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Decoupling, Information Technology, and the Tradeoff between Organizational Reliability and Organizational Agility

by

Robert Keller, Philipp Ollig, Gilbert Fridgen

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University of Augsburg, D-86135 Augsburg
Visitors: Universitätsstr. 12, 86159 Augsburg
Phone: +49 821 598-4801 (Fax: -4899)

University of Bayreuth, D-95440 Bayreuth
Visitors: Wittelsbacherring 10, 95444 Bayreuth
Phone: +49 921 55-4710 (Fax: -844710)

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DECOUPLING, INFORMATION TECHNOLOGY, AND THE TRADEOFF BETWEEN ORGANIZATIONAL RELIABILITY AND ORGANIZATIONAL AGILITY

Keller, Robert, University of Augsburg, Augsburg, Germany, Project Group Business & Information Systems Engineering, Fraunhofer FIT, Augsburg, Germany, robert.keller@fim-rc.de

Ollig, Philipp, FIM Research Center, University of Bayreuth, Bayreuth, Germany, philipp.ollig@fim-rc.de

Fridgen, Gilbert, Faculty of Law, Business & Economics, University of Bayreuth, Bayreuth, Germany, Project Group Business & Information Systems Engineering, Fraunhofer FIT, Bayreuth, Germany, gilbert.fridgen@fim-rc.de

Research paper

Information technology units within organizations pursue organizational reliability and agility goals. Both capabilities are imperatives for business success but there is an organizational tension arising in being agile and reliable at the same time. Reliability ensures the stability and business continuity of organizations, whereas agility helps to detect and exploit market opportunities. In our research, we study projects in 19 organizations and seek to unravel the relationship between agility and reliability. We observe that in certain cases reliability can undermine agility and vice versa. Global rules, routines, and procedures can hinder organizational agility whereas responding creatively for agility can locally undermine global organizational reliability. Further, we find that organizations often use decoupling to deal with this trade-off. Although decoupling enables them to be agile and reliable at the same time, it risks undermining both capabilities in the future, by encouraging the accumulation of technical debt. We find indications of how technical debt limits opportunities to creatively respond and increases vulnerabilities.

Keywords: Organizational Agility, Organizational Reliability, Decoupling, Technical Debt.

1 Introduction

Managing digital transformation and disruption is one of the biggest challenges and opportunities of information technology (IT) units within organizations (Legner et al., 2017; Bourton, Lavoie and Vogel, 2018). Detecting and exploiting emerging market opportunities faster than competitors can be a crucial advantage (Overby, Bharadwaj and Sambamurthy, 2006; Tallon and Pinsonneault, 2011). Therefore, organizational agility is an imperative for business success (Lee, Sambamurthy, Lim and Wei, 2015). At the same time, IT units need to maintain reliable processes and proactively avoid external disruptions (Urbach, Drews and Ross, 2017). Organizational reliability is a key objective of information systems practitioners (Butler and Gray, 2006). Thus, IT units need to manage two critical imperatives: organizational agility and organizational reliability.

Organizational agility refers to the ability to sense external opportunities and threats and to respond to these factors in an appropriate manner quickly – agility is a crucial determinant of business success (Sambamurthy, Bharadwaj and Grover, 2003; Urbach et al., 2017). IT can both enable and impede agility (Overby et al., 2006). Lu and Ramamurthy (2011) argue that organizations can increase their agility by spending on their IT capabilities. Absorptive capacity mediates the impact of IT knowledge and IT operations on agility (Mao, Liu, Zhang and Zhang, 2017). Organizational reliability, on the other hand, refers to an IT unit's ability to continue operating and delivering efficient and effective outcomes

despite external disruptions, issues, and challenges (Butler and Gray, 2006). Reliability involves sensing and responding to external influences (Butler and Gray, 2006), but to preserve service levels rather than to bring about change (as in the case of agility). Rules, routines, and procedures can improve an organization's reliability for a stable environment and processes (Butler and Gray, 2006). Therefore, robust IT-enabled rules, routines, and procedures are crucial to business continuity and to delivering efficient and effective outcomes.

IS research has long implicitly assumed the relationship between agility and reliability to be positive since both imperatives require similar capabilities around sensing and responding to the environment (Sambamurthy et al., 2003; Butler and Gray, 2006). However, this relationship is not expressed explicitly, and researchers provide little theoretical foundation for relating the two concepts. Gregory et al. (2018) call for research to investigate the organizational tensions between convenience and security as well as between IT-based exploration and exploitation. We look to rectify this situation and provide a theoretical foundation for relating the two, and to take a step toward unraveling the relationship between agility and reliability and the role of the actions of IT units. We address the following research question: *How are organizational reliability and organizational agility related to each other and how do organizations deal with this trade-off?*

We report on a study of projects in 19 organizations to unpack the relationship between organizational reliability and agility. We conducted interviews with IT leaders in these organizations and observed different relationships between responding creatively and reliability as well as robust rules, routines, procedures, and agility. First of all, besides the already described positive relationship, we observed a possible negative relationship between responding creatively and organizational reliability. The same phenomenon applies to robust rules, routines, procedures, and organizational agility. We explored how organizations deal with this tradeoff. Decoupling enables organizations to entirely separate their systems (Orton and Weick, 1990; Berente and Yoo, 2012). Thus, organizations can maintain their reliability and respond creatively outside their existing robust rules in the short term. However, we reveal that decoupling causes problems. As a result of decoupled systems, organizations may accumulate technical debt on a local level over time. "Technical debt" is a metaphor used in software engineering and was first introduced by Cunningham (1992). It characterizes "the gap between the current state of a software system and some hypothesized ideal state" (Brown et al., 2010) or as "software maintenance obligations that need to be addressed in the future" (Ramasubbu and Kemerer, 2016). We further address the impact of technical debt on organizational agility and organizational reliability.

The remainder of the paper is organized as follows. First, we characterize the notions of organizational agility and reliability. This is followed by a case description and our analysis and a discussion of our findings. We then present our study, derive our research model, and conclude with the implications for research and practice.

2 Theoretical Background

Two distinct literature streams offer insights about the relationship and influence on organizational capabilities. Firstly, Sambamurthy et al. (2003) and Overby et al. (2006) deal with the factors that affect organizational agility. In the interaction with sensing environmental change, responding readily is a necessary condition for agility (Figure 1) (Overby et al., 2006). In our cases, we focus on the processes in IT organizations. Process-oriented IT is crucial for the ability to respond readily and creatively to opportunities (Overby et al., 2006). Organizational agility is an imperative for business success (Lee et al., 2015). Secondly, Butler and Gray (2006) illustrate the interaction between mindfulness and routines to achieve organizational reliability (Figure 1). Reliability ensures business continuity that is a fundamental criteria for business success as well (Butler and Gray, 2006; Thomas and Fernández, 2008). Therefore, IT units strive for both imperatives: organizational agility and organizational reliability.

Similar to organizational agility mindfulness-based reliability relies on human cognition to come up with new options in unexpected situations (Butler and Gray, 2006). Mindfulness has been defined as the opposite of mindlessness which is "the inactive state of mind characterized by reliance on distinctions" (Langer, 1989). Vice versa, mindfulness is the active state of mind, a state of alertness and dynamic

awareness (Langer, 1989; Dernbecher and Beck, 2017). The attentiveness and active processing of information enable to make distinctions in data and to pay attention to important attributes like failure, simplification or resilience (Weick and Sutcliffe, 2006). Therefore, mindfulness enables decision-makers to take more deliberate decisions which are beneficial for the IT organization (Dernbecher and Beck, 2017). Levinthal and Rerup (2006) agree with this understanding of mindfulness by attributing it a “sustaining high level of attention”. Notably, the perception of the context and the creation of new resulting options is a characteristic of mindfulness (Khan, Lederer and Mirchandani, 2013). IT units are often faced with new situations, in which false decisions can become very costly (Butler and Gray, 2006). Sambamurthy et al. (2003) use the term “entrepreneurial alertness” to describe the influence of the active attention to stimuli in the environment. Since organizations are enacted in repeatable processes that are inherent to the culture of the unit, routines and meta-routines affect the agility of an organization. Meta-routines enable generating change and the performance of nonroutine tasks (Adler, Goldoftas and Levine, 1999; Feldman and Pentland, 2003). Organizations use these high-level routines for the development of dynamic capabilities (Teece and Pisano, 1994; Feldman and Pentland, 2003). Dynamic capabilities are identifiable and specific routines that enable an organization to respond to changing environments and refer to all organizational and strategic processes. (Teece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000).

Mindfulness and Meta-routines are fundamental for both organizational reliability and organizational agility (Figure 1). That is why, previous research assumes a positive relationship between agility and reliability as for both the organizations need similar components (Sambamurthy et al., 2003; Butler and Gray, 2006; Overby et al., 2006).

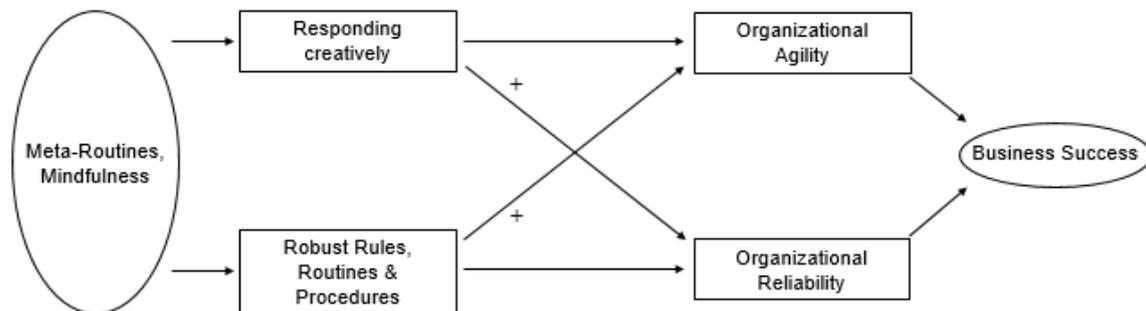


Figure 1. Nomological net of existing research streams

Next, we address literature on IT-enabled organizational agility and reliability, followed by a description of our research.

2.1 Organizational agility

Agility refers to an organization’s ability to sense opportunities and respond to them quickly (Sambamurthy et al., 2003). The organization has to face a continually and unpredictably changing environment (Lu and Ramamurthy, 2011). These changes come rapidly, relentlessly and unexpectedly (Overby et al., 2006; Lu and Ramamurthy, 2011; Tallon and Pinsonneault, 2011). Therefore, organizations have to respond with speed and in the right way (Overby et al., 2006). Responding in the right way includes creativity and “innovative endeavors” (Urbach et al., 2017).

Agility enables organizations to thrive in this turbulent environment (Overby et al., 2006; Lu and Ramamurthy, 2011). Furthermore, agility is about exploring and exploiting opportunities (Sambamurthy et al., 2003). Market capitalizing agility refers to the ability of the organization to sense the environmental change (Lu and Ramamurthy, 2011; Mao et al., 2017). Then, the organization has to respond readily to exploit it (Overby et al., 2006). This ability is referred to as operational adjustment agility (Lu and Ramamurthy, 2011; Mao et al., 2017). This process requires the collection and analysis of a significant amount of information. IT may enable organizations to handle and analyze the collected data.

Thus, IT can be an enabler of agility, but it can impede agility as well (Overby et al., 2006; Van Oosterhout, Waarts and Van Hillegersberg, 2006; Lu and Ramamurthy, 2011). Inappropriate deployment or management might hinder agility. However, IT can support and facilitate decision making and communication (Overby et al., 2006). IT capabilities may enable organizations to sense technological advancements and the way how to exploit them (Overby et al., 2006; Lu and Ramamurthy, 2011). Especially the readily responding to opportunities in IT-driven industries presumes strong IT-capabilities (Sambamurthy et al., 2003). IT infrastructure flexibility enhances the agility (Tallon and Pinsonneault, 2011). On the one hand, the alignment of business strategy and IT facilitates agility by enabling an easier communication (Tallon and Pinsonneault, 2011). On the other hand, alignment can impede agility by excluding opposite ways from the beginning, although these ways could lead to the faster detection of opportunities (Tallon and Pinsonneault, 2011). Overby et al. (2006) introduce an enterprise agility score to measure the agility in organizations.

2.2 Organizational reliability

Organizational reliability refers to an organization's ability to continue operating and delivering efficient and effective outcomes despite external disruptions, issues, and challenges (Butler and Gray, 2006). Reliability refers less to the average level than to the minimization of the variance (Hannan and Freeman, 1984). Organizations achieve reliability by "preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and underspecified structuring" (Weick, Sutcliffe and Obstfeld, 1999). Butler and Gray (2006) identify routines and mindfulness as a basis for reliable performance. Routines define a set of repeatable actions and corresponding decision rules to prevent human errors. Depending on the situation, the person responsible acts without questioning it. Rules, routines, and procedures can improve an organization's reliability for a stable environment and processes (Butler and Gray, 2006). A routine is a "behavior that is learned, highly patterned, repetitious, or quasi-repetitious, founded in part in tacit knowledge" (Winter, 2003). Organizations that recognize patterns of action may learn them over time and develop capabilities from them (Winter, 2003; Helfat and Raubitschek, 2018). However, these patterns are changing in the turbulent environment and routines that are inflexible and inert need to be further revised (Feldman and Pentland, 2003). Therefore, Adler et al. (1999) introduce the notion of meta-routines that are routines for changing other routines. Meta-routines enable generating change and the performance of nonroutine tasks (Adler et al., 1999; Feldman and Pentland, 2003). Organizations use meta-routines in order to adapt their routines to the changing environment.

The application of rules and routines are likely to act rigidly without considering the current circumstances (Langer and Moldoveanu, 2000; Butler and Gray, 2006). This routine-driven approach would be characteristic for mindless behavior (Levinthal and Rerup, 2006). However, rules and routines can provide options or guide our behavior (Langer and Moldoveanu, 2000). Therefore, Butler and Grey (2006) describe routines as a "double-edged sword". Since rules do not cover unexpected things, understanding and acting mindfully is crucially important in these situations (Weick and Sutcliffe, 2006; Ndubisi, 2012).

Even if reliability is desirable, the inherent reliability of essential systems is not always possible (Butler and Gray, 2006). Thus, there are situations, in which individuals decide on the reliability of the organization since they have to work with unreliable systems (Butler and Gray, 2006). However, the process of a transformation of organizational structures impedes reliability and makes the organization vulnerable to external effects (Hannan and Freeman, 1984). Accordingly, there are necessary measures that require limiting the reliability of the organization.

Mindfulness enables organizations to be more resilient and sustainable reliable than routines (Ndubisi, 2012). This "way of working characterized by a focus on the present, attention to operational detail, willingness to consider alternative perspectives" (Butler and Gray, 2006) enhances the organization's ability to cope external disruptions and challenges.

3 Research Method

We used a multiple case study approach (Yin, 2003) to provide a first understanding of the relation between IT-related agility and reliability. As we seek to answer the question how these two concepts are related to each other and we have no control over behavioral events, exploratory case study research is appropriate for investigating a contemporary phenomenon (Yin, 2003). Case studies allow to get a first understanding of the phenomena and help to develop a first possible research model. The primary method for data collection were qualitative interviews. The interview is a standard method of qualitative research (Myers and Newman, 2007; Schultze and Avital, 2011). We conducted interviews with selected experts in video calls and person. Interviews ranged from 60 to 180 minutes, and meetings were audio-recorded as well as transcribed. Secondary sources of data were project-related documents, including news coverage related to the projects and internal documents, which were partly available. We also took into account the participant observation in the interviews that we conducted personally. The integration of multiple data sources is recommended to triangulate the results (Creswell, 2013).

We used a semi-structured protocol intended to elicit stories from the IT organizations (Myers and Newman, 2007). First, the interviewer situated himself within the context by introducing himself and the research project. Second, to minimize social dissonance in the interview, the interviewer explained how each interview will be anonymized and secured. Further, to build rapport, each informant told about their background and relationship to recent projects concerning either the reliability or the agility of the organization. The interviewer offered a way that both mirrored the verbal posture and vocabulary of the informant and in a way that flexibly allowed the informant to go in a direction that he or she found interesting, using terms that are comfortable for that informant. This approach is consistent with interpretive research techniques (Orlikowski and Baroudi, 1991). Example questions included:

- Can you think about a situation where you ran into some new opportunities and your current IT setup was limiting you from pursuing this opportunity? How did you react? (Request examples)
- Can you think about a situation where you had to find a quick and maybe dirty solution? To what extent was the solution different from the ideal solution? (Request examples)

In several cases, we approached the interviewee again after the interview in order to clarify questions. We produced a full case write-up for each interview to triangulate our results (Yin, 2003). We followed a two-stage process of inductive and deductive coding of data, building upon and adapting the recommendations by Miles and Huberman (1994). Authors scrutinized and coded the data independently of each other and subsequently discussed their interpretations, through which we became immersed in the data and began to explore for recurring themes. We constructed categories and subcategories, grouped codes and looked for relationships and patterns. We made four observations that we detail here as findings.

4 Case Study

4.1 Cases overviews

We conducted nineteen interviews with different organizations (see Table 1). During the interviews, we asked about specific IT-related initiatives and queried how these initiatives influence their ability to be flexible, innovative and agile, while at the same time provide business continuity, security, and reliable performance.

Case	Business Domain	Interviewee	Employees
1	IT Consulting	Managing Director	> 100
2	IT Hardware	Enterprise Architect	> 100.000
3	Industrial	VP Core Business Apps	> 10.000
4	Financial Services	IT Portfolio Manager	> 1.000

5	Financial Services	Risk & Compliance Manager IT	> 1.000
6	IT Consulting	Senior Manager	> 100
7	Media	Head of IT	> 1.000
8	Industrial	Lead of Digital Business	> 10.000
9	IT Software	CEO	> 10
10	IT Consulting	Senior Manager	> 1.000
11	Industrial	Head of CRM	> 10.000
12	Consulting	Senior Consultant	> 10
13	Strategy Consulting	Consultant	> 10.000
14	Media	IT Portfolio Manager	> 1.000
15	Research Institute	Research Assistant	> 100
16	IT Consulting	Software Engineer	> 100
17	IT Consulting	Senior Consultant	> 100
18	IT Software	Software Developer	> 100
19	Industrial	Head of Process- and Organizational Development	> 1.000

Table 1. Interviews

In the interviews, we look for stories about agility and reliability.

4.2 Findings

As indicated above, responding creatively with IT and robust IT-related rules and procedures supports organizational reliability and agility. However, we observe that responding creatively can also undermine reliability, just as robust rules, routines and procedures can undermine agility. Therefore, we expand existing literature streams by demonstrating that the relationship between these concepts can be not only positive but negative as well (Figure 2).

Since business continuity is one of the main strategic goals of IT units, they typically closely manage robust IT-supported rules, routines, and procedures to achieve organizational reliability. They implement global routines, processes, and systems to ensure a company-wide standard. As a result, they can implement changes to their global systems more quickly and easily. However, as a result, local sites are no longer able to adapt their systems to their requirements [Case 1, 2, 3, 5, 8, 18].

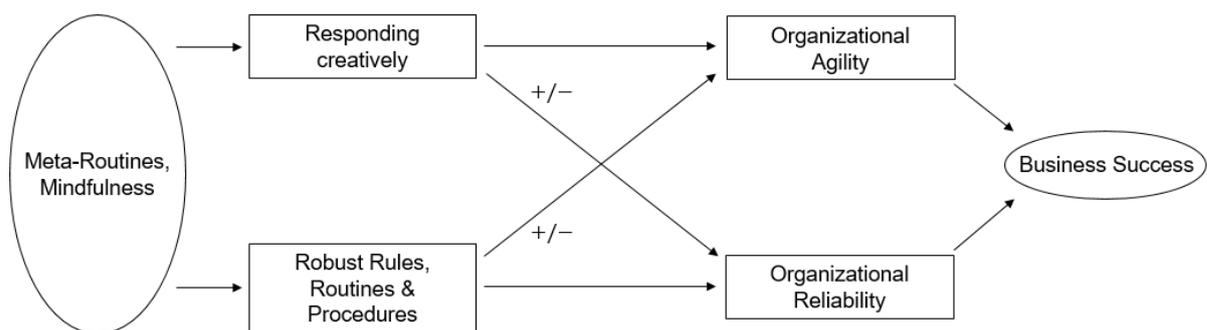


Figure 2. Research model

This leads us to our first finding:

F₁: Global rules, routines, and procedures can hinder organizational agility.

In case 1, the introduction of a global template leads to the loss of previously customized processes. As a result, some processes must be executed manually again. Robust global routines limit the freedom to react locally to changes. Further, the implementation of the global template and the connection to the global system takes around two years. Since they must do each change twice in the local system and in

the implementation project, the organization has stopped changes for the runtime of the implementation. We could observe the same procedure in case 2. In case 3, a global system replaces local applications. On the one hand, the individual departments have more applications at their disposal. On the other hand, they lose their local applications, which were specially adapted to their needs. There was no demand for further applications in the departments. The global measures, therefore, restrict the scope for action and agility at the local level. Moreover, global approaches increase the dependence of local sites on global centralized services, as case 19 illustrates.

Case	Description	Illustrative Data
Case 1, Managing Director	The implementation of the global system leads to a loss of local customized processes and opportunities.	“So, they had their local ERP system. It was customized to their requirements. To their very specific requirements for almost 15 years. So, they had everything set up the way they wanted it to be. They had much automatization that had much reporting. Now, it was replaced with another ERP system with processes that had to work in all other locations as well. So, they lost a lot of flexibility. They lost much about very particular processes because they wanted to streamline all locations.”
Case 1, Episode B, Managing Director	During the implementation of the global system, the local site must not make any changes because the effort would increase exponentially.	“Every change is on hold for those two years within the site. (...) Because every change has an impact on the running implementation. As every change they do in their system might change the gap analysis we did in the beginning. Even if they say it is only a five-day implementation of my old system, it might have an impact on 20 days of implementation on the current project for the rollout. This happens, that is something you cannot prevent, and it is just an additional effort which is much higher than the implementation would be if you do it locally.”
Case 2, Enterprise Architect	Applications must comply with the local standard. Otherwise, the project is not allowed.	“They set a global standard and reserved already the necessary structures for it. Then there is governance, which is not directly implemented, but anybody is no longer allowed to touch this area. If anybody wants to use it, he has to comply with the global standard immediately.”
Case 3, VP Core Business Apps	The global robust CRM system replaces all previous local customized applications.	“Some subgroups did not have a real CRM system. They had an offer system. They did not manage any opportunities in the past. They did not know that. They have looked after their individual customers. Each sales representative is sitting there waiting for the customer to call and say, I need an offer. On the other hand, we have a traditional distribution where people are constantly working on their accounts and looking to identify and work with any opportunities.”
Case 19, Head of Process- and Organizational Development	Due to the different time zones, the location in the U.S. may have to wait until it gets an answer.	“As a company, you have to think about whether you want to centralize certain things or not. In the U.S., we have three locations that have similar IT landscapes as we do here in Germany. That is why we offer them support. However, this also causes problems like different time zones. If things go wrong with them, there has to be someone in Germany who can answer.”

Table 2. Illustrative data for our first finding

Market changes and changing requirements result in steady challenges for organizations. Especially responding creatively is often in contrast to the rigid routines and processes, which are supposed to guarantee operational reliability [Case 1, 2, 3, 4, 6, 8, 11, 19]. In order to still be able to respond in an agile way to market opportunities, organizations, therefore, create workarounds and exceptions on a local level. Global systems have long release cycles and complex coordination processes that prevent organizations to implement quick changes. Thus, responding creatively on a local level makes an exception to global security standards, which can undermine the reliability of the organization. From this we derive our second finding:

F₂: Responding creatively for agility can locally undermine global organizational reliability.

In case 1, it would have taken too long to set up the global template. That is why they used an outdated local solution instead for the local site. Therefore, setting up the new site readily requires falling back to an old solution instead of using the organizational standard. Otherwise, the location cannot start production, which would result in enormous costs and loss of earnings. However, the introduction of local workarounds increases vulnerabilities especially if creative solutions have different security standards than global solutions. Global linking of local systems reduces local as well as global reliability as case 2, shows. Furthermore, the reliability of local applications is significantly compromised by dependencies on individuals. This dependency makes the organization vulnerable in the case the employee is sick or a bus hits him on his way to work, which is called bus factor.

Case	Description	Illustrative Data
Case 1, Managing Director	Setting up the new location requires an exception to the robust global procedure.	“They were building a new site in Germany, and they were looking for an ERP system to support that location, and it would have been a perfect fit just from the process scope to this template. As they said, there is no way that we can have it done in between. So, they are going on a different, on a very old different system temporarily and have to move it whenever they have time in 5 to 7 years. The market is changing quicker than they have their IT systems set up. Also, if you go to new factories, it takes three years, so it is not a surprise. They cannot handle it within the timeline of their ERP system.”
Case 2, Enterprise Architect	Local legacy systems do not always meet robust security standards.	“Local legacy systems are a security risk. They are managed locally and do not fulfill the global standard. In countries like Indonesia or Vietnam the security standards are significantly lower, but because of the created interconnectivity, they are not separated anymore.”
Case 3, VP Core Business Apps	The maintenance and modification of local applications depend on individual employees, which can be a reliability risk.	“In such projects as customizing or decommissioning legacy systems, you are partly dependent on individuals. There are only one or two people in the whole corporate group, who know and work with this application. There is often a certain dependence. This is clearly a disadvantage if you have so many legacy systems because then you have only one or two people who are familiar with this system. With a centralized system, the resource availability is better. Then you have at least two or three people who are familiar with a module in this application.”

Table 3. Illustrative data for our second finding

Finding the right degree of robust rules and creative responses is an act of balance for organizations. Table 4 provides an overview to summarize possible effects of robust rules, routines and procedures and responding creatively.

Robust Rules, Routines and Procedures	Responding creatively
<ul style="list-style-type: none"> • Global rules can lead to a loss of customized processes • Introducing robust rules can decelerate the implementation of upcoming requirements • Global procedures can enable a faster roll-out of security standards 	<ul style="list-style-type: none"> • Responding creatively may need an exception from global rules • Responding creatively can enable fast individual solutions • Creating creative responses may increase the dependency on the individuals that developed this solution

Table 4. Overview of the effects of robust routines and responding creatively

The negative relationship between responding creatively and reliability and robust rules, routines, procedures, and agility leads to a trade-off that poses a significant challenge to the organization. On the one hand, business continuity is one of the main objectives. On the other hand, organizations must respond

creatively to market opportunities in order to remain competitive. In order to achieve both goals, we find that pursuing the strategy of “decoupling” may be an answer to resolve the trade-off. Organizations decouple their local systems from their global systems to prevent global reliability from being compromised [Case 1, 4, 6, 8, 11]. Certainly, decoupling can reduce the reliability of individual processes. Responding creatively implies workarounds that might not have a high standard as global solutions with extensive test phases. However, decoupled systems are no longer connected to each other. Similar to a chain an IT organization is only as strong as its weakest link. Decoupling can avoid security breaches by decreasing the vulnerability of the global systems. Possible resulting vulnerabilities only affect the decoupled local system. From this, we derive our third finding.

F₃: Decoupling can enable responding creatively without undermining the global organizational reliability.

Creative responding is required especially in the field of innovations. In addition to speed, this also involves out-of-the-box solutions. In case 6, the organization uses decoupling to try out some things in the open countryside independent from regular release cycles and compliance regulations. The organization in case 8, pursues a similar strategy. In some cases, the new projects are not linked to the global systems as in case 11. As the integration level is low and the mobile app is decoupled from the global system, the organization considers the risk of malfunctioning to be low as well. The low risk assessment enables the organization to implement changes quickly and outside traditional release cycles. If errors occur, only the local mobile app is affected, but not the global system. Moreover, decoupling can also involve outsourcing tasks to manual forces as case 1, illustrates.

Case	Description	Illustrative Data
Case 6, Senior Manager	Decoupling enables the introduction of an innovative platform which would not have been possible with a traditional procedure.	“They wanted to simply try out many things. They noticed when they take the traditional procedure, first thinking the project through. They would have to specify half a year and another year getting approvals by some committees that others will offer the services and then they cannot gain a foothold in the market. It takes too long plus it is too expensive and cost-intensive to go ahead with big steps in such a heavyweight delivery. (...) However, we have not thought about what that means if we get data worthy of high protection.”
Case 8, Lead of Digital Business	The organization uses decoupling to test new products outside the robust, standardized systems.	“If you are in this exploration area, you have clear transfer points somewhere in the sense of some decoupling. Where it is clear, here you can do a little experiment and, for example, use new tools somehow, which I just need now to bring new products or new services to the market. Also, before I somehow demand that every new product is created immediately in ERP and I need n mandatory fields. Then, I have a customizing project for half a year before I made one euro of sales. Therefore, I allow some things. This stable world of reliability is the hand-over point for existing systems, which of course must be implemented in ERP, but for new young products, we allow them to be outside and to do some other things.
Case 11, Head of CRM	The organization decouples mobile apps from the traditional release cycle to be able to react faster to market opportunities.	“Where then came all the new features and such a release is since it is twice a year and super complex on a global system or it is super risky because if that breaks down, it is worldwide broken. It has been a huge effort. That means with adequate planning. It started three months earlier, and then the market organizations had to test. There were several revisions rounds and so on and so on, so it was complicated. And when they said: "Let's build mobile apps like this". In the traditional process, the pipeline for the release would be more or less full, and we would have to do that in a year and a half. (...) We said: Okay,

		the level of integration is very low. As a result, the risk is very low. That is why the release cycle does not have to be bound to the usual release cycle.”
Case 1, Managing Director	Instead of running the task within the system, an employee does it manually.	“We did not have a solution for that. Then the Chinese manager proposed to hire someone who is doing it manually. He took our printouts from ERP with a couple of missing signs in Chinese. He rebuilt it in Word and was sitting eight hours a day next to the printer.”

Table 5. Illustrative data for our third finding

We observed in our cases that organizations struggle to be agile and reliable in their systems at the same time. Decoupling can provide a short-term solution since it enables the organization to separate their systems and to be agile without undermining their reliability. In the decoupled systems, organizations can apply technologies which otherwise they could only use with a high expenditure of time and money. However, organizations often lack at least one of the two. Furthermore, they might not yet know the benefits of implementing the project and would like to test it in a pilot project. Decoupling enables organizations to understand the problem and find creative solutions quickly without being limited by robust rules. Thereby, organizations can generate learnings in case they decide to rollout a local solution globally. Either individual locations or departments are suitable since the corresponding system must be decoupled. Since organizations can seize market opportunities only within a certain period, it is crucial to respond readily and creatively. Due to the time pressure, organizations can be forced to use outdated services as well. Nevertheless, the organizations must reconcile their decoupled IT systems in the long term. Organizations should therefore pursue the decoupling strategy only as a short-term solution. Otherwise, decoupling leads to fragmented IT landscapes. This means that the organizations only postpone the necessary investments in the IT systems. From this, we identify our fourth finding.

F₄: As a result of decoupling, organizations may accumulate technical debt over time.

In case 1, the organization is not able to readily implement the global template in the new location. The implementation of the global template takes significantly more time due to the high effort of implementing and testing, which is necessary in order not to jeopardize global reliability. For this reason, the organization decouples the local system from the global template and relies on an outdated ERP solution. This approach creates technical debt, which initially enables the organization to set up the new site readily. However, the organization has to pay their technical debt in the future, which is time and cost intensive. Otherwise, the organization has to implement internal and external requirements in both systems. The organization in case 2, also follows the decoupling strategy to remain locally agile. However, decoupling would result in each user having two IDs, one local and one global, which in turn contradicts the goal of usability. For this reason, they use interfaces that link the outdated local software with the new global software. In case 3 and 19, decoupling leads to a lack of information exchange between the different systems. The organizations must either harmonize their systems in complex transformation projects or build interfaces.

Case	Description	Illustrative Quotation
Case 1, Managing Director	The organization uses an outdated ERP system since the implementation of the current global template would take too long.	“The market is changing quicker than they have their IT systems set up. And if you go to factories, it takes two to three years, so it is not a surprise. They cannot handle it within the timeline their global ERP implementation. That is why they use an old ERP system. They have it on the shell. They are not changing anything to it. It is running on a couple of locations, on small warehouse facilities. They use it. I think the reasons why they were looking for a solution with this provider is that they hope that the migration might be easier in the future.”
Case 2, Enterprise	The organization connects the decoupled systems with	“Our approach is to find a solution with interfaces. We develop an interface with a mapping of the local and global system until

Architect	interfaces instead of replacing the local legacy systems.	they are ready to replace the legacy system and to adapt to the global standard. But until then we always live in a hybrid work-around world.”
Case 3, VP Core Business Apps	As a result of decoupling, the organization cannot optimally serve its customers.	“The customer had to talk to different departments depending on which product he was looking for. Since we work in these subgroups, relatively independently. (...) Now, the focus is to serve customers globally. We orientated ourselves towards the customer needs. Therefore, we need a collaboration platform for sales, and that is a CRM system. There is a business need which made us say we want to have one platform in the future.”
Case 19, Episode A, Head of Process-Development	As a result of decoupling, there is a lack of information between countries.	“A customer asked for a product at our site in North America, but also at our site in Germany and got two different prices. Because the two IT systems are independent and did not know about each other.”

Table 6. Illustrative data for our fourth finding

5 Discussion

Generally, agility requires similar capabilities in IT knowledge and processes as reliability (Butler and Gray, 2006; Overby et al., 2006). However, instead of seeing a purely positive relationship between agility and reliability we observe a trade-off between being reliable and agile at the same time in certain instances. Our findings reveal that responding innovatively and creatively is often not possible within traditional robust procedures. These effects are similar to those of standardization (Jakobs, 2007). Due to robust rules, routines, and procedures that are reinforced by IT such as global ERP systems, local sites are no longer allowed to customize their systems. As a result, they react more slowly or not at all to market opportunities. We identified that responding creatively may require exceptions from robust rules and routines. Our finding is consistent with organizational tensions in the context of IT governance bypassing and force-fitting (Gregory et al., 2018). If one were to allow all local units to act in an agile way and flexibly adapt their practices, systems, rules and procedures, this would significantly undermine the global reliability.

Therefore, organizations pursue decoupling as a strategy to achieve simultaneous local agility and global reliability. Consistent with previous interpretive studies, our third finding indicates a relationship between the coupling and the degrees of agility and reliability (Orton and Weick, 1990; Berente and Yoo, 2012). On the one hand, tightly coupled systems are highly integrated and responsive to each other, which produces stability. On the other hand, decoupled systems are entirely separate and unresponsive, which supports local flexibility (Orton and Weick, 1990). Decoupling can provide a possible solution to achieve both imperatives since it enables the organization to completely separate their systems (Orton and Weick, 1990; Berente and Yoo, 2012). Thereby the vulnerabilities or security breaches in one system do not influence the reliability of the other system. Therefore, the advantages of decoupling are similar to those of modularity and loose coupled systems (Yoo, Henfridsson and Lyytinen, 2010; Berente and Yoo, 2012).

However, decoupled systems are independent concerning maintenance and customizing as well. IT units must take care of two or even more systems instead of one. Depending on the degree of decoupling, more and more disadvantages can arise. Continuous decoupling over a longer period of time leads to fragmented IT landscapes. The maintenance of fragmented IT landscapes is significantly more complicated since each change must be implemented in different systems. A single team can often not implement the change in all systems because it lacks time and knowledge. For this reason, local IT departments usually manage decoupled systems. In addition to the increased costs due to the additional expense, this can lead to inconsistencies if the departments understand the requirements differently. Furthermore, due to the time pressure associated with creative responding, organizations can be forced to use outdated or non-compliant services – essentially accruing technical debt.

Technical debt characterizes obligations that need to be addressed in order to achieve the hypothesized ideal state of the IT (Brown et al., 2010; Ramasubbu and Kemerer, 2016). First, technical debt breeds increased, partly recurring costs in the future (Brown et al., 2010; Woodard, Ramasubbu, Tschang and Sambamurthy, 2013; MacCormack and Sturtevant, 2016). These costs can either materialize as higher maintenance cost or additional effort to exercise digital options (Woodard et al., 2013; MacCormack and Sturtevant, 2016). These higher costs lead to an influence on the allocation of resources. Second, akin to financial debt, technical debt entails both interest and principal (Li, Avgeriou and Liang, 2015). As long as these recurring costs do not grow too large, they can be easily monitored (Brown et al., 2010). Vice versa, a considerable amount of technical debt will breed significant challenges.

Up to now, there is a lack of research on to what extent technical debt itself influences organizational agility and reliability. In our cases, we found indications that technical debt may hinder both imperatives. We observe that outdated and fragmented infrastructures are not compatible with new technologies or business models. In addition, tying up resources to maintenance projects leads to a lack of resources in creative responding, which is necessary for agility. Moreover, technical debt can have a direct impact on reliability if security policies and firewalls are not kept up to date. In one of our cases, technical debt directly results in a breakdown of the system as a result of a hacker attack.

Nevertheless, decoupling can create digital options which in turn can increase reliability and agility (Sambamurthy et al., 2003; Rolland, Mathiassen and Rai, 2018). This becomes particularly evident in pilot projects where organizations apply technologies in decoupled systems. In these delimited decoupled systems, organizations can test more quickly whether an organization-wide rollout is possible. Afterwards, the organization can decide if it wants to adopt the local solution across the organization.

However, digital options can increase technical debt as well. Fowler (2009) distinguishes in his quadrant between incurring technical debt deliberate or inadvertent and reckless or prudent. Brown et al. (2010) follow a similar approach by distinguishing between strategic debt and unintentional debt. Furthermore, in order to avoid strategic debt, an organization therefore may hesitate to pursue digital options that involve technical debt. Mindfulness enables decision-makers to take more deliberate decisions (Dernbecher and Beck, 2017). Therefore, mindfulness not only influences agility and reliability but also determines how the organization decouples its systems, pursues digital options and manages technical debt.

Overall, especially in the short term, decoupling can enable agility and reliability. In the long run, however, decoupled systems result in technical debt which undermines agility and reliability, since maintenance and transformation becomes more complicated.

6 Conclusion

In this research paper, we seek to unravel the relationship between organizational reliability and organizational agility. Both capabilities are imperatives for business success but there is an organizational tension arising in being agile and reliable at the same time. On basis of insights in 19 cases of different organizations, we extend the already existing, positive relationship between these two imperatives by introducing situations where there can be a negative relationship. Global rules, routines, and procedures can hinder organizational agility whereas responding creatively for agility can locally undermine the global organizational reliability. Further, we observe that organizations often use decoupling to alleviate this trade-off. Decoupling proposes decomposed and unresponsive systems that enable organizations to be agile and reliable at the same time in the short term. Thereby, organizations find either workarounds, dispense with patches or even use outdated solution. As a result, decoupling initializes a fragmented IT landscape, which is more complex to maintain. In the long term, therefore, we observe that additional expenditure and higher costs are necessary which arise in the backdrop of technical debt. Even if decoupling thus enables organizational agility and reliability in the short term, it leads to the accumulation of technical debt in the long term. Furthermore, we find indications of how technical debt limits the opportunities of creative responding and increase vulnerabilities.

7 Limitations and Further Research

Since our paper is just a first step, our study has several limitations which stimulate further research. Our multiple case study research design is not entitled to claim generalizability, but can solely provide a first glance at the extension of the relation between organizational reliability, organizational agility and business success. The relationship between decoupling, technical debt and digital options requires further research to be unraveled. We identified our findings on the basis of interviews in which managers are retrospectively drawing past IT decisions and projects. Hereby the researchers' own biases may have influenced the result of the interview. In addition, we focused our interviews on IT departments. As part of the digital business strategy, the IT strategy influences the business strategy (Bharadwaj, Sawy, Pavlou and Venkatraman, 2013). Therefore, we propose to consider different sectors in organizations in future studies.

Another limitation of our study is that we did not undertake to analyze the relationship between organizational reliability and organizational agility in a quantitative way. We propose that further research can build upon our research model and test the relationship statistically. Even though we are confident that we got a good overview of the cases within the companies, the small number of interviews per case may be another concern. Further research in form of an in depth case study could investigate additional aspects concerning the impact of decoupling and technical debt.

Besides these limitations, we have several implications for research and practices. Since organizational agility and organizational reliability are imperatives for competitive success, organizations pursue both goals at the same time. Our contribution to the literature on organizational agility (Sambamurthy et al., 2003) and reliability (Butler and Gray, 2006) is a first analysis of the theoretical relationship between both concepts. By addressing the downsides of decoupled systems we also contribute to theory since existing literature on decoupled systems and modularity mainly focus on the positive aspects (Yoo et al., 2010; Berente and Yoo, 2012). A better understanding of the relationship helps managers to find an appropriate strategy to deal with the trade-off. Moreover, decoupling may seem tempting for managers in the short term. However, we point out that the organization may accumulate technical debt in the long term. Our findings do not suggest to avoid decoupling but that managers should be aware of risking to undermine both capabilities in the long term.

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