initiatives for implementing systems for ensuring segregation of duties as GRC IS. Others implemented systems to document and report on organizational controls as GRC IS. Some experts understood aligning business processes and organizational controls, what they call process control. Another understanding given by experts was die integration of operational and strategic risk management. Finally, interviewed executives saw GRC IS as a management philosophy for situational awareness based on IT-enabled control data collection. A detailed look at the background and the GRC perspective helped classify the elements depending on the underlying value drivers. We asked the interviewees to explain why s/he would implement GRC IS, what the underpinning goals and the impacts of the implementation were, how technology serves these goals, and who is involved in GRC IS concerning responsibility, accountability, consulting and being informed. As stated in section 3.2, we followed the fundamental analytical process by braking down the described phenomena. We compared them to others to reveal similarities and differences and started to conceptually label and develop the categories. In the next steps, we built and tested the relationships between the categories, finding that each category was related to an IT value driver (Table 2). We identified more statements relating to the developed categories and grouped them into an overall core category, the underlying motivation to introduce and operate GRC IS, which we call *value driver*. We derived the following five value drivers as unique to the GRC IS discussion since they require an integrated perspective of GRC and require the introduction of accounting information systems.

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4.1 Control Measurability

One of t,he most central arguments for implementing GRC solutions was the system's ability to collect and aggregate information for control purpose. Consider the example of the implementation of a so-

called access control system for assuring segregation of duties: Such systems support data collection by predicatively analyzing ERP roles and aligning user rights with the organizational structure. Such systems highly ease collecting control data, since they are automatically documented within accounting information systems and can remotely be collected without interrupting the operational tasks of the employee. Interviewees reported that having no accounting information systems to collect the control data caused trouble and rush on every regular and irregular audit within business units. This additional work of collecting the necessary data is taken over by the system:

"If we had a compliance problem in Russia, England or anywhere else in the past, I always had to find out first, why it's there. I used several manually started programs and then we analyzed the results. We approached the regional executives and told them that in this context we need an additional financial control and one more oversight control. That means that every time someone made a printout, he has to go to his boss and to sign that he reviewed it. Then this would be stored in the archive for control purposes. Today, we have all this data in a central system and now we are able to gain additional information on certain risks without interacting so much with the division or country." (Compliance expert 2)

Furthermore, using accounting information systems for control data collections is a first step toward continuous control monitoring. Using continuous control monitoring, organizations ensure that their controls are in place and effective. To allow the automatic determination of control effectiveness, existing controls have to be integrated within accounting information systems. Such systems enable organizations to see in real time, whether their control system is working properly or not. Instead of focusing on automating detective controls, GRC IS establish a preventive control set and ensure continuous monitoring of its effectiveness:

"The verification of invoices is based on the implemented inspection of the purchase requisition within our systems. It works only when the accounting department can access the data, that means that this information is really in the system and checkable. If volume or price of the purchase requisition and the final bill differ, the bill cannot be released for payment. That is 100% automated. The only thing, what you have of course still to do, is to intervene if there pops up any anomaly." (Company expert 3)

4.2 Control Performance

All experts named meeting compliance regulations as value driver of GRC IS. SOX and other regulations require organizations to report on the reliability and effectiveness of internal controls. Especially in global, networked and complex organizations, it is impossible to meet the plethora of regulations without the support of IT. GRC IS support meeting these regulations through using manual and automated processes to collect and document relevant information. GRC IS help provide evidence to auditors that certain controls were implemented and are working properly. They contribute to the early recognition of certain risks and to the implementation of adequate mitigation strategies.

"Today, our [access control] system is logging permanently every access issue in every country. If we need to update roles or permissions, the system automatically validates it with the current role and permission matrix. If there are conflicts the system will not allow the change. […] [We] implemented something like a compliance cockpit. The system generates reports about the situation of certain permissions in specific countries on a regular basis and sends them to the responsible executive. We are now able to meet every audit request at any given point in time. We can now provide them with absolutely clear information." (Auditor 2)

Automated internal controls in the context of GRC range from segregation of duty to policies and code of conduct. In the context of Enterprise Resource Planning (ERP) systems, the most prominent control is segregation of duty, called access control. Access control is a control mechanism which is characterized by high process knowledge and tasks complexity. It includes automation of end-to-end access and authorization management with strong integration within the access control solutions. Such controls can be implemented early in the organizational value creation process and provide first insights on fraud or other undesirable behavior. Such controls can only be implemented with IT, enabling the processing of masses of data in real time and allow compliance with e.g. SOX.

"Consider the example, that the user in the procurement system has one ID and in the other system as well. If those systems are not connected within our GRC tool, I can obviously not check if he did something in the one system, he can take advantage of in the other one. Especially for purchase orders within the FI/CO system, there

comes a lot of stuff from other systems into it and generates FI bookings, general ledger, sub ledger, accounts, and payments to customers and suppliers. Of course, one could say we could just do identity management and take care that all users have the same ID in every systems. It is almost impossible to keep this updated and it requires too much coordination. If a user changes the department or leave the company, then I have this access control system, where I can delete this user with one button from all systems." (Consultant 2)

4.3 Control Coherence

An aspect which persistently appeared in the study was the ability to create transparency over internal controls that are performed in the background of existing accounting information systems. The different GRC perspectives reveal several reasons for creating transparency. From an audit and compliance perspective, transparency accelerates audits and therefore reduces costs. Similarly, before the implementation of IT-enabled control, management had to rely on its employee's engagement. Organizations were not able to know about all tasks performed on each hierarchical level. Therefore, they had to trust their employees and could only monitor the results at a reasonable level of costs. Automated controls are able to process high amounts of data and provide information in real time. This allows satisfying management's need to get structured, real-time, and comparable information:

"It is important to ensure GRC convergence. The function of monitoring […] is very important throughout the organization. I have seen it a few times now and I can tell you that the average company has […] different risk management functions. All risks seem different and similarities can easily be overlooked. Therefore, management doesn't have a good view of the whole company. They can't see the total risks." (Governance expert 1)

Experts gave several examples ranging from the energy sector to risk management solutions for IT companies, providing automated testing of controls. A prominent example for controls, which provides transparency and contributes to comparability, is called process control. Process control serves as control for continuously monitoring existing internal controls. It further ensures a

standardized workflow and reporting. Hence, process control spares cost-intensive manual oversight and provides a real time integrated perspective.

"To ensure e.g. access control performance, the systems have to be integrated with process controls. Such controls allow testing the effectiveness of internal controls." (Governance expert 2)

4.4 Risk Responsiveness

The study results revealed clear evidence that automated internal controls within GRC IS increase the ability to build effective management control systems, which prevent future incidents early in time. In organizations, there are often enough warnings, which, if correctly interpreted, could prevent certain negative outcomes. The case of one interviewee's organization, Alpha, may serve as a good example to understand why these warnings often perish. Having several hundred thousand employees in more than 70 other countries, Alpha operates more than 100 different accounting information systems for procurement alone. Regarding the SOX-required segregation of duties, management is not able to oversee all these systems. Even when aggregating less than 100 standard rules and introducing automated access control monitoring, internal audit detected several ten thousand violations when going live. This illustrates the extensive effort, necessary to fulfill regulations, and reveals that implementing internal control today is not possible without the support of IT. They ensure the processing of the high amounts of data. Alpha plans to further implement GRC functionality, providing meta control for automated internal control monitoring which provides additional data for companywide risk management. Similarly, fraud-indicators can be collected and analyzed.

"Monitoring is a big issue. […] The most fraud is committed by top management. I don't know any control, which I as employee could effective implement. Should I tell my boss 'you are not allowed to do this!'? But I can monitor to see where cost units are created, where cash is thrown away and so on." (Auditor 2)

Today's organizational settings become more complex and intricate, and it is often impossible to monitor and control all contributing factors. Although there has always been early information on possible negative outcomes, there was hardly any possibility to examine all indicators and derive

preventing measures. IT-enabled control allows management to monitor continuously and rate weak signals in anomalies that possibly lead to either negative or positive outcomes. Management has to find countermeasures for negative incidents, but can use positive incidents to drive innovation. Automation supports this argument, as it enables mass data processing and reduces reaction time.

"I can conduct real time monitoring. That means that I can see something happen as soon as it occurs. So I don't have to reconstruct the happening afterwards. This is of course covering a lot more information – though still not complete – than a certain excerpt that I request afterwards. This is the difference and it is automated. Nobody is sitting any more there for two weeks analyzing stuff that has happened months ago." (Risk manager 2)

4.5 Management Resilience

Practitioners operating GRC solutions request decision support from the gathered GRC information. The functional units report on their situation and management uses this information as a basis for their decisions. Therefore, this information needs to be reliable. Before the development of solutions based on automated controls, management had to rely on informal control mechanisms like guidelines and codes of conduct, both not guaranteeing reliable results. With the development of GRC IS, management is able to verify the given information and to compare different reports.

"The most interesting problem is assessing risk levels. Usually you have just a few data points on which you can base your assessment. However, you need information about how high or low a certain risk is. If you want to do something about it, it will cost a lot of money and you need to decide whether it is worth the money. […] It is very easy to come up with many potential incidents that could harm you in some way. Nevertheless, it is not so easy to estimate how likely those incidents are to happen and how bad it is, if they can. You want to be able to identify as many incidents as possible among those that can potentially happen. So this dilemma of finding the right tradeoff between identifying all risks that maybe relevant and at the same time being able to perform the risk analysis in the given time frame is a big challenge." (IT professional 2)

Building upon data from GRC IS, enough information for management has been aggregated and selected to provide management resilience. Using the data provided by GRC IS, management can choose countermeasures for mitigation or seize the chance of positive variation to innovate and enhance organizational performance. Management can use the GRC IS to examine additional and more detailed information for a certain decision.

"You ha[ve] a risk management officer and you ha[ve] risk intelligence, but judgment [is] not being applied. This is a big failure because risk was not given the attention it needed. When you are thinking about having effective governance, it includes the situation of risk. You cannot have effective governance and strategies if you do not understand risks. So management has to take risk into account." (Governance expert 2)

4.6 A Framework for GRC IS Value Drivers

The different examples and underlying perspectives on GRC IS reveal that practitioners differ in terms of their GRC IS value drivers. Consultant 1, an interviewee with more than 20 years of experience in the field of IT consulting, summarizes the differences in value driver as follows:

"Although initially triggered by providing evidence for implementing risk management and internal control systems, companies want GRC systems to go beyond these narrow solutions. […] In a recent project, we create process transparency, leading to the ability to evaluate control effectiveness. […] Finally, this data has to be summarized and thinned out. Only then will management be able to know how the company is doing and what decisions it has to make to correct possible errors." (Consultant 1)

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Using the prominent example of GRC IS, we identified several contributions of IT on management control (Table 3). IT enables both, the exploitation and exploration of management controls. On the one hand, IT has an impact on the data collection, efficiency, and effectiveness of controls (see

column 2 through 4 in Table 3), on the other hand, it allows new capabilities in developing effective control systems and providing additional decision support for management resilience (see column 5 and 6 in Table 3). When designing management controls, IT ensures control standardization and therefore audit efficiency through automation. Auditors are able to get an integrated picture of the complex control implementation. Similarly, IT ensures control coherence as automation and mass data processing enable monitoring the effectiveness of controls and therefore choosing the right control composition. Furthermore, IT enhances accounting toward knowledge service providers as it allows interpretation of weak signals and providing decision support. Aiming at implementing more effective management control systems, IT creates transparency through ubiquity of information and therefore enhances management's absorptive capacity. This strengthens management's ability to interpret weak signals. Similarly, IT allows suggesting measures and actions for mitigation more efficiently. Instead of just preparing information on (non-) compliance, accounting can actually use intelligence and benchmarks to provide decision alternatives to management.

5 Discussion

This paper illustrates the role of IT for designing and managing control systems within organizations: using IT-based control systems allows using controls for both, preventing error, which we call "ensuring organizational performance" and fraud, which we call "ensuring organizational integrity". We show that impact of IT on control design strategies consists of cost effectiveness, integrity, ability to measure control success, and mass data processing. This allows organizations analyze implemented controls for different purposes beyond their original function.

5.1 The Balanced Control Model

This research found five value drivers of IT-based management control systems, which serve different purposes. In the following, we discuss a model that helps to understand the existence of the identified

value drivers. This model is based on existing literature on management control systems and explains the impact of IT on control design strategies. Figure 1 gives an overview of this model. We found two underlying objectives for management control systems, which lead to different conditions. The objective of ensuring organizational performance requires exploiting the situational context. The objective of ensuring organizational integrity requires exploring the control conditions. These different requirements influence the implemented control strategies. This research found IT as enabler for balancing these requirements by providing an integrated database.

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Management control systems have different underlying control objectives: on the one hand, managers use management control systems to align the goals and risk preferences of their subordinaries with the organization (Cardinal et al. 2010; Merchant and Otley 2006). They serve the purpose of ensuring organizational performance (Ouchi and Maguire 1975). This objective is driven from an internal perspective since managers need this information for running the organization (Merchant and Otley 2006). On the other hand, our data revealed that management also implement control systems to disclose that their reporting for stakeholders is correct (Jensen 1993; Lange 2008). Such control systems serve the purpose to ensure organizational integrity (Committee of Sponsoring Organizations of the Treadway Commission 2004). This rather externally driven perspective is heavily influence by compliance requirements (Volonino et al. 2004).

Ensuring organizational performance requires organizations to implement effective control systems, which provide the necessary information. Management can design three types of control systems focusing on different control goals (Cardinal et al. 2010): Input control systems support the selection of the right resources such as materials, services, and employees for conducting a certain task. Behavior control implements control systems that help management evaluate the subordinaries'

behavior. It enforces the formal control strategy through evaluating the tasks that the subordinary performs on appropriateness and alignment with the overall strategy. When implementing output control systems (Eisenhardt 1985), management monitors the subordinaries' achievements at the end of the given tasks. The monitoring of the value creation process implements formal control through analyzing the output of the performed tasks (Ouchi 1979). Management can implement these control systems depending on the conditions of the task, which has to be controlled. Designing control systems depends on the task conditions 'ability to measure output' and 'knowledge of the transformation process'. For example, implementing output control systems requires a clear understanding of the results of the value creation process and the ability to evaluate the outcome (ability to measure output). Behavior control on the other hand requires knowledge of the transformation process and understanding of the involved resources (Ouchi 1979). This study shows the capabilities of IT to enhance the two underlying task conditions for control purposes. As reflected in the value driver 'control measurability', our results show that IT-based control systems enhance management's knowledge of the transformation process through precisely defined, documented, and enforced process descriptions (Davenport 1993; Hammer and Champy 1993). Centralized processes, continuous result documentation, and workflow management enable transparency about organizational operations. Consider the example of controlling the process of approving a credit in a bank. Process documentation and workflow systems create transparency of the transactions and reduce control effort and lead-time from several days to only few minutes. On the other hand, our study shows the capabilities of IT to enhance management's ability to measure output through providing extant control information on the output, collected for various other purposes such as procurement or production. As reflected in the value driver 'control performance', our results show that IT-based control systems allow collecting output control data early and at reasonable costs. Consider the evaluation of sales representatives in a global organization. Executives can use a management cockpit for real-time information on sales and pricing for every sales division in any country to evaluate the subordinaries' performance.

Ensuring organizational integrity requires exploring control results for different purposes. Management can use the collected control data to produce reports for external stakeholders to ensure that organizational aims are achieved and compliance with standards, rules, and guidelines is ensured (Fisher 2007; Lange 2008; Volonino et al. 2004). Similar to the exploiting task conditions for ensuring organizational performance, our data suggests that in order to use control systems for external issues, two characteristics determine the control design. Regarding these explorative objective, two conditions influence the control design: synchronicity of control information and certainty of action. Synchronicity refers to the point in time, where the control data is usable for management. It ranges from a delay of several months to almost real-time. IT enhances synchronicity as indicated in the value driver 'risk responsiveness' by providing real-time progressing and analysis of control information for management purpose. Consider the example of employee fraud within the procurement department. Implementing in-memory computing processes to provide immediate results from analyses and transactions allows immediately identifying suspect actions and terminating transactions before the fraud has been carried out. IT further enhances the certainty of actions for management decisions by structuring and visualizing complex information and allows detailed solution development for complex problems. Consider the example of ensuring process compliance through process mining. Implementing mining techniques to analyze process variants, management is able to identify transactions, which do not comply, and suggestions for process improvement.

The opposing goals of on the one hand ensuring performance and on the other hand ensuring integrity have different impacts on designing management control systems. Management has to focus on designing control systems for both purposes (Cardinal et al. 2010; Liu et al. 2010). This requires balancing rather performance-oriented controls and showing compliance by reporting on integrity (Chapman and Kihn 2009; Dechow and Mouritsen 2005). We found that IT provides an integrated data base for both, exploitive and exploratory requirements. Hence, IT enhances designing control strategies by providing balance between controls. Consider the example of the strategic decision of entering a new market. Management has to understand market trends and future capabilities, but needs

to link these to the current organizational performance and situational conditions. IT allows management to get an integrated perspective on information regarding possible alternatives to explore different strategic options and their implications and side effects.

5.2 Linking the Value Drivers to Existing Theory

The interviews revealed five value drivers of GRC IS, which we integrated into a framework (Table 3). We discussed a model that helps to understand the existence of the identified value drivers and explains the impact of IT on control design strategies. This leads to several challenges for existing theories on management control systems (summarized in table 4). The following linkage to theory reveals that existing theories lack the integration of the impact of IT and would highly benefit by integrating research from an IT perspective.

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The objective of organizational performance relates to organizational control theory (Eisenhardt 1985; Ouchi 1979). Reflecting the extant body of knowledge on organizational control theory (OCT) reveals several unsolved issues concerning the role of IT. Although the concept of GRC IS is broad and comprehensive, the only implemented control type is output control. Segregation of duties, identity management, whistle blowing, business activity monitoring, or global trade compliance all evaluate and control work and process results. Although we do not have any clear explanations, we assume that this phenomenon might have the following two reasons: One alternative would be that GRC IS are not developed well enough to implement other control mechanisms. This seems unusual, since on the one hand, it is easier to implement behavior control and on the other hand, the experts revealed ideas of GRC IS value drivers that do not exist in nowadays' solutions but could be implemented in the future.

Another reason, which seems more realistic, might be that behavior control becomes obsolete through the usage of IT.

The underlying assumptions for the objective of organizational integrity have been discussed in the context of interpreting early warnings (Ansoff 1975). Research in early warnings tries to identify weak signals as early as possible in the organizational context (Weick and Sutcliffe 2007). With the help of automation and mass data processing, IT could enable new forms of interpretation of early warnings, which further enhance management control systems toward a knowledge services provider (Sutton 2010).

When designing control strategies, research found existing theories too simple (Cardinal et al. 2010) and calls for integrating control (Liu et al. 2010; Turner and Makhija 2006). Similarly, Alles et al. (2008) point out the value of IT in auditing by control automation, but the authors also emphasize that practice still lacks adoption, especially for continuous data assurance similar to the case of company expert 1. They provide a typology of audit automation efforts and conjecture that certain controls can be subject of automation, but others cannot. In practice, external compliance requirements usually drive GRC initiatives. These often require balanced controls systems, which are implemented with an integrated system. Therefore, management has to meet external stakeholder requirements by using and reinterpreting internal control systems for other purposes. Although, first explanations for integrating management control systems exist, practice still lacks roadmaps to design effective management control systems fulfilling both objectives.

5.3 Need for Further Research

Our aim in this paper is not to exhaustively list all feasible impacts of IT on management control in which IS academics have an edge, but rather, by conducting exploratory research, to illustrate the utility of IT in helping enhance management control. We consider several aspects worth highlighting. First, it could be beneficial of future research to focus on the impact of IT on control coherence.

Further explanation from a meta perspective is needed on how organizations can effectively select and orchestrating controls. Future research should address the selection and evaluation of implemented controls and consider the requests for identifying successful controls and preparing decision-making. As suggested by Alles et al. (2008), further research could provide decision support for selecting controls that are suitable for automation. Additional research on control coherence would provide an additional part of the necessary overall theory of organizations as demanded by Jensen (1993) by providing effective management controls.

5.4 Implications and Limitations

The framework shows that IT offers new opportunities for control design strategies by balancing the exploitation and exploration of richer data about performance deviations and potential shocks. We show that IT has two catalyzing impacts on management controls: first, control automation allows managers to exploit the increasing amount of data, which is available in organizations, for control purposes. Second, a coherent set of controls enables managers to explore control data in order to find new risks as well as opportunities. We have integrated the catalyzing effects into a framework that positions IT in the context of organizational control theory. Our theoretical framework provides a balancing view on the capabilities of IT to constitute value to management control. The linkage to theory reveals that integrating IT into the context of management control reveals several unsolved yet promising issues in theory which future research might address.

The identified value drivers have practical implications as well. They help to structure use cases of GRC IS beyond regulatory compliance. Further, they provide practitioners with an overview of existing value drivers of GRC IS to tailor GRC initiatives. Hence, this research provides a starting point for strategic reasoning for GRC IS initiatives depending on the individual company's situation.

However, there are several limitations to take into account. First, it should be conceded that this grounded theory approach is based on only 21 interviews, which were chosen by convenience

sampling. Although the exploratory nature and the aim of maximizing diversity allows certain broadness at the expense of depth, selecting only three experts from each GRC perspective could bias the findings through their personal opinion or specific experience and limits capabilities for generalization on the total population. Since the scope of this research was to explore value drivers, further research needs to address a deeper empirical validation. In addition, although it is the most obvious, OCT might not be the appropriate theoretical lens for researching GRC IS. Goal-setting theory might also be an alternative, as it is more output oriented (Locke and Latham 2002). Instead of using theories from management and organization science, we could also have used theories from computer science or IS which can be extended to accounting information systems as well. For example, the theory of technology dominance (Arnold and Sutton 1998) might also help assessing the impact of IT on accounting especially in terms of management resilience. We also focused on exploiting existing control capabilities. We examined control automation and coherence, but did not consider a self-contained perspective on exploration. Future research should address the issue of workarounds within IT-enabled management control systems and their effect on the discussed value drivers (Ignatiadis and Nandhakumar 2009). Finally, the level of detail on the combination and interdependencies of the found value drivers is limited.

6 Conclusion

In this paper, we structure the value drivers of IT in management controls using the prominent example of GRC IS as accounting information system for management control. We first applied a grounded theory approach to structure the value drivers of GRC IS. We identified control measurability, control performance, control coherence, risk responsiveness and management resilience as fundamental value drivers. In order to increase the understanding of the impact of IT on management control, we suggested a theoretical framework to relate the GRC value driver to theories, including organizational control theory, weak signals, and risk-based decision-making. We found two underlying objectives for management control systems, which lead to different conditions. We show

that the objective of ensuring organizational performance requires exploiting the situational context. The objective of ensuring organizational integrity requires exploring the control conditions. By influencing control exploitation and exploration of new capabilities for accounting as knowledge provider, IT can contribute to designing management controls by providing a foundation for implementing more effective control systems.

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Perspective	Expert ID	Language[1]	Length	Background	Experience
Audit	Auditor 1	German	1 h 04 min	Business	8 years
Audit	Auditor 2	German	1 h 04 min	Accounting	4 years
Audit	Auditor 3	German	0 h 40 min	IT	10 years
Consulting	Consultant 1	English	1 h 25 min	Business	10 years
Consulting	Consultant 2	German	0 h 59 min	Audit	23 years
Consulting	Consultant 3	German	0 h 45 min	Management	25 years
Governance	Governance expert 1	English	1 h 02 min	Audit	16 years
Governance	Governance expert 2	English	1 h 15 min	Compliance	10 years
Governance	Governance expert 3	German	0 h 58 min	Accounting	6 years
User	Company expert 1	German	0 h 51 min	IT	6 years
User	Company expert 2	German	1 h 13 min	IT	12 years
User	Company expert 3	German	0 h 53 min	Accounting	9 years
Compliance	Compliance expert 1	English	1 h 07 min	Finance	16 years
Compliance	Compliance expert 2	German	1 h 49 min	Finance	22 years
Compliance	Compliance expert 3	German	0 h 45 min	Law	12 years
Software	IT professional 1	German	1 h 22 min	Accounting	17 years
Software	IT professional 2	German	1 h 59 min	IT	11 years
Software	IT professional 3	German	1 h 31 min	IT	7 years
Risk	Risk manager 1	German	1 h 04 min	IT	14 years
Risk	Risk manager 2	English	1 h 02 min	Risk Management	3 years
Risk	Risk manager 3	German	0 h 42 min	Banking	10 years

Table 1. Perspectives on GRC IS and Interviewees.

[1] German quotations were translated into English by the authors.

Selected phenomena (total 139)	**Concept (total 11)**	**Category (total 5)**
Ease of collecting control information	Automation of collecting control information	Control measurability
Reuse data from ERP system		
Automatically generate control reports		
Less interruption of day-to-day work		
Continuous control monitoring	Continuous control	
Data collection in real-time		
Report control liability & effectiveness	Meet required regulations	Control performance
Ensure that controls are in place and up-to-date		
Automate processes to collect audit data		
Find disconnected, fragmented information		
Integrated, global segregation of duties	SOX compliance	
Allows effective fraud detection		
Recognize undesirable behaviour		
Use IT to accelerate audits	Enhance control effectiveness	Control coherence
Management can observe organizational units		
Process high amounts of control data		
Provide real-time information		
Reduce manual oversights	Continuous monitoring of existing internal controls	
Allow automated control testing		
Avoid fragmentation	Comparability	
Standardized workflows and reports for risks		
See whether certain countries or units are compliant		
Build effective internal control system	Prevent future incidents ahead of time	Risk responsiveness
Create organizational resilience		
Recognize anomalies early	Avoid negative outcomes	
Find early risks, blurry but indicator		
Understand which loss indicators are right		
Use positive incidents to drive innovation	See opportunities	
Reduce reduction time for market trends		
Use risk management to process abstract innovation		
Use functional unit's reports to make decisions	Prepare decision support	Management resilience
Provide more information for management		
Increase reliability of internal controls		

Table 2. Selected phenomena, derived concepts, and corresponding categories

Value driver	Control measurability	Control performance	Control coherence	Risk responsiveness	Management resilience
Objective	Collect data for control issues	Efficiency of auditing	Effective controls	Interpret weak signals	Rationales for actions
Organization-al level	Operational	External audit	Internal audit	Management	Senior management
Contribution of IT	Centralization, Continuous measuring	Control automation, digitalization	Control integration	Transparency, Business Intelligence	Patterns, Benchmarks
Impact	Reduced costs and complete-ness of data collection	Ensure proper control implementation	Monitor control effectiveness	Enhances management's absorptive capacity	Provide backing for actions

Table 3. Value drivers of information systems for Governance, Risk, and Compliance (GRC).

Value driver	Theory	Citation	Challenge
Control measurability	Principle-Agent Theory	(Eisenhardt 1985)	IT eases collection of control data leading to a more transparent agency relation-ship
Control performance	Organizational Control Theory	(Ouchi 1979)	IT influences underlying situational condition of knowledge of the transformation process
Control coherence	Organizational knowledge management	(Turner and Makhija 2006)	IT allows continuous integration of data for control purposes
Risk responsiveness	Early Warnings	(Ansoff 1975)	IT allows navigating through control data at low costs and provides understanding of risks
Management resilience	risk based decision-making	(Sitkin and Pablo 1992)	IT allows management to get resilient against unexpected developments by providing early information

Table 4. Value drivers of information systems for Governance, Risk, and Compliance (GRC).

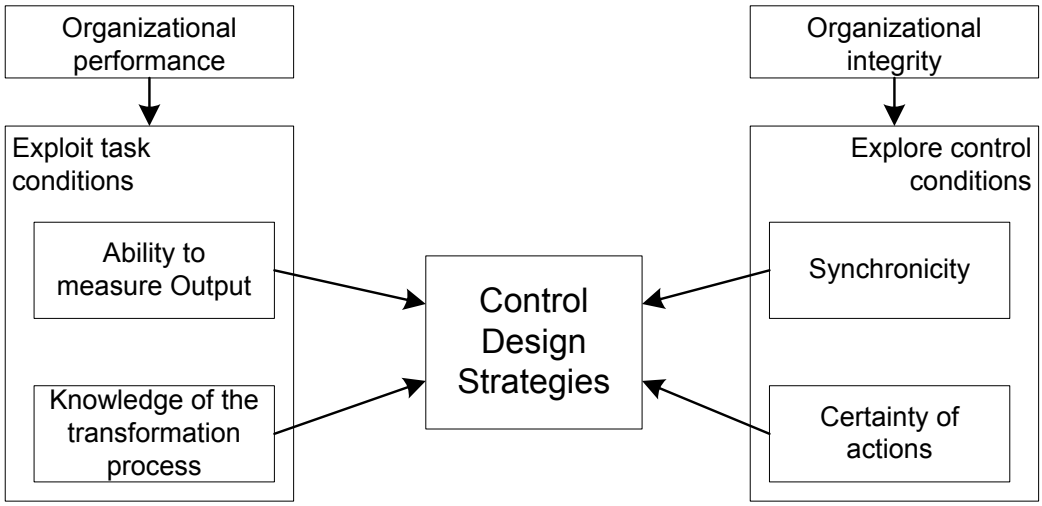

Figure 1. The balanced control model.