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Exploring the Effect of Workarounds in Ambidextrous Organizations

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Abstract

Problem Statement: Organizations are challenged to achieve a trade-off between two opposing modes of innovation - exploration and exploitation. Exploration refers to an extensive search that creates new knowledge, planned experimentation, and play. Exploitation refers to value creation along an existing knowledge dimension and experiential refinement in the form of reusing knowledge. In order to balance both concepts, organization theory scholars investigate how business process management (BPM) enhances the modes of exploration and exploitation. As the standardization of business processes promises to have a positive effect on the overall performance, many organizations implement a "one-size-fits-all" approach in order to deliver exploratory and exploitative innovations. In practice, workarounds challenge the standardization as the incongruence of formal process descriptions and actual working practices is yet not well understood. Workarounds are related to anomalous information system (IS) use where the actual practices are not consistent with the designed uses and official rules. This thesis addresses this challenge by exploring how workarounds can be understood as a solution to deliver exploratory innovations in exploitative organizations by designing affordances in IS.

Research Design: We combine qualitative methods to investigate our research questions and extend our investigation with design research. We do this in order to achieve a more complete view on a multifaceted phenomenon that is in the early stage of theory development. Using a qualitative research approach, we are able to encapsulate the multi-dimensionality of our research endeavor. We use a synthesized literature review, in-depth multiple case studies and a design science research paradigm. We review existing literature to understand the current struggle of balancing exploratory and exploitative concepts. The case study enables us to extend our findings by investigating the theoretical concepts in a practical environment where workarounds are pervasive. Building on these findings, we were able to create and evaluate a meta-model extension to the Business Process Management Notation (BPMN) to visualize workarounds following a design science paradigm.

Results: We find that organizations are challenged when balancing exploratory and exploitative innovations. To overcome this challenge, organizational members modify and adapt processes and technologies in the form of workarounds. Workarounds are used to deliver exploratory innovations when organizational structures are focused on exploitative processes. In our research we show that the outcome of workaround behavior is twofold: the consequences can be beneficial or harmful. We propose that organizations that are able to control the institutionalization of beneficial workarounds, exhibit structures that enhance exploratory innovation activities. Thus, achieving a balance between exploratory and exploitative innovations in organizations is largely a function of controlling workarounds. In order to control this behavior, an understanding of prevailing workarounds in organizations is necessary. We provide an ontology of workarounds to structure and organize the existing knowledge of the field. We show that on a process-instance level the execution of workarounds depend on situational factors whereas a process level workaround manifests as unofficial routines. Workarounds that are institutionalized are part of organizational routines

and can hardly be prevented. Thus, workarounds that appear after weighing situational factors are more likely to be controlled. Situational factors are diverse and vary within organizational structures and influence the decision on executing workarounds. The willingness of decision makers tolerating workarounds is influenced by expected efficiency gains, exposure to compliance risk and perceived process weakness. To support organizations in deciding how to deal with incongruence we propose a modeling notation to visualize workarounds. We offer insights into how workarounds evolve by proposing affordance theory as viable lens. We turn on the concept of desire paths taken from architectural theory – as a form of path that is taken informally rather than following a set route – and propose that organizations need to understand the concept as expression of users' desires in response to restrictive formal structures. Following desire paths, we absorb action potential of workaround behavior by proposing affordance theory as a viable lens for designing IS. Affordances are defined as the "qualities or properties of an object that define its possible use or make clear how it can or should be used" (Meriam Webster). Based on the possibility of interpreting workarounds as desire paths, we propose that the action potential of workarounds can absorbed. We show how organizations can design their IS using affordances to institutionalize workarounds as an anchor for becoming ambidextrous.

Contribution: This thesis contributes to theory and practice in several ways. We contribute to organization theory in advancing our understanding of ambidexterity. Our findings propose that organizations which aim to balance exploration and exploitation need to understand workarounds as the possibility to provide a structural bridge between different units. Researchers need to investigate how knowledge may evolve without competing against existing structures and mindsets, e.g., not-invented-here syndrome. We contribute to workaround theory by proposing the concept of affordances as a viable lens. Adding the perspective of affordances, offers new insights into how workarounds are perceived by different organizational members, e.g. employees or management. Furthermore, we are able to provide insights into the sociomateriality of workarounds and highlight the need to consider the relational perspective of the social and the material in IS research. We contribute to practice by providing guidelines on how to deliver exploratory innovations in exploitative organizations and thus, how to achieve ambidexterity. We show that organizations, although not being designed for delivering exploratory innovations, may use workarounds to overcome inertia. Using desire paths we provide a step towards designing affordances into a system to encourage certain patterns of use and behavior in order to absorb the knowledge and potential behind workarounds.

Study Limitations: First, as we followed a qualitative research approach this thesis is limited in its generalizability. We are confident that our findings may be replicated and that further cases show the same characteristics when studying workarounds in ambidextrous organizations. Second, with our interviews we are only able to provide a short term data set collected over three years. As the phenomenon of workarounds evolves over time, we integrated observations and archival data in order to provide a longitudinal approach. Third, workarounds are a rather sensitive topic and need to be treated with caution. Using a snowball sampling, we were able to identify organizational members that are open to talk about

deviations from formal business process descriptions. The visualization of workarounds encourages them to externalize their knowledge and to gain insights into actual working practices. Fourth, our research is focused on special industries that are prone to workarounds. Therefore, we added one domain that is commonly reported on when it comes to strict compliance regulations, the accounting domain. Fifth, we found that individuals belonging to the same group do not always respond uniformly to the IS. This leads to the need for investigating workarounds on an individual level to provide assumptions on how organizations can design IS on a group level.

Future Research: With regard to our results and the limitations, this thesis opens up various avenues for future research. First, we encourage researchers to investigate the role of dynamic structures in ambidextrous organizations. As business processes undergo a drift, workarounds are exposed to change as well. Transforming organizations towards agile units requires to understand how exploitative structures may be enhanced with exploratory approaches. Deepening the understanding of desire paths in information systems research provides promising avenues for future research. Second, the ongoing discussion about the opposing theories of affordances needs to be studied from a new perspective, namely that they are not contradictory but rather built on each other. Third, a quantitative or mixed method approach promises fruitful insights for understanding the emergence of workarounds. Experimental design promises rich insights into the use of IS in a realistic working environment with reasonable working tasks. Fourth, the evaluation of risks and benefits is yet not well understood. Attempts to measure the consequences of workarounds seek to shed light on the ongoing debate about the effect of business process standardization.

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List of Abbreviations

ACM TMIS – Association for Computer Machinery Transactions on Management Information Systems

AMCIS – Americas Conference of Information Systems

DIGIT – Diffusion Interest Group in Information Technology

DSR – Design Science Research

BPM – Business Process Management

BPMN – Business Process Modeling and Notation

ECIS – European Conference of Information Systems

EJIS – European Journal of Information Systems

HICSS – Hawaii International Conference on System Sciences

IS – Information Systems

IT – Information Technology

PFA – Perceived Functional Affordances

RQ – Research Question

TACT – Technology Affordances and Constraints Theory

WI – Internationale Tagung Wirtschaftsinformatik

WKWI – Wissenschaftliche Kommission der Wirtschaftsinformatik

WPMN – Workaround Aware Business Process Model Notation

PART A

1 Introduction

1.1 Motivation

This doctoral thesis explores how workarounds become institutionalized in order to achieve a trade-off between exploitative and exploratory innovations. We started this research by understanding how organizations are able to overcome inertia while reacting to change in an innovative environment (Robey et al. 2002). Literature argues that being successfully innovative is largely a function of exploring new competences and exploiting existing competences (Gibson/Birkinshaw 2004). The concept of ambidexterity refers to the notion of achieving a trade-off in allocating resources to two kinds of competing activities. Ambidexterity challenges research where there is considerably less clarity on how this balance can be achieved (Cegarra-Navarro/Dewhurst 2007).

Organizations are confronted with the incompatibility of opposing processes and fail to adhere to the need for simultaneously serving those contradictory expectations (Gupta et al. 2006). Literature shows that tensions in how to manage positive and negative consequences of opposing concepts do not simply challenge organizations but may provide the opportunity for knowledge creation as well (Faraj et al. 2011). Especially mature organizations are challenged to engage in exploratory innovation modes but at the same time may be able to absorb new capabilities from this challenge as well. The need for balancing the incompatibility of two conflictive perspectives leads to unintended side effects in form of deviations from defined routines in IT-enabled business processes. As many organizations are mired in contexts that do not effectively support ambidexterity and high performance, organizations need to restructure their business process to shift the behaviors they encourage (Birkinshaw/Gibson 2004). In this thesis we find that organizational members who strive to engage in exploratory innovation modes in organizations resolve the tensions by creating workarounds.

Recent approaches broadly define workarounds as goal-driven changes to defined routines in business processes (Alter 2014). The reasons why workarounds are pursued range from a misfit between technology, process and culture (Ansari et al. 2010) to incongruent goals (Ignatiadis/Nandhakumar 2009). Misfit occurs when IS poorly support the defined process (Safadi/Faraj 2010) or certain steps cannot be performed at all due to hindering obstacles (Vogelsmeier et al. 2008). Incongruent goals occur when organizational environment and the day-to-day work practices require opposing actions, such as when physicians strive to save lives but need to comply with hospital's privacy standards (Azad/King 2012). In addition to these motivating factors, workarounds are fostered by organizational phenomena such as lack of accountability and drift, but also future improvement (Jenkins/Durcikova 2013; Azad/King 2012; Boudreau/Robey 2005). Literature shows that recurrent engagement with routines affects willingness to engage in workarounds when they become a persistent part of organizational processes and may even become institutionalized (Orlikowski 2000).

The institutionalization of workarounds can only hardly be prevented (Azad/King 2012). In research different terms have been used when naming the phenomena, e.g., transformation into systematized methods (Alter 2014), routinized respond to exceptions (Strong/Miller

1995), or persistence of workarounds (Koppel et al. 2008). All in common, the shared perspective is that tensions between day-to-day work and top-down pressure (Azad/King 2012) as well as the multiplicity of relationships among causes lead to the institutionalization of workarounds (Koppel et al. 2008). As workarounds challenge business process standardization and thus the performance improvements expected from IS (Ignatiadis/Nandhakumar 2009), we are interested in how organizations are able to gain control over the institutionalization of workarounds.

A promising and viable lens for investigating workarounds provides affordance theory. The concept of affordances can be defined as a concept which offers an action potential to what an individual or organization with a particular purpose can do with IS (Majchrzak/Markus 2012). Affordances in form of IS related action potential affect workarounds and their institutionalization. From an affordance perspective, workarounds can be investigated by analyzing and researching the technology appropriation process (Faraj/Azad 2012). This enables organizations to design IS that enable rather than restrict certain behavior. Success in designing affordances into IS is based on understanding the user, the user's tasks, and the context in which the user accomplishes tasks and goals (Karat et al. 2000). This thesis provides a first attempt in understanding workarounds as a solution to deliver exploratory innovations in exploitative organizations by designing affordances in IS.

1.2 Problem Statement

Even though literature has already investigated the need for a balance of exploration and exploitation, the solution about how exactly the compensation can be achieved presents a challenge for researchers. Literature provides only fragmented explanations on ambidextrous concepts that provide a short- and long-term solution for the incompatibility (Gupta et al. 2006). Ambidextrous organizations are capable of simultaneous, yet contradictory, knowledge management processes, exploiting current competencies and exploring new domains with equal dexterity (Lubatkin et al. 2006; Andriopoulos/Lewis 2009). Still, striving to maintain ambidexterity, organizations suffer from their inability to organize for this trade-off (Raisch et al. 2009). Research relating ambidexterity to performance shows that an imbalance leads to a loss in long-term firm performance (Raisch et al. 2009). Therefore, current research seeks to provide theoretical models towards leadership for innovation (Rosing et al. 2011) and information systems control (Tiwana 2010) but still is in the early stage of how to design IS for promoting ambidexterity.

The beneficial deterministic effects that IS have on organizational performance are challenged by research that indicates the existence of more complex sociotechnical processes (Leonardi 2011). We assume that IS are at a drift and in consequence the organizational business processes are neither fixed nor immutable (Beverungen 2014). Until now, literature does not provide an understanding of how organizations overcome inertia while reacting to change in an innovative and flexible environment (Robey et al. 2002). While studying the role of workarounds in ambidextrous organizations, we were confronted with four challenges that are not yet addressed in research.

Challenge 1: Generalization of Workarounds

Workarounds have been reported frequently in research with various outcomes. From a security perspective workarounds are a threat to organizations (D'Arcy et al. 2009). In the context of software engineering they are understood as necessary activities in every-day work (Safadi/Faraj 2010). The opposing view of workarounds highlights the different perspective that research exhibits when studying alternate paths in organizational business processes. Especially in the research area of IS, workarounds are yet not well understood and more than often misunderstood by decision makers (Silic/Back 2014). A plethora of research directly addresses workarounds as a part of their research question (Azad/King 2012) while others find the phenomena quite unexpected (Behrens/Sedera 2004). Still, a coherent and interrelated structure to organize the knowledge of workarounds is missing.

Researchers who study the relationship among the core concepts of workarounds are challenged when it comes to a consistent definition. Up to date, several different concepts are used to explain the same behavior. Providing a list of workaround types that are used frequently in literature points out the existing characteristics: shadow system or IT or work (Azad/King 2012), resistance (Fürstenau/Rothe 2014), non compliance (Jenkins/Durcikova 2013), employee or workplace deviance (Bennett/Robinson 2000), system misuse (D'Arcy et al. 2009), decoupling or loose coupling (Azad/King 2012), customization (Niehaves et al. 2012), rule breaking (Martin et al. 2013), fraud (Bagayogo et al. 2013), computer abuse (Straub/Nance 1990), tweaking (Boudreau/Robey 2005), reinvention (Malaurent/Avison 2011) and non conformity (Mainemelis 2010).

This thesis analyzes existing literature to address the lack of a conceptual consensus, fragmentation and the static perspective in workaround research. Understanding the phenomenon of workarounds as incongruence between formal process descriptions and actual working practices provides a first attempt in structuring existing research. We use different types of workarounds to provide a common understanding of the structure and the related concepts.

Challenge 2: Missing Explanation on how to achieve Organizational Ambidexterity

Literature discusses the concept of ambidexterity as balance of exploration and exploitation. While assuming that ambidexterity is a desirable organizational trait (Birkinshaw/Gibson 2004), it is relatively unclear on how to achieve a balance from a long-term perspective (Tushman/O'Reilly 1996). Research provides structural and contextual separation of business units as a solution on how to become ambidextrous (Raisch et al. 2009). Structural ambidexterity is achieved when exploration and exploitation activities are done in separate units or teams (Birkinshaw/Gibson 2004). On the opposite, when individual organizational members divide their time between exploration and exploitation activities then contextual ambidexterity is prevalent (Birkinshaw/Gibson 2004). Other streams discuss orthogonality versus continuity as a solution on how organizations become ambidextrous (Gupta et al. 2006). Using the punctuated equilibrium as a form of achieving a trade-off between exploration and exploitation brings up further avenues for investigation. The punctuated equilibrium refers to temporal differentiation and suggests that cycling through periods of

exploration and exploitation is a more viable approach than a simultaneous pursuit of the two (Gupta et al. 2006).

Solutions on how to achieve ambidexterity are provided in a multitude of theoretical approaches. Still, whether a structural or time-oriented solution is provided, organizations are mired in contexts that do not effectively support ambidexterity and high performance. As a result, organizations need to restructure their business process to shift the behaviors they encourage (Birkinshaw/Gibson 2004).

This thesis examines the dynamics of organizational structures in ambidextrous organizations. Following a case study method we investigate how exploratory and exploitative innovation concepts exhibit structures that allow them to transfer their outcomes. We argue that this kind of transfer is the solution to balance contradictory concepts and drives organizations to become ambidextrous.

Challenge 3: Effect of Drifting Information Systems on Business Processes Standardization

Organizations implement IS in order to standardize their business processes and thus advance their performance improvements (Bala/Venkatesh 2007). Every kind of variation or change challenges this standardization and has an effect on organizational performance (Pentland et al. 2012). Therefore, understanding predictable threats that challenge the potential value of business process standardization have gained interest in research (Münstermann et al. 2010). Literature assumes that change in organizational processes is not continuous nor does it follow a gradual evolution (Volkoff et al. 2007). Instead, technology and organizational elements, such as organizational routines and roles, serve as the source and cause of changes (Volkoff et al. 2007).

We argue that research on standardization no longer may assume that IS are fixed and immutable. This assumption blinds researchers to the possibility of people using technology in “unintended” ways (Majchrzak/Markus 2012). Drifts in business processes or IS are part of every organization and need to be better understood to deal with potential threats to standardization (Beverungen 2014). We turn on the concept of emergence and improvisation to help to explain how workarounds create new ways of organizing and using IS in practice (Orlikowski 2000). Current research on adaption and diffusion theory shares the common perspective that workarounds are an unfavorable and rather surprising outcome (Faraj/Azad 2012).

This thesis addresses the drift in standardized business processes and IS. We investigate how the use of IS, behavior of organizational members and their knowledge create a changing environment. We advance the understanding of actual working practices as a part of business process management. In our research, workarounds are the starting point for investigation and we focus on how to manage, visualize and design for them.

Challenge 4: Design of Information Systems to Control Workarounds

Research finds that when organizations change their IS users react differently depending on whether they perceive that the system affords or constrains their goals (Leonardi 2011).

Perceptions of constraints lead people to change their technologies while perceptions of affordances lead people to change their routines (Leonardi 2011). Depending on the perception of control, organizational members react differently and thus the design of controls has an impact on the way business processes are executed (Sadiq et al. 2007).

Organizations need to identify foreseeable exceptions or obstacles that might call for a workaround (Alter 2015b). In order to design IS in a way that organizational members' behavior is in line with the organizational goals, there is a need for a relational view on the interaction of IS, human agency, processes, and outcomes (Orlikowski 2000). Based on the notion of affordance, researchers have suggested design elements that provide IS with afforded possibilities for action, e.g. a technologies' capabilities and constraints (Savoli/Barki 2013). We refer to the phenomenon of desire paths that is routed in architecture and refers to tracks that are tramped across grassy spaces regardless of formal pathways (Myhill 2004). Desire paths provide the possibility to visualize a pointer to the shortcomings that the process exhibits (Cabitza/Simone 2013). By illustrating the steps that organizational members take in order to achieve their goals, processes may be designed that are aligned with the daily working tasks and thus be adapted to IS.

Providing insights into how changing IS affect the behavior of organizational members, this thesis uses affordance theory as a viable lens to study the social and material of workarounds. The findings we gained throughout the research phase provide a basis for our suggestions on how to use affordances for designing workaround aware information systems.

1.3 Research Questions

The overall objective of this thesis is to advance the understanding of workarounds as a solution to deliver exploratory innovations in exploitative organizations by designing affordances in IS. We briefly introduce the research questions (RQ) that guide this thesis and that will be addressed in our publications.

Research Question 1: How can ambidexterity be organized through IT enabled agility?

Research Question 2: a) What types of workarounds are discussed in literature and how can they be classified?
b) Which concepts are relevant when investigating workarounds and how are these concepts related?

Research Question 3: How does Alter (2014) help in understanding how and why employees enact workarounds in formalized IT-enabled business processes?

Research Question 4: Which factors influence manager's decision on tolerating or prohibiting workarounds?

Research Question 5: How can business process management be improved by including capabilities for modeling workarounds?

Research Question 6: How can affordances advance our understanding of the institutionalization of workarounds?

This thesis addresses the challenges we introduced by answering the research questions separated in different publications.

Table 1: Research Questions and Addressed Challenges
Source: Own illustration

	RQ1	*RQ2*	*RQ3*	*RQ4*	*RQ5*	*RQ6*
C1: Generalization of Workarounds	•	•	•	•	•	•
C2: Missing Explanation on how to achieve Organizational Ambidexterity	•		•			
C3: Effect of Drifting Information Systems on Business Processes Standardization	•	•	•	•	•	•
C4: *Design of Information Systems to Control Workarounds*					•	•

1.4 Structure

This cumulative thesis is structured in three parts (see Figure 1). Part A provides an overview of the thesis, which is divided into three Chapters. Chapter 1 constitutes the introduction, followed by the conceptual background and the underlying research approach. Part B contains the relevant peer-reviewed publications (publication 1 to 8). Part C provides the summary of findings, a discussion, the limitations of this thesis, the contribution as well as future research directions and the conclusion.

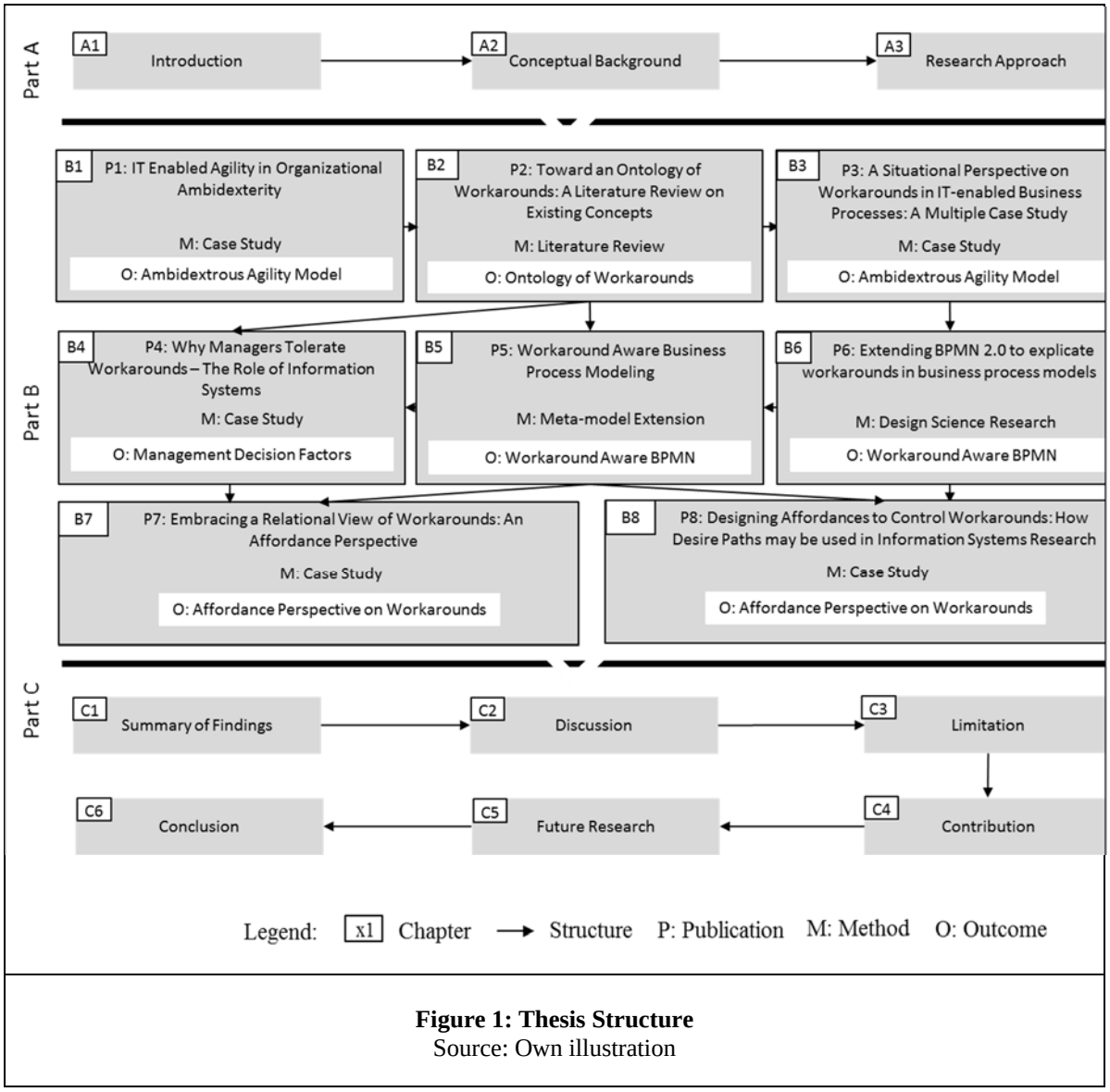

Figure 1: Thesis Structure
Source: Own illustration

This thesis builds on eight research publications that have been discussed on conferences or submitted to journals (see Table 2). The following section introduces a short overview of each publication with regard to the research problem, the method, and the contribution.

P1: IT Enabled Agility in Organizational Ambidexterity

The aim of ambidextrous organizations is to balance exploratory and exploitative learning concepts. This paper discusses the relationship of organizational ambidexterity and IT enabled agility. The question "how can ambidexterity be organized through IT enabled agility" is investigated using a case study from a German car manufacturer. Interviews of 21 employees were conducted and analyzed with regard to the research question. The findings show that (1) entrepreneurial agility impedes exploitative concepts, (2) adaptive agility impedes exploratory concepts and (3) ambidextrous organizations exhibit structures that allow them to transfer results from exploratory to exploitative activities through IT enabled agility. It is suggested that exploitative concepts require IT enabled agility mechanisms that are incompatible with

those for exploratory concepts, and oppositely. Additionally, knowledge transfer between business units often occurs, but is yet not fully integrated from an organizational perspective. The need for ambidextrous organizations to facilitate permeable boundaries with IT enabled agility by offering a transfer is also highlighted.

P2: Toward an Ontology of Workarounds: A Literature Review on Existing Concepts

Workarounds are an omnipresent part of organizational processes and are more than often related to the use of information systems. Existing research on workarounds has identified the phenomena as a surprising outcome. In contrast, this paper focuses on workarounds as a starting point and seeks to understand their dynamic structure. Scanning literature, three gaps currently challenge workaround research: lack of conceptual consensus, fragmentation and static perspective. Following a literature review the paper provides an overview of different types of workarounds, which are frequently used in literature. Building on these findings the provided working definitions are connected to a technical and process perspective that highlight the underlying intention of organizational members (positive or negative). Finally, the paper provides an ontology of workarounds in order to enable researchers to study the relationships among the core concepts and make them comparable when analyzing their dynamic structure.

P3: A Situational Perspective on Workarounds in IT-enabled Business Processes: A Multiple Case Study

Business process management research and practice has gained high interest in the phenomena of workarounds. On a daily basis, managers have to decide whether to tolerate or to contest workarounds. However, research and practice show that workarounds may have vastly different outcomes. This paper advances recent theory on the emergence of workarounds by analyzing empirical data from a multiple case study. The cases are taken from the health care, accounting and automotive industry. The cross-case analysis reveals that employees utilize workarounds based on a risk-benefit analysis of the situational context. If the realized benefits (efficiency gains) outweigh the situational risks (exposure of process violations) workarounds will be perceived as process improvement. Erroneous risk-benefit analysis leads to exposure of the same workaround as control failure. Quite unexpectedly, it was found that IS serve as critical cues for the situational balance of risks and benefits. The result suggests that process-instance-level workarounds are treated as options that are engaged if the situation permits, in contrast to process-level workarounds that manifest as unofficial routines.

P4: Why Managers Tolerate Workarounds – The Role of Information Systems

Workarounds as deviations from defined routines in business processes challenge standardization and as a result the performance improvements expected from IS. Literature associates workarounds predominantly with performance losses. Only few studies report on performance improvements from workarounds. Thus this study examines situations in which managers are able to decide whether to tolerate or to prohibit workarounds. A multiple case study in two organizations is reported and existing research on workarounds is used to structure the analysis. The data is drawn from the health care and supply chain domain and is

triangulated in a cross-case analysis. It is shown that expected efficiency gains, exposure to compliance risk and perceived process weakness have an effect on the willingness of management to tolerate workarounds. The results provide insights on the aspects of situations that influence this willingness and outline the role of IS in understanding workarounds.

P5: Workaround Aware Business Process Modeling

Workarounds are an omnipresent part of organizational settings where formal rules and regulations describe standardized processes. Still, an approach to model workarounds is missing in order to learn from process deviations. This study provides an extension to the Business Process Modeling Notation 2.0 (BPMN 2.0) by conducting a metamodel transformation, which visualizes workarounds. As a result, the Workaround Process Modeling Notation (WPMN) (1) leads organizations in designing workaround aware systems, (2) supports managers in deciding how to deal with workarounds, and (3) provides auditors with visualizations of non-compliance. The proposed metamodel extension is tested within an example from the health care domain. It is shown that WPMN can be used to model workarounds with the example of accessing patient-identifying data in a hospital. The model is particular suitable as an empirically grounded BPMN extension.

P6: Extending BPMN 2.0 to explicate workarounds in business process models

This paper proposes a conceptual modeling notation to address the need to explicate incongruent practices in the context of formal business process descriptions. The resulting modeling notation is named Workaround Aware Business Process Model Notation (WPMN) and builds upon the Business Process Modeling Notation (BPMN). WPMN enables business process managers to explicate and evaluate incongruent practices in the context of formal business process models. Additionally, WPMN allows managers to describe and discuss the consequences of workarounds with stakeholders and enables organizations to identify business process variations that are less prone to workarounds. The notation is based on a literature review where existing approaches to model workarounds are analyzed. Tentative constructs are derived that address limitations revealed in the foregoing review of existing literature and current practice. We evaluate the modeling notation with the model construction and model interpretation approach. We conduct a model assignment and two focus groups to ensure ontological expressiveness. The paper then concludes with the potential benefits and implications of WPMN. Using WPMN enables organizations to explicate workarounds, and to uncover and evaluate incongruent practices in the context of formal business process models.

P7: Embracing a Relational View of Workarounds: An Affordance Perspective

The challenge in workaround research is that incongruence between formal processes and actual working processes produces various outcomes, which are not controllable using a standard approach. This research advances the understanding of workarounds by proposing affordance theory as viable lens for investigation. The focus is on investigating the properties of IS that trigger the emergence of workarounds. With a multiple case study the paper proposes that affordances are multifaceted, evolve during their actualization and that they can be used to control processes. The relational view shows that the actualization of affordances

leads emergent workarounds to their institutionalization. Affordances may be the reason for organizational members working around IS but at the same time they may be the solution on how to gain control as well. We show that instead of being opposing, existing concepts of affordance theory rather built on each other.

P8: Designing Affordances to Control Workarounds: How Desire Paths may be used in Information Systems Research

Inspired from architecture, this paper investigates how desire paths may be used in information systems research in order to absorb action potential from workarounds. Desire paths refer to a path that is taken informally rather than following a set route, e.g., a short cut through a grassy park. In this research we call for a change in perspectives and assume that workarounds can be also interpreted as source of improvement and adaption to inefficiencies. We investigate workaround behavior as information system mediated interaction between users and organizations and find that the action potential of workarounds can be absorbed with desire paths in order to design necessary affordances for IS. We are able to visualize how users work around standardized processes using the Workaround Aware Business Process Model Notation (WPMN). Using the concept of desire paths as an ex-post view on workarounds, we use affordance theory to explain how IS can absorb action potential from workarounds. Thus, affordances can be used to enable certain behavior to provide hints on how the information system mediated interaction between users and organizations should take place.

Table 2: Overview on Embedded Publications
Source: Own illustration

No.	*Authors*	*Title*	*Outlet*	*Type*
1	Röder, Wiesche, Schermann, Krcmar	Toward an Ontology of Workarounds: A Literature Review on Existing Concepts	HICSS 2016	CON (WKWI: B)
2	Röder, Schermann, Krcmar	IT Enabled Agility in Organizational Ambidexterity	AMCIS 2014[1]	CON (WKWI: B)
3	Röder, Wiesche, Schermann	A Situational Perspective on Workarounds in IT-enabled Business Processes: A Multiple Case Study	ECIS 2014	CON (WKWI: A)
4	Röder, Wiesche, Schermann, Krcmar	Why Managers Tolerate Workarounds - The Role of Information Systems	AMCIS 2014	CON (WKWI: B)
5	Röder, Wiesche, Schermann, Krcmar	Workaround Aware Business Process Modeling	WI 2015	CON (WKWI: A)
6	Röder, Pflügler, Schermann, Wiesche, Alter, Krcmar	Extending BPMN 2.0 to externalize workarounds	ACM TMIS[2]	JN (WKWI: A)
7	Röder, Wiesche, Schermann, Krcmar	Embracing a Relational View of Workarounds: An Affordance Perspective	DIGIT[3] 2015	CON (NR)
8	Röder, Schermann, Wiesche, Krcmar	Designing Affordances to Control Workarounds: How Desire Paths may be used in Information Systems Research	EJIS[4]	JN (WKWI: A)

[1] Outstanding Paper Award; [2] under review; [3] Nominated for Best Paper Award, [4] Revise and Resubmit

HICSS: Hawaii International Conference on System Sciences, AMCIS: Americas Conference on Information Systems, ECIS: European Conference on Information Systems, WI: Internationale Tagung Wirtschaftsinformatik, ACM TMIS: Association for Computer Machinery Transactions on Management Information Systems, DIGIT: Diffusion Interest Group in Information Technology, EJIS: European Journal on Information Systems, NR: Not Ranked, WKWI: Wissenschaftliche Kommission der Wirtschaftsinformatik

2 Conceptual Background

Ambidextrous organizations are able to deliver two opposing concepts: exploratory and exploitive innovations. In practice, organizations are challenged when seeking to achieve this trade-off. Therefore, prevalent research studies how business process management can be used in order to organize and standardize exploratory and exploitative business units (Benner/Tushman 2003). Introducing standardized procedures, management is challenged with organizational members that engage in workaround behavior. Perceived limitations due to standardized processes bring organizational members to find other ways in order to deliver innovations. Workarounds are reported frequently in research but lack a conceptual consensus. Especially, research on how to react to workaround behavior from an organizational perspective is yet not well understood. The multitude of possibilities on how to deal with workarounds ranges from punishment to looking away. Instead of implementing new forms of control we suggest to use the theory of affordances to provide IS that are aligned with the intentions of organizational members.

To address this issue, this thesis investigates how workarounds enable organizations to deliver exploratory innovations. First, we explain the basics of Business Process Management (BPM) as key to maintain competitiveness. We then introduce the concept of organizational ambidexterity as a form of balancing exploratory and exploitative innovations. Building on this, we provide an overview of workaround literature and finally introduce affordance theory as a viable lens for investigating relational settings. Summing up, we built on understanding the incongruence between formal business process descriptions and actual working process and how affordances affect this relation. By doing so, we seek to understand the effect that workarounds have in ambidextrous organizations.

2.1 Advancing Business Process Management

Before exploring how actual working practices deviate from formal business process descriptions, it is helpful to begin with a general introduction to the basics of Business Process Management (BPM). BPM includes an organization's capability of capturing, modeling, implementing, and controlling all activities taking place in the organizational environment in an integrated manner (Scheer/Nüttgens 2000). Table 3 provides definitions of BPM that address different issues they are related to. Properties that are addressed by research are mainly connected to the analysis and improvement of existing business processes. Using BPM organizations seek to achieve flexibility and rapid responsiveness to address challenges through better understanding of their business processes (Bandara et al. 2005; Davenport 1993). To recognize the success in BPM it is necessary to understand the context of the organization and the multi-disciplinary nature of business processes (Ko et al. 2009). Therefore, organizations need to describe their formal business processes with regard to the tasks, the technologies and actual working practices.

Table 3: Definition of Business Process Management
Source: Own illustration

Definition	*Issues addressed*
"[BPM has a] management focused on using business processes as a significant contributor to achieving an organization's objective through the improvement, ongoing performance management and governance of essential business processes." (Jeston/Nelis 2014, 47)	- Achievement of objectives - Improvement and ongoing performance management
"Business Process Management (BPM) is a comprehensive system for managing and transforming organizational operations, based on what is arguably the first set of new ideas about organizational performance since the Industrial Revolution." (Hammer 2010, 3)	- Managing and transforming organizational operations - Comprehensive system
"Supporting business processes using methods, techniques, and software to design, enact, control, and analyze operational processes involving humans, organizations, applications, documents and other sources of information." (van der Aalst et al. 2003, 4)	- Support of business processes - Analysis of operational processes - Involving different sources of information
"BPM is a structured approach to analyze and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company's operation." (Zairi 1997, 64)	- Structured approach - Analysis and improvement of fundamental activities
"Business process management (BPM) is a process-oriented management discipline. It is not a technology. Workflow is a flow management technology found in business process management suites (BPMSs) and other product categories." (Ko et al. 2009, 748)	- Process-oriented management discipline
"Business Process Management (BPM) is a discipline involving any combination of modeling, automation, execution, control, measurement and optimization of business activity flows, in support of enterprise goals, spanning systems, employees, customers and partners within and beyond the enterprise boundaries." (Palmer 2015)	- Combination of modeling, automation, execution, control, measurement and optimization of business activity flows

The interplay of the design and emergence of business processes adds challenging demands when it comes to their management (Beverungen 2014). Business processes are prone to variation as changing technologies and requirements lead to different actions. Therefore, a need to advance BPM research is induced by theorizing about the workings behind the drift of business processes and IS (Beverungen 2014). In research the focus is not always well aligned with the needs of industry as changing environments and evolving systems are yet not an integral part of BPM (Indulska et al. 2009).

In order to include demands from practice, literature suggests to use business process models to compare or represent to-be and as-is situations (Erol et al. 2010). Process modeling is supposed to be an instrument to understand the complexity of managing business processes (Becker et al. 2000). Process modeling is used to enable organizations to (1) identify process weaknesses, (2) adapt best practices, (3) document and communicate about the design of new business processes, (4) end-user training, (5) enhance compliance and risk management and (6) design and configure systems (Bandara et al. 2005). In practice business process models help to learn about organizational processes and to make decisions on the processes (Aguilar-Saven 2004) or they can be transformed into an executable model description (Erol et al. 2010). From a change perspective, process models are frequently used as an enabler of reorganization (Becker et al 2000). In line, a better understanding of organizational processes provides possibilities to identify areas of improvement (Jun et al. 2009) and aims to cope with the complexity of process planning and control (Becker et al. 2000).

Modeling business process is a fundamental requirement but still represents a significant challenge to many organizations (Indulska et al. 2009). Per definition business process modeling offers an approach to graphically display the way organizations conduct their business processes (Indulska et al. 2009). Providing a step-by-step framework for documenting a process is essential to enhance BPM (Ungan 2006). One approach to model business processes is provided by the Business Process Modeling Notation (BPMN). BPMN is rich and expressive and provides an increasingly important standard for process modeling (Recker 2010). Using modeling techniques organizations are able to visualize their processes and thus, achieve consistency in operations. In practice there exist difficulties when achieving consistency because of the different ways that organizational members perform the same task (Ungan 2006). The main purpose is to capture business requirements with a focus on business process and their standardization (Bandara et al. 2005).

Research shows that a main challenge of standardization is the preservation of needed flexibility (Trkman 2010). Even if a process has identical inputs, operations, and intends to produce identical outputs, its standardization is far from easy (Ungan 2006). Thus, process models document existing or planned processes to ensure a shared understanding but are never immune against deviations in the form of workarounds (Jun et al. 2009). Standardization makes process activities transparent and seeks to achieve uniformity across the value chain and across firm boundaries (Wüllenweber/Weitzel 2007). Instead of reducing process variations, standardization may lead to the paradoxical consequence of having more variability as organizational members may bypass the formal system entirely (Azad/King 2012). We are therefore interested on how actual working practices are considered when visualizing business processes (Alter 2015b). In his research, Münstermann (2010) reports on several examples which highlight the positive effect of standardization. For example Ramakumar and Cooper (2004) show that business process standardization proves profitability. Swaminathan (2001) asserts that process standardization provides immense benefits. Manrodt and Vitasek (2004) prove that global process standardization can benefit the company as well as its customers (Manrodt and Vitasek 2004). Nevertheless, several

studies reveal the challenges that excessive standardization may engender, for example alienation and rigidity (Andriopoulos/Lewis 2009).

Summing up, business process modelling enables a common and comprehensive understanding of working processes (Aguilar-Saven 2004). Nevertheless, current research is at its limits when it comes to model incongruence between formal process descriptions and actual working practices. There exist several approaches for representing adaptive or flexible process designs that integrate changes that may occur during the lifetime of a business process (Rosemann et al. 2006). For example Rosemann and van der Aalst (2007) provide a process modeling technique that supports adaptability by extending traditional techniques with variation points. Schmidt (2005) on the other hand suggests supporting process flexibility by web services. Narendra (2004) introduces an approach to support and manage adaptive workflows (Rosemann et al. 2006). Within this thesis we introduce the referred approaches and explain their shortcomings when it comes to illustrate workarounds. This thesis follows the assumption that flexibility needs to be considered in BPM and therefore provides an attempt to study incongruence between formal process descriptions and actual working processes in organizations.

2.2 Organizational Ambidexterity: Balancing Exploration and Exploitation

In literature the concept of ambidexterity refers to the organization's ability to be aligned and efficient in its management of today's business demands while simultaneously being adaptive to changes in the environment (Raisch et al. 2009). Most studies built upon March's (1991) fundamental paper where exploration refers to "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation [and] exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution" (March 1991, 71). Long-term success is defined by exploratory activities whereas exploitative activities establish routines that determine short-term success (Levinthal/March 1993).

Table 4: Related Concepts of Exploration and Exploitation
Source: Own illustration

	Exploration	*Exploitation*
Process characteristics (March 1991)	Search, variation, risk taking, experimentation, play, flexibility, discovery, innovation	Refinement, choice, production, efficiency, selection, implementation, execution
Competences (Gilsing/Nooteboom 2006)	Radical innovation	Incremental innovation
Network (Gilsing/Nooteboom 2006)	Informal, flexible ties	Formalization
Transitional process (Gilsing/Nooteboom 2006)	Divergence in knowledge and organization	Convergence in knowledge and organization
	Variety through break-up of existing networks and new relations to outsiders Convergence	Selection by the institutional environment
Search behavior (Katila/Ahuja 2002)	Search scope	Search depth

In organizations the different business units are organized in an exploratory manner with the focus on short-term success or in an exploitative manner concentrating long-term success. Building on these definitions, persistent success of a firm is based on the organizational adaptation consisting of both, exploitation and exploration (March 1991). An organization's ability to compete over time is not only depending on its ability to increase efficiency but also in its ability to be efficient and innovative simultaneously (Benner/Tushman 2003). Ambidextrous organizations pursue synchronous exploration and exploitation via loosely coupled and differentiated subunits or individuals, each of which specializes in either exploration or exploitation. Arguments in favor of the need for both exploration and exploitation are well established and accepted (Gupta et al. 2006).

Depending on their incidents, organizational antecedents can influence exploratory and exploitative activities in different ways (Benner/Tushman 2003). They may affect technologies, working behavior and subsequently the outcome of processes and tasks. Exploration and exploitation are contradictory organizational processes, which have to be physically and culturally separated from one another. They have different measurement and incentives, and have distinct managerial teams (Benner/Tushman 2003). The balance between exploration and exploitation leads not only to organizational renewal but also helps firms to become more innovative (Tushman/O'Reilly 1997). However, an organization that is not able to stir in a balance will fall into a trap. Focusing only on exploration will drive out exploitation. In this case the organization will never gain return of its knowledge (Levinthal/March 1993). In contrast, an organization that engages only in exploitation will usually suffer from obsolescence. The basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and, at the same time to devote enough energy to exploration to ensure its future viability. Survival requires a balance, and the precise mix of exploitation and exploration that is hard to specify (Levinthal/March 1993).

The paradox of exploration and explanations stems from three challenges (Gupta et al. 2006). First, both concepts compete for scarce organizational resources. Organizations that only invest their resources in exploitative innovations can only invest fewer resources for exploration, and vice versa. Second, both concepts are iteratively self-reinforcing. When organizations experience success in exploration they will engage in more exploration. Organizations that have success in exploitation focus will focus on more exploitation. Third, the mindsets and organizational routines needed for exploration are radically different from those needed for exploitation. This makes the simultaneous pursuit of both all but impossible. From an organizational control perspective this means that explorative learning concepts require distinctly different organizational control mechanisms compared to exploitative concepts (Gupta et al. 2006). Literature suggests that units engaging in exploratory learning tend to be small and decentralized, with loose cultures and processes, whereas exploitation units are larger and more centralized, with tight cultures and processes (Benner/Tushman 2003).

Similar, in their research Birkinshaw and Gibson (2004) draw on the concept of ambidexterity and define the trade-offs between alignment and adaptability as foundational to organizations.

The capacity to simultaneously achieve alignment (excellence in daily operations) and adaptability (referring to the organization's ability to innovate and change in response to changing demands in the environment) describes an effective ambidextrous organization (Datta 2011). Thus, research still needs to understand how opposing concepts may be mastered at the same time in order to ensure long-term success. Therefore, this thesis investigates how organizations crusade for becoming ambidextrous. We seek to understand how the business processes of exploratory and exploitative innovation modes are designed and how organizational members interact with them.

2.3 Workarounds in IT-enabled Business Processes

Prevalent research has linked the topic of workarounds to IS and uses this concept to explain how a user is able to adjust a technology to meet his or her particular needs and goals (e.g., Pollock 2005). When people accept a goal but lack access to legitimate means to achieve it, they may engage in nonconformity by striving for organizational goals in illegitimate ways (Mainemelis 2010). This argument finds endorsement when assuming that people are purposive, knowledgeable, adaptive, and inventive agents who engage with IT in a multiplicity of ways to accomplish various and dynamic goals. When IT does not help them achieve those goals, they abandon it, work around it, change it, or think about changing their ends (Orlikowski 2000; Pollock 2005). Thus, this effort can be seen as a product of employees' opposition to control and domination (Cook/Brown 1999). Throughout this thesis we refer to the following definition when we report on workarounds: "A workaround is a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals" (Alter 2014, 1044)

In literature workarounds are studied across different domains and industries with varying outcomes. Workarounds are used in different situations in order to solve problems (Niazkhani et al. 2011), circumvent rules or bypass limitations (Davison/Ou 2013), address poor system usability (Yang et al. 2012), and save time (McGann/Lyytinen 2008). In some situations even bottom-up ideas that are executed behind the scenes and circumvent regular processes – also known as bootlegging (Augsdorfer 1994) – are sources of organizational success (Miller/Wedell-Wedellsborg 2013). Workarounds as a form of incongruence between the formal business process description and actual business process execution are a pervasive element in society and gain recent interest among organizational theory researchers (Alter 2014). We categorize existing workaround literature as having improving or endangering business processes results (Table 5). By doing so, we show the ambivalent character of workarounds and how research investigates the phenomena when searching for an explanation.

Table 5: An Overview of Positive and Negative Workarounds
Source: Own illustration

Per-ception	*Context*	*Description of Business Process*	*Description of Workaround*	*Consequence for Organization*	*Conse-quence*
Business Process helpful for daily routine	Public management (Campbell 2012)	Business assistance services lack funding for socially deprived people	No designated funding for business assistance services, therefore a percentage of existing funding streams are siphoned off	Agencies pool funds for unfunded business assistance services and improve their services	Improve
	Health Care (Azad/King 2008)	Medication dispense needs to await formal approval order	Nurses disconnect orders from awaiting approval and dispense restricted medication immediately when needed	Improvement of time span for patients well-being and dispense fulfilled immediately without awaiting approval	
	Print industry (Button et al. 2003)	Track full process with IS by respective worker	Operators record the progress of their work on paper instead of system as it is conflicting with the activities involved	Resistance to system results in paper based work tracking and improving system drop outs	
	Fire service (Ferneley/Sobreperez 2006)	Officer in charge needs to report the run immediately in fire tracking system	Report is not done immediately after run. Instead of a single report from officer in charge, the whole team is submitting a collective report of run in fire tracking system	Report of run in fire tracking system is improved due to the collective briefing of all participants instead of single perception of officer in charge	
Business Process hindering for daily routine	Fire service (Ferneley/Sobreperez 2006)	Officer in charge needs to report the run immediately in fire tracking system to ensure correctness and completeness	Report is not done immediately after run. Instead of a single report from officer in charge, the whole team is submitting a collective report of run in fire tracking system	Report of run in fire tracking system endangers process as report is not attributable and difficult to follow-up	Endanger
	Health Care (Timmons 2003)	3 hours after physical admission need to complete care plan	Care plans are not completed in specified time frame as nurses perceive system useless as long as patients happy	Documentation of care plans not electronically and endangers traceability	
	Call Center (Russell 2007)	IS is built to create control over call center employees and track their work	IS only ‘wrapped around’ existing system, therefore employees managed their work all differently to achieve managements’ targets.	Managers follow ‘assembly line in the head’ by limiting worker autonomy and endanger acceptance of IS	
	Hotel Chain (Davison/Ou 2013)	Employees are not allowed to use social media due to restriction of bandwidth, concerns about abuses or the introduction of viruses	Employees log into the guest network which is not subject to IP blocking to use social media via mobile device surreptitiously.	The use of mobile devices is prohibited on duty but is the only possibility for employees to use social media which endangers abuse	

In the public sector, Campbell (2012) focuses on common managerial responses to horizontal (network) and vertical (bureaucratic) relationships, which he refers to as workarounds. To ensure the work of business assistance services, agencies pool funds and appropriate money to a purpose. Azad and King (2008) found that formal prior-approval procedures are not followed in hospital processes. Within health care, patients' well-being stands above all bureaucratic procedures. Instead of awaiting the approval, nurses dispense the medication immediately. Avoiding IS and using paper forms instead, Button (2003) investigates the print industry and how lacking system flexibility leads to workarounds which onward lead to other workarounds. He proposes that employees may resist but at the same time conform to management control. The employees did not circumvent control by not using the IS, instead they report on paper and add notes about system failures. Building on two case study sites Ferneley and Sobreperez (2006) differentiate between negative and positive resistance and derive a perspective that sees workarounds as harmless, hindrance and essential. The first case provides insights at the public sector (regional fire service) in which the tracking system is used collaboratively to submit the run and improves the overall quality of the report.

However, Ferneley and Sobreperez (2006) introduced another perspective on the same workaround seeing the individual contributions to one reporting objective as not attributable and difficult to follow-up. Timmons (2003) provides nurses' perception of reporting systems in hospitals. In his research he shows that miscommunicated reasons for the purpose of a reporting system result in resistance. Physicians do not execute their audits frequently and are demotivated since nobody else reports. "They were not able to resist the implementation, but were able to resist the surveillance" (Timmons 2003). In a case study at a call center, Russell (2007) found that a new integrated IS supports the formulation of specific production targets to which workers are held accountable. As the IS only was 'wrapped around' the existing one, employees managed their work all differently to achieve managements targets. In a hotel chain Davison and Ou (2013) study the internet access behavior of employees. As the bandwidth is restricted and management is concerned about abuses or the introduction of viruses, employees are not allowed to use social media. Therefore, they log in via their mobile device into the guest network surreptitiously as using mobiles on duty is prohibited.

Over all, user resistance to IT has been dominated by negative associations in literature (Ferneley/Sobreperez 2006) and represents a costly alternative to a robust and flexible IS (Petrides et al. 2004). On the other hand workarounds can be seen as inventive solution to press organizational needs and to deal with the inherent uncertainty of dynamic work environments (Kobayashi et al. 2005). When workarounds are successful, the results and the way in which they have been conducted can provide organizational solutions for exceptions that recur. Workarounds that miss the target and result in discontinuation are likely to lead to widespread instability in an organization (Kobayashi et al. 2005). In research, workarounds are interpreted as deviations from predefined routines, e.g., non-compliance, resistance, or shadow-systems (Alter 2014), but they are still one of the most controversially discussed phenomena in IS research and practice (Mainemelis 2010; Davison/Ou 2013). Several studies reflect the consequences of improvisation and exhibit organizations permitting and in some cases facilitating workaround activities (Miner et al. 2001). Still, little is known about

recurrent decision making when deciding whether to tolerate or to hinder workarounds (György et al. 2012).

However, research and practice show that workarounds may result in different outcomes depending on their types, effects and perspectives (Alter 2014). Frequently, outcomes are seen as rather negative and may range from internal shortcomings, e.g., loss of control, facades of compliance, or inferior process quality (Boudreau/Robey 2005; da Cunha/Carugati 2009) to severe external consequences, e.g., loss of revenue, fraud, or penalties (Hunt/Jackson 2010). In contrast, the concept of workarounds as source of improvement (Patterson et al. 2002), creative flexibility (Miller/Friesen 1982), or adaption to inefficiencies (Debono et al. 2013) casts a positive light on the phenomena. Depending on the situation and target outcome, acceptance may lead to negative impacts while resistance may give way to more favorable impacts (Bagayogo et al. 2013). However, workarounds are predominantly seen as threats rather than opportunities (Debono et al. 2013). The tension in which workarounds are perceived both as positive and negative, describes the ambivalent character of this phenomena (Augsdorfer 1994; Pollock 2005). From different perspectives, the execution of workarounds can either be perceived as an improvement of business processes or can result in endangering (Debono et al. 2013). In research, approaches for structuring workarounds have interpreted the phenomena from an organizational perspective and resulted in general theories about the phenomena (Alter 2014; Martin et al. 2013; Ansari et al. 2010). However, these studies neglect the ambivalent character of workarounds and still, it remains unclear which processes result in workarounds that either improve or endanger the business process.

Especially in the context of business process standardization, exceptions and deviations from predefined structures challenge organizations (Sadiq et al. 2007). Individual adoption of business processes can vary in the extent of faithfulness and avoidance (Venkatesh 2006). However, research on the effects of organizational structures like standardization and formalization has generated contradictory findings (Pugh et al. 1968). Therefore, analyzing existing process formalization and the ability on how to express all desired or potential processes is crucial (Recker 2014a). Research assumes that bureaucracy on the one hand stifles creativity, fosters dissatisfaction, and demotivates employees but on the other hand provides needed guidance, clarifies responsibilities, and helps individuals to be more effective (Adler/Borys 1996). In general, formalization is proposed as a worthwhile notion to predict individuals' positive or negative attitudes toward formalized business processes (Adler/Borys 1996; Chapman/Kihn 2009; Wouters/Wilderom 2008).

The related concept of decoupling provides a theoretical approach where formal rules are worked around on purpose but actual organizational routines may remain unchanged (Orton/Weick 1990). From this perspective workarounds are understood as a response to organizational expectations where members seek to show compliance while hiding nonconformity (Ansari et al. 2010). Organizational members engage in workaround behavior to satisfy external audiences without disrupting ongoing internal activities (Martin et al. 2013). Therefore, in this research we are interested on how organizational members decouple formal process descriptions from actual working process to provide an environment where exploratory and exploitative processes may converge. We are particularly interested in

workarounds that occur in business processes that involve information systems, that e. g., implement the defined business process or support these (Safadi/Faraj 2010; Sia et al. 2002).

2.4 Affordance Theory in IS Research

Literature on adoption and diffusion theory has paid little attention on what IS mean to users and how they fit with their daily tasks and activities (Faraj/Azad 2012). A promising perspective on what IS means to users is provided by affordance theory. In line with Markus and Silver (2008, 626) we define affordances as "the possibilities for goal-oriented action afforded by technical objects to a specific user group". The main limitation of affordance theory is inconsistency in the terminology (Majchrzak/Markus 2012). The two opposing concepts provided by Gibson (1979) and Norman (1988) are actively discussed in research. Gibson (1979) introduces the term affordances to explain how animals perceive their environments where surfaces and objects offer certain possibilities for action. This theory grounds in affordances as properties of an artifact that can be designed (Gibson 1979). With regard to Norman (1988) the other theory grounds in affordances as emergent properties in a dynamic actor–environment system (Norman 1988). The existence of different interpretations of affordances (action possibility vs. perceived suggestion) (McGrenere/Ho 2000) has challenged IS research and existing theories.

On the one hand Gibson (1979) introduces the term affordances to explain how animals perceive their environments where surfaces and objects offer certain possibilities for action. On the other hand literature adds a subjective perspective on affordances where they support and create a representation of people's interaction (Norman 1999). We understand affordances as actionable properties between an artifact and an actor (Zhang 2008). Affordances are objective properties of the environment and have nearly deterministic consequences for action (Jung/Lyytinen 2014). They provide key characteristics that make it more or less likely that a practice will be adapted (Ansari et al. 2010). Affordances do not cause behavior but make certain behavior possible (Withagen et al. 2012). In his research Leonardi (2011) finds that when a user perceives that the IS offers affordances, the user will look to change the routines to take advantage of that affordance. Affordances are always perceived by a user that interprets a system through personal goals of action. As IS already come with built-in physical affordances, designers primarily can control only perceived affordances (Norman 1999). Thus, affordances emerge dynamically from a specific actor–environment system (Jung/Lyytinen 2014). Stoffregen (2003) argues that affordances should include both, enablers of and limits on behavior. Derived from literature Strong et al. (2014) provide conclusions from ecological psychology for investigating IT-associated organizational change with an affordance-based theory. First, affordances are relational. They are not a property of the system or of the user but describe relations between the abilities of the actor and features of the environment. Second, affordances offer potential action. They exist without any user actualizing them. Third, affordances are not limited. They are enabling but also constraining and offer certain action possibilities but others not. Fourth, affordances are goal directed. The potential actions that users actualize are goal directed and depend on actor characteristics.

Affordances provide key characteristics that make it more or less likely a practice will be adapted (Ansari et al. 2010) and support and create a representation of people's interaction (Norman 1999). Affordances do not cause behavior but make certain behavior possible (Withagen et al. 2012). When constraints are implemented, users may either utilize alternative IS or manipulate the current system to achieve their desired outcome outside the organizational scope (Thatte et al. 2012). In their research Carlo et al. (2012) for example observe several examples of how new IS-related affordances foster novel competences through bricolage and combinations of existing skills. With their analysis they are able to show that organizational members engage in multiple, contradictory ways to actualize an affordances of the same set of IS capabilities as part of the dialectic of collective minding (Carlo et al. 2012).

From an organizational perspective, prior literature regarding affordances concentrates on technical issues in software design to prevent users from engaging in workaround behavior (Russell 2007). Literature assumes that IS enhance users to enact them in multiple ways (Boudreau/Robey 2005). Therefore, organizations need to understand the user, the user's tasks, and the context in which the user accomplishes tasks and goals. Knowledge about possible forms of how users enact IS enables organizations to understand the behavior of their employees. Subsequently organizations can derive leverage for influencing organizational members behavior and thus, achieving control. What is still missing is an understanding of the difference between motivation and control and how to design them with an awareness of the distinction (Karat et al. 2000). Understanding how slight differences in the perception of an IS can result in powerful differences in the user behavior provides new insights into workaround research. Using affordance theory enables researchers to understand the interactions between technology and humans without relying only on psychological or social behavior. Considering the functionalities and purpose of IS advances affordance theory by adding a relational concept to scholarly management literature (Majchrzak/Markus 2012). Affordances promise to shed light on how workarounds originate and how they institutionalize in organizational processes.

We provide an overview of existing literature on the concept of affordances (Table 6). As there are several fundamental publications on the topic of affordances, we reduce the examples to the most appealing related to workaround research. The overview shows how research defines affordances and if Gibson or Norman is used as an underlying definition. Furthermore, we provide insights into the research question, and the type of study (empirical or conceptual). Faraj and Azad (2012) present affordance as a translation of sociomateriality where they present a significant element in developing explanations on how specific actions unfold. In his research Leonardi (2011) finds that that perceptions of constraint lead people to change their technologies while perceptions of affordance lead people to change their routines. Majchrzak and Markus (2012) provide a "Technology Affordances and Constraints Theory" (TACT) which considers the dynamic interactions between people and organizations when studying IS. As an outcome of their research Markus and Silver (2008) redefine functional affordance as a relationship between a technical object and a specified user (or user group) that identifies what the user may be able to do with the object, given the user's capabilities and goals. Pozzi et al. (2014) review exiting literature on affordances and propose

a theoretical framework with four research areas: affordance existence, affordance perception, affordance actualization, and affordance effect. Using a multiple-case approach Savoli and Barki (2013) identify four types of Perceived Functional Affordances (PFA): PFA as facilitator, as inhibitor, as guardian angel, and as imposer. In their research Seidel et al. (2013) derive a theoretical framework that identifies four functional affordances originating in IS: reflective disclosure, information democratization, output management, and delocalization. Strong et al. (2014) discover three key gaps in affordance theory and close them by providing a mid-range theory for EHR-associated organizational change in a health care organization. In their study van Osch and Mendelson (2011) provide a typology of affordances for disentangling complex sociomaterial interactions which includes three types of affordances: designed affordances, improvised affordances, and emergent affordances. In their research Volkoff and Strong (2013) introduce the use of critical realism as underpinning for theories of IT-associated organizational change and show how researchers may proceed when using affordance theory.

While studying affordance research we were challenged with two essential facts. First, we found that only little has been reported from case studies providing concrete examples (exceptions are Leonardi 2011; van Osch/Mendelson 2011; Savoli/Barki 2013). Mainly existing research is concerned with establishing concepts that differentiate forms and concepts of affordances, e.g. affordance existence, affordance perception, affordance actualization, and affordance effect (Pozzi et al. 2014). Furthermore, research concentrates on providing guidelines on how to use affordance theory from a conceptual perspective (Robey/Anderson 2013). Second, existing research is not consistent in using the term of affordance theory equally. Several studies provide conceptual methods to derive an overview describing the differences of Gibson's and Norman's affordance perspective. Still, when it comes to a basic explanation literature splits in two opposing research streams. On the one hand the stream that interprets affordances as being independent of the actor's experience, knowledge, culture and experience to perceive (Gibson 1979). On the other hand the stream that focuses on the dependencies of experience, knowledge and culture of the actor (Norman 1988).

Table 6: An Overview of Existing Literature on the Concept of Affordance
Source: Own illustration

Source	*Affordance perspective*	*Underlying affordance theory*	*Research question*	*Type of Study*
Faraj and Azad (2012)	Technology affordances are action possibilities and opportunities that emerge from actors engaging with a focal technology.	Gibson/ Norman	What are the weaknesses in how extant research conceptualizes technology	Conceptual
Leonardi (2011)	Affordances and constraints are constructed in the space between human and material agencies	Gibson/ Norman	Explore the relationship between human and material agencies in contexts where people work with flexible routines and flexible technologies	Empirical
Majchrzak and Markus (2012)	Technology affordances refer to an action potential, that is, to what an individual or organization with a particular purpose can do with a technology or information system	Gibson	How can technology affordances and constraints theory (TACT) be used?	Conceptual
Markus and Silver (2008)	Functional affordances are defined as the possibilities for goal-oriented action afforded to specified user groups by technical objects	Gibson	How can we conceptualize IT artifacts in ways that help us hypothesize about, and investigate, their potential effects?	Conceptual
Pozzi et al. (2014)	Four types of affordances: existence, perception, actualization, effect	Gibson/ Norman (highlights the differences)	Why affordance's theory is useful in IS research?	Conceptual
Savoli and Barki (2013)	Perceived functional affordances (PFA) are an IT's afforded possibilities for action as perceived by an individual user	Markus and Silver (2008) who refer to Gibson	Aim is to create a typology of functional affordances across different cases	Empirical
Seidel et al. (2013)	Functional affordances describe the action possibilities allowed by material properties existent in IS	Gibson	How do IS contribute to the implementation of sustainable work practices?	Empirical
Strong et al. (2014)	Affordances are the possibilities for goal-directed action provided by an object in relation to a goal-oriented actor	Markus and Silver (2008) who refer to Gibson	Development of theories that explain IT-associated organizational change processes in a way that provides actionable recommendations	Empirical
van Osch and Mendelson (2011)	Three types of affordances: designed, improvised affordances, emergent affordances	Gibson	What types of affordances occur in the interactions between actors and artifacts in the context of group generativity?	Empirical
Volkoff and Strong (2013)	Affordances as the potential for behaviors associated with achieving an immediate concrete outcome and arising from the relation between an object and a goal-oriented actor or actors.	Gibson/ Norman	- How affordances arise in the real domain - How affordances are actualized over time - How these actualizations lead to various effects	Empirical

3 Research Approach

3.1 Research Strategy

We follow a qualitative research strategy to answer the research questions resulting from our problem statement and add design science research (DSR). The combination of qualitative methods allows us to achieve a more complete view on a multifaceted phenomenon that is in the early stage of theory development. Through extending our research with DSR we are able to formulate principles to support and guide the design and development of our artifact (Germonprez et al. 2011). We follow an explanatory research approach where we are able to encapsulate the multi-dimensionality of our research endeavor. The research strategy consists of (1) a synthesized literature review (Webster/Watson 2002) to capture existing literature on the constructs of workarounds, (2) an in-depth exploratory multiple case study phase (Yin 2009), (3) and a design science research paradigm (Hevner et al. 2004)

We review existing literature to understand the current discussion of how organizations struggle when becoming ambidextrous. The exploratory multicase study enables us to extend our findings by investigating the theoretical concepts in a practical environment where workarounds are pervasive. Building on these findings, we were able to create and evaluate an approach to visualize workarounds following a design science paradigm.

3.2 Research Methods

3.2.1 Literature Review

The goal of a literature review is to gain insights into the current status of research (Webster/Watson 2002). In general, the process of analyzing literature plays a fundamental role in crafting a thorough review on a research topic (Zorn/Campbell 2006). The identification of literature and factors that potentially affect the research question drives the development of a research model (vom Brocke et al. 2009). Therefore, a literature review is a summary of a subject field that supports the identification of a specific research question (Rowley/Slack 2004). A literature review additionally seeks to uncover the sources relevant to a topic under study and makes a vital contribution to the relevance of the research by searching for high quality paper (vom Brocke et al. 2009). When writing the review it is essential to provide a well-grounded planning phase and a detailed description of the literature search process (vom Brocke et al. 2009). Figure 2 introduces a framework for reviewing literature according to vom Brocke et al. (2009) which consist of five steps that need to be followed. By following those steps a transparent documentation of the review is ensured (Zorn/Campbell 2006).

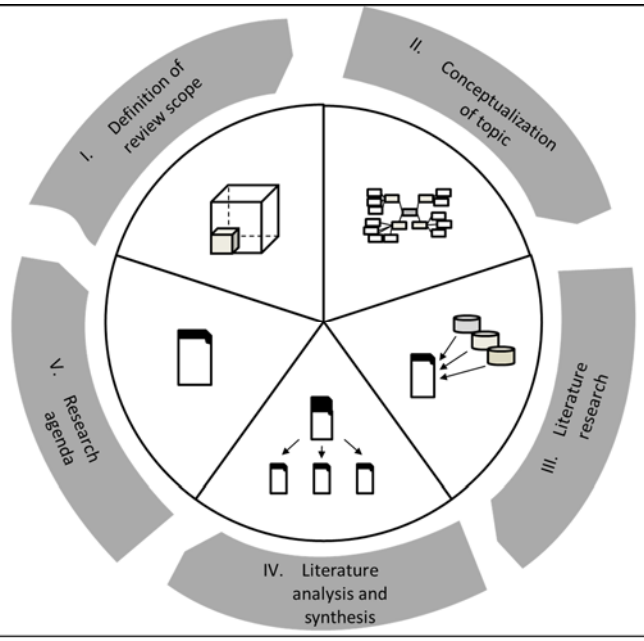

Figure 2: Framework for reviewing literature
(Source: vom Brocke et al. 2009)

First, the definition of the review scope is important in order to address the research topic that will be of interest. This step may be addressed by drawing on the established taxonomy for literature reviews provided by Cooper (1988) to define the scope of the review (see Figure 3).

Characteristic		Categories			
(1)	focus	research outcomes	research methods	theories	applications
(2)	goal	integration	critisism	central issues	
(3)	organisation	historical	conceptual	methodological	
(4)	perspective	neutral representation		epousal of position	
(5)	audience	specialised scholars	general scholars	practicioners/ politicians	general public
(6)	coverage	exhaustive	exhaustive and selective	representative	central/ pivotal

Figure 3: Taxonomy of literature reviews
(Source: Cooper 1988)

Second, during the conceptualization of the research topic a conception of what is known about potential areas where knowledge may be needed. Within this step key terms are suggested. Following Webster and Watson (2002), a literature review consists of a keyword search from several literature databases, giving access to a broad spectrum of international IS and business journals. Furthermore, key concepts are identified and an overview on key issues relevant to the topic is provided. The actual search process involves database, keyword, backward, and forward search, as well as an ongoing evaluation of sources. Third, the step of searching for literature is guided by scanning top-ranked, peer-reviewed IS journals (e.g.

Senior Scholar Basket of Eight[1]). As a result high quality research is considered for further investigation. When excluding sources it is necessary to provide insights in order to guarantee transparency and to provide proof of credibility. The search itself is done by providing certain key terms that are used to scan literature. Subsequently articles are evaluated based on their abstracts to determine their relevance for the study and whether the previously defined requirements are met. Fourth, after a suitable analysis and synthesis of literature the results are integrated in a concept matrix. Fifth, a research agenda is constructed comprised of sharper and more insightful questions for future research.

In the literature review of this thesis we were interested in how workarounds are investigated throughout existing research. Ensuring a transparent documentation of the process, our second publication provides in detail how the literature review was conducted (Zorn/Campbell 2006). In order to define the scope of the review, we used the taxonomy of literature reviews and integrated our research endeavor (Cooper 1988). We define the review scope and scanned literature for workaround application. The goal of our literature review is to summarize types of workarounds. For organizing the review, we adopted the conceptual perspective and used a neutral representation to inform general scholars. With the review we cover central types of research.

3.2.2 Case Study

In research case studies are used to provide rich, empirical insight into real-life settings (Yin 2009). Case studies provide a description to test or to generate a certain theory (Eisenhardt 1989) and are frequently categorized as an interpretive and qualitative approach in IS studies (Wilde/Hess 2007). They are used when a new perspective on a research topic is needed as the current perspectives seem inadequate because they have little empirical substantiation or they conflict with each other (Eisenhardt 1989). Furthermore, case studies are used when little is known about a certain phenomenon as the method does not rely on previous literature or prior empirical evidence (Eisenhardt 1989).

According to Siggelkow (2007) a case study is done for motivation, inspiration, and illustration. Motivation means that a case study is always a great way to motivate a research question. In case of inspiration the final paper structure starts with case study and then focuses on theory, on the contrary with regard to illustration the paper starts with theory and then illustrates this theory by a case study. Inspiration is a justification for case study researches if not enough theoretical knowledge exists but also to sharpen an existing theory. Illustration in contrast gives a concrete example of every construct that is employed in the conceptual argument. Like this one can much easier imagine how the conceptual argument might actually be applied to one or more empirical settings (Siggelkow 2007).

Highest value of generalizability can be produced using multicase research as this approach allows to understand the phenomena beyond a single context (Stake 2013). Following a replication logic (Yin 2009), multicase studies are used to strengthen the precision, validity,

[1] Senior Scholars' Basket of Journals: Accessed on September 9th 2015 http://aisnet.org/general/custom.asp?page=SeniorScholarBasket

stability and trustworthiness of the findings (Miles/Huberman 2014). If a finding holds in multiple comparable settings and in a contrasting case it is more robust. Multicase studies offer researchers a deeper understanding of processes and outcomes of each case by providing a holistic picture of locally grounded causation. For this reason cases within a multicase study need to be arrayed on a continuum with few exemplars of each or they are contrasted. Using a multicase study gives confidence that the emerging theory is generic, because it can be adapted to several working environments (Miles/Huberman 2014). According to Yin (2009) a case study researcher needs to follow six steps (see Figure 4).

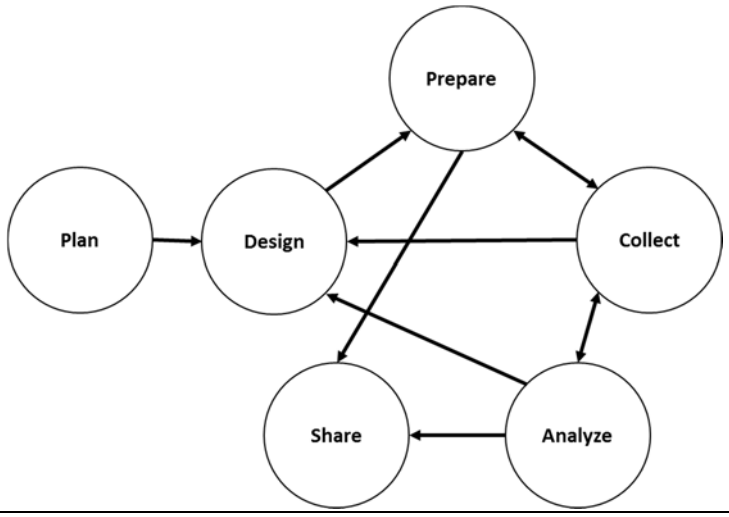

Figure 4: A linear but iterative case study research process
(Source: Yin 2009)

In a first step, case study research starts by defining a research question that guides the method. By providing a well-described research question the field of investigation is determined and the construct measures are confined. The definition of research questions focuses the efforts of the literature review (Eisenhardt 1989). For planning the case study research it is necessary to understand its strengths and limitations with regard to the proposed research question. The second step is concerned with defining the cases, identifying related theory and propositions. Issues related to the anticipated studies are developed and the case study design (single, multiple, holistic, embedded) is identified. Additionally procedures to maintain the case study quality are defined. Theoretical sampling of the cases enables researchers to focus on theoretically useful cases that replicate or extend theory by filling conceptual categories (Eisenhardt 1989). Within the third step it is necessary to prepare the data collection by crafting the instruments and protocols. Considering multiple data collection methods facilitates synergies of different sources of evidence (Eisenhardt 1989). During the collection phase, the case study is executed. This includes following the case study protocol and creating a case study database. A case study in general may combine different data collection methods such as observations, interviews, and documents (Eisenhardt 1989). According to Yin (2009) the fourth phase is for analyzing the collected data. During this step the researcher needs to rely on theoretical propositions and other strategies to investigate the collected data. This can be done by using quantitative data, qualitative data or both.

Displaying the data apart from interpretations and providing explanations for the findings are part of this phase. The last step is to share the findings with a certain target audience. In order to share data, textual and visual materials need to be composed.

In this thesis we use a multicase study and followed the guidelines by Yin (2009). We used a replication logic which allows better cross-cases analysis and improves theory building by deriving insights from different case settings (Yin 2009). Table 7 highlights collection types we included to answer our research questions.

Table 7: Overview of data collection for case study
(Source: based on Creswell 2014)

Data collection type	*Included data*
Observations	Field notes about the behavior and activities of individuals at the research site
Interviews	– Face-to-face interviews with participants – Focus group interviews
Documents	Collection of public (official reports, minutes of meetings) and private (email correspondences, presentations) documents

During the observation phase we adopted an active role at the research site. As part of the team the observer is able to gain insights in the daily working procedures. The qualitative observation has the advantage of firsthand experience where unusual aspects can be noticed (Creswell 2014). The main source of data is drawn from face-to face interviews. Using interviews, researchers are able to gain historical information on how certain issues have emerged. With the control over the line of the questions, the research may take advantage and guide the conversation. The collection of additional documents enables the researcher to obtain the language and the words of the participants. We were able to collect presentations, archival data and mails regarding out field of interest. All interviews were transcribed and were integrated into a hermeneutic unit using the software ATLAS.ti (Muhr 2008). For analyzing the data we followed the recommendations by Glaser (1978) and used ‘The Six C's’: causes, context, contingencies, consequences, conditions, and covariance Figure 5). We approached our data with this first general code in order to provide a theoretical coding paradigm.

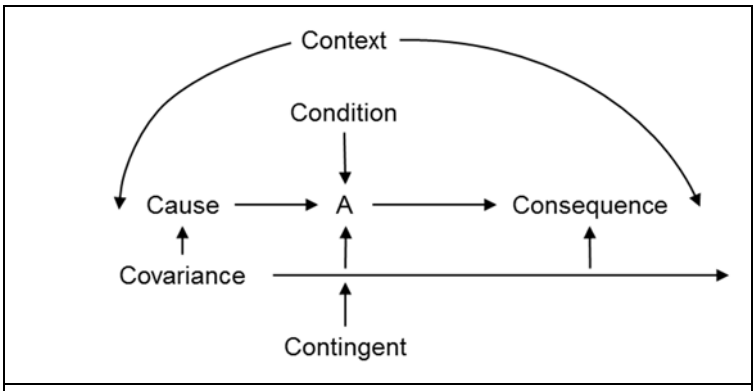

Figure 5: The Six C's
(Source: Glaser 1978)

Following the 'The Six C's' we were able to structure all interviews and gain insights that are discussed throughout the publications.

3.2.3 Design Science Research

In research the design science research (DSR) paradigm is increasingly accepted as a viable IS research approach to investigate how something needs to be implemented in order to change consumptions (Gregor/Hevner 2013). DSR is fundamentally a problem-solving paradigm which is concerned with the analysis, design, implementation, management, and use of information systems (Hevner et al. 2004) (Figure 6).

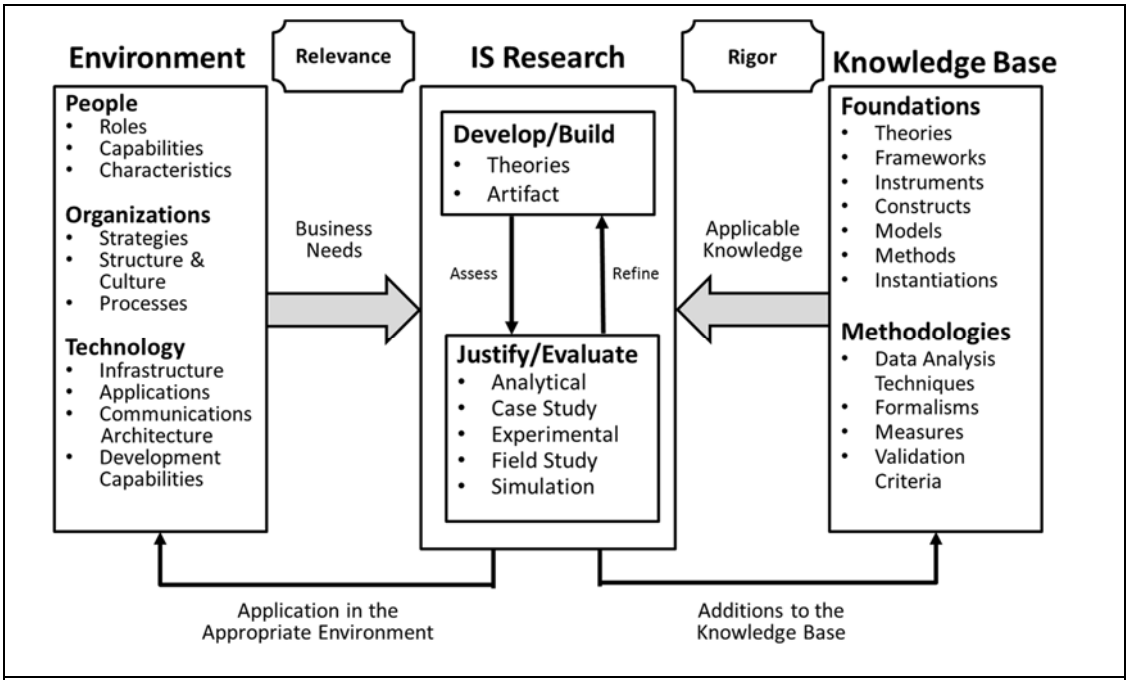

Figure 6: Information Systems Research Framework
(Source: Hevner et al. 2004)

It focuses on problems relevant to stakeholders and is predominant in process, knowledge and information management research (Indulska/Recker 2010). In IS the focus of DSR is mainly on constructing socio-technical artifacts such as construct, a model, a method, or an instantiation. This can for example be decision support systems, modeling tools, governance strategies, methods for IS evaluation, and IS change interventions (Gregor/Hevner 2013). By using DSR researchers can better understand the problem addressed by the artifact and the feasibility of their approach to its solution (Hevner et al. 2004). In turn, the utility, quality, and efficacy of the artifact have to be demonstrated via well-executed evaluation methods. To address this issue Rosemann and Vessey (2008) provide the applicability check (AC) method (Table 8). AC method is an evaluation of theories, models, frameworks, processes, technical artifacts, or other theoretically based IS artifacts that are used or produced in research. Within the lifecycle of DSR applicability checks can be done as soon as findings are known or IS models are provided. This may be for example to evaluate a researcher's object's importance, accessibility and suitability to practitioners (Rosemann/Vessey 2008). AC consists of seven steps that explain how to evaluate a socio-technical artifact and use the feedback in theory-focused research (Rosemann/Vessey 2008).

Table 8: Steps of the Applicability Check Method
(Source: adapted from Rosemann/Vessey 2008)

Stage	*Description*
Planning	Objectives, needed information and research object are defined
Selecting	Person with in-depth knowledge of the research object and significant social skills is selected
Ensuring	Ensure familiarity of participants with research object
Designing	Material for conducting the check is designed
Establishing	Appropriate environment that is conducive to a fruitful interaction is established
Conducting the check	Ensure that agenda and ground rules are presented and that conduction of the check happens in a professional manner
Analyzing	Collected data is analyzed with qualitative methods (multiple sources of evidence)

3.2.3.1 Meta-model Extension

Following the DSR paradigm, our research creates a new artifact that addresses limitations we revealed from reviewing existing literature and current practice. The new artifact is an extension of BPMN 2.0 that incorporates concepts needed to describe and document workarounds. We choose to extend the meta-model of an existing modeling notation (Bocciarelli/D'Ambrogio 2011). With regard to the argumentation provided by Becker et al. (2009) this approach has several advantages. First, the development of redundant language constructs is avoided. Second, it facilitates the adaption by experienced modelers, as they can leverage their developed knowledge. Third, the implementation of the new notation constructs into existing software tools is easier and finally, the new models are to a certain extent compatible with legacy models.

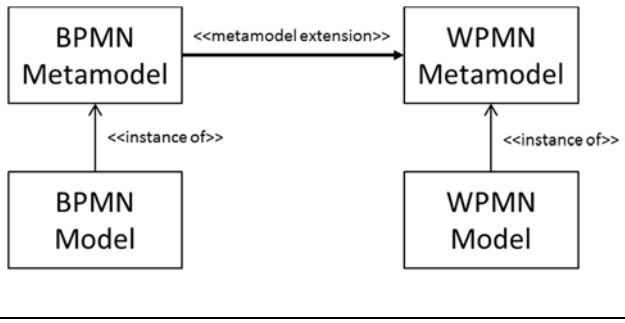

Figure 7: Metamodel Extension Process
(Source: adapted from Bocciarelli/D'Ambrogio 2011)

This thesis builds upon BPMN 2.0, because it has become a de facto standard for graphical process modeling (Recker 2010). Other widely used notations, such as activity diagrams from UML and event driven process chains (Becker et al. 2010; Harmon/Wolf 2014), could as well have been chosen. However, various studies show that BPMN is superior to both notations regarding conceptual coverage and usability (Becker et al. 2010; Nysetvold/Krogstie 2006). In the current state, BPMN 2.0 is not able to capture workarounds as this would result in a construct overload, where one construct has to be used for different purposes (Wand/Weber 1993). Bocciarelli et al. (2011) focus on the extension of BPMN and provide an approach to integrate non-functional properties. We use this idea and extend the BPMN to provide a WPMN model (Figure 7).

In order to understand the meta model extension, we introduce the basic modeling elements from BPMN with a Business Process Diagram (BPD) (OMG 2011; Rodríguez et al. 2007) (Figure 8). Pools and lanes are used to structure different organizational units (pools) and roles or functions within those units (lanes). Three connecting objects set three categories of flow objects (events, activities, and gateways) in relation to each other. Within the same pool, sequence flow is used to indicate the order in which the activities are performed - including sequence flows that have to fulfill a condition before traversing (part of BPMN 2.0). Message flows are used between pools to model communication with other organizations. Associations relate artifacts (data objects, groups or comments) to other modeling elements (Müller/Rogge-Solti 2011). With BPMN 2.0 this basic model has been refined and enhanced to strive for a new level of integrating business-user-friendly modeling (OMG 2011). Still, the proposed elements do not cover the possibility to integrate the risk-benefit analysis as part of workaround behavior.

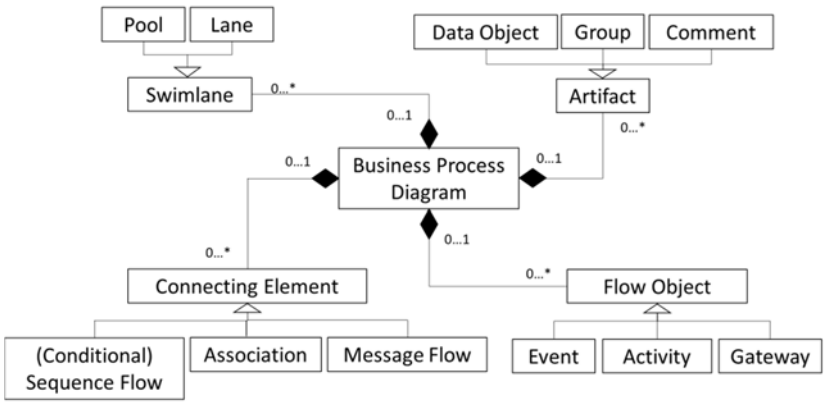

Figure 8: Business Process Diagram (BPD) Modeling Elements
(Source: Rodríguez et al. 2007)

There are two approaches on how to evaluate modeling notations - the model construction and model interpretation approach (Siau 1996). In this study, we use both tasks in order to evaluate WPMN. Model construction is used to force engagement in both broader conceptual thinking, as well as focusing on problem-solving activities (Batra/Davis 1992). It involves the construction of a model based on a given case description (Siau 1996). The interpretation of modeling notations involves the interpretation of information that is given in the model. Therefore, a developed model is provided to practitioners who are involved in the process in order to validate the constructs.

The evaluation of the conceptual modeling notation is based on the ontological deficiencies (Wand/Weber 1993) (Figure 9). Construct deficit refers to the case, where an ontological construct that has no mapping to any modeling construct. If there is one ontological construct that has a mapping to two or more modeling constructs, construct redundancy occurs. Construct overload is present, if there are two or more ontological constructs that have a mapping to the same modeling construct. Construct excess represents the case, where a modeling construct has no mapping to any ontological construct.

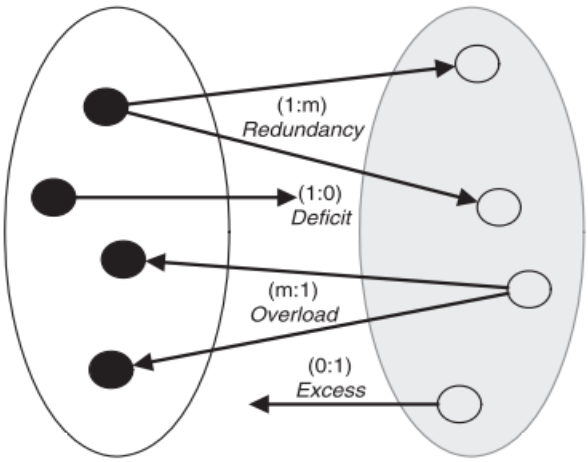

Figure 9: Types of Potential Ontological Deficiencies
(Source: according to Recker et al. 2010)

We evaluated WPMN in two ways. First, with a modeling assignment involving IS master students. The aim of the modeling assignment is to show the possibility to model and understand the workaround constructs. Second, we obtained comments from two focus groups of technical experts and physicians. The two focus groups were conducted to show the comprehensibility and practical relevance of WPMN.

3.2.3.2 Modeling Assignment

In a first step we conduct a modeling assignment to be able to evaluate the possibility to model and understand the workaround constructs. In natural language we described a workaround case and developed a "best practice" solution. Furthermore, we derived a scoring method with regard to the constructs for ontological expressiveness (Wand and Weber 1993) that assigns one point for each of six criteria. Points were deducted for modeling errors. Additionally, we developed a questionnaire in order to gain further insights on the construction of the model. The students received a two page description of the basic constructs of WPMN along with a process example. We asked them to model the previously described health care case Download Data using a case description. Each student created a WPMN model and answered a survey. The evaluation of these models is based on a scoring method related to the workaround constructs mentioned earlier (each correct construct was rated with a score).

3.2.3.3 Focus Groups

As the artificiality of the evaluation with a modeling assignment may provide limitations, we furthermore conducted two focus groups (Rosemann/Vessey 2008). In order to explore the comprehensibility and practical relevance of WPMN we introduced our modeling language to two groups of experts. We followed the recommendations provided by Rosemann and Vessey (2008) for conducting the applicability check solution, which we already described in the prior section. The focus group method is a qualitative research approach that is originated

from behavioral science research. In general it consists of group interviews, which are based on a small number of persons that have certain expertise in a concrete field. During the focus groups they discuss the topics raised by the researcher who guides the interview process (Morgan 1997). After collecting the feedback of the focus groups participants, we need to analyze the gained data. As well-established design criteria, we use the ontological deficiencies for analyzing our data (Wand and Weber 1993). The aim of the focus groups was to explicitly use the interaction of the participants to identify their needs, expectations and problems when modeling with WPMN. We do this to explore and clarify their views and guide them to generate their own questions and pursue their own priorities (Kitzinger 1995).

PART B

Publication 1

Toward an Ontology of Workarounds: A Literature Review on Existing Concepts

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Abstract

While workarounds are studied frequently in information systems research, a coherent and interrelated structure to organize the knowledge of the field is still missing. In this study, we provide a first step towards an ontology of workarounds in order to enable researchers to study the relationships among the core concepts. By identifying existing literature, we discover three gaps in workaround research: (1) lack of conceptual consensus, (2) fragmentation and (3) static perspective. To advance theory, we provide an overview of different types of workarounds that are frequently used in literature. Based on these findings we derive core concepts of workarounds that are used in literature and provide an ontology of workarounds.

Keywords: Workaround, Customization, Shadow IT/system, Decoupling, Rule Breaking, Workplace Deviance

Individual Contribution of Doctoral Candidate: In this paper the doctoral candidate conducted the literature review by identifying existing literature and deriving existing gaps. Based on the review she introduced the ontology of workarounds and discussed her findings in the context of existing literature. She substantially contributed to the introduction, theoretical background, conducted the method and introduced the results. She included the thoughts and ideas from the co-authors.

1 Introduction

The utilization of information systems (IS) within organizations often results in workaround behavior (Ferneley/Sobreperez 2006). Workarounds as non-trivial IS topic are prevailing across various industries and domains with different outcomes (Alter 2014). Special interest has been drawn on the use of enterprise resource planning (ERP) systems and how organizational members use them in unintended ways (Ignatiadis/Nandhakumar 2009; Behrens 2009). Other perspectives interpret workarounds as a form of resistance (Guo et al. 2011) where they may lead to harmful consequences (Ignatiadis/Nandhakumar 2009). In other situations workarounds may improve the daily work and thus have a positive effect on organizations (Miller/Wedell-Wedellsborg 2013). All in common, research agrees upon the assumption that workarounds have an effect on organizational performance (Guo et al. 2011) but literature still lacks a profound theory.

We discover three key gaps in workaround theory. First, our data shows that the phenomenon of workarounds lacks a conceptual consensus. Research is at odds when it comes to a consistent interpretation. As existing literature has not offered a coherent and cumulative body of work, the theoretical and empirical investigation of workarounds can currently not be advanced. Second, we find that workarounds are currently investigated fragmented and largely independent of types and concepts. The interrelation of existing research streams offers insights into how workarounds are referred to and connected to each other. Third, workarounds are studied from a static perspective as a rigid phenomenon, which treats their emergence as a black box. Current research focuses on workarounds as an outcome rather than a process with temporality and dynamic structures. The gaps we discovered need to be considered when investigating workarounds as a behavior where organizational members utilize IS in unintended ways. Therefore, we ask the following research questions (RQ): *RQ1: What types of workarounds are discussed in literature and how can they be classified? RQ2: Which concepts are relevant when investigating workarounds and how are these concepts related?* Our research seeks to provide a first step in addressing the gap in research by answering the RQ.

2 Theoretical Background

Previous definitions have described workarounds as “misfits with the idealized representations of work” (Gerson/Star 1986). We define workarounds as anomalous use of IS where actual practices are not consistent with the designed use and official rules (Azad/King 2012). Research on workarounds primarily originated from the area of organizational psychology and were considered mainly as a misuse of resources with harmful consequences (Robinson/Bennett 1995). Disincentives and punishment were seen as effective reactions against workarounds (Straub/Nance 1990). Later, workarounds were increasingly related to the use of information technology as they became an essential part of every organization (Auer 1998). In different situations workarounds are used in order to solve problems (Niazkhani et al. 2011), save time (McGann/Lyytinen 2008) or circumvent rule limitations (Davison/Ou 2013). Workarounds as bottom-up ideas that are executed behind the scenes are

seen as source of innovation and organizational success what sheds a positive light on the phenomenon (Miller/Wedell-Wedellsborg 2013). Pioneers of the neutralization model even address justification of breaking rules (Siponen/Vance 2010). These studies attribute less importance to punishment as rule breaking most often grounds in conflicts (Azad/King 2012). The conflicts include situations where regulations are circumvented due to moral conflicts (Ansari et al. 2010) or limited functionality of a system (Alter 2012). Workarounds are seen as user response to system design, e.g. shadow IT (Quast/Handel 2012). Studies about workarounds in IS are strongly connected to research regarding the introduction of new systems (Boudreau/Robey 2005). Research that investigates workarounds as the main focus is particularly often positioned within health care and public institutions (universities and administration) (Azad/King 2012; Koppel et al. 2008). This roots in the fact that physicians are able to save lives when working around IS (Azad/King 2008) and public institutions struggle with outdated statues (O'Leary 2010). In unpredictable environments workarounds are an acceptable factor to address flexibility. The diversity of workflows can even be used in order to learn from emergent change (Alter 2014).

3 Research Method

To provide rich insights we follow the literature review from Webster and Watson (2002) extended by the guidelines from vom Brocke et al. (2009) and the taxonomy of literature reviews (1988). Prior to the literature search, we defined the review scope and scanned literature for workaround applications. The goal of our literature review is to summarize types of workarounds. For organizing the review, we adopted the conceptual perspective and used a neutral representation to inform general scholars. With the review we cover central types of research.

In a **first step** we included the top eight IS journals according to the AIS senior scholar list: MIS Quarterly, Information Systems Research, Information Systems Journal, European Journal of Information Systems, Journal of Management Information Systems, Journal of Strategic Information Systems, Journal of Information Technology, Journal of the Association of Information Systems. Furthermore we included Americas Conference on Information Systems, European Conference on Information Systems, Hawaii International Conference on Systems Sciences, and International Conference on Information Systems as the leading conferences in IS. We performed an explorative search by combining selected keywords related to workarounds and selected the relevant articles through a full-text search guided by the following keywords: *workaround, customization, shadow IT/system, employee + decoupling, rule breaking, employee/workplace deviance.* The review of the IS journals and conferences led to 259 initial results. During this step, we refined the search terms to build a final search string to cover as many of the relevant articles. We added the terms *resistance, non-compliance, system misuse, fraud, computer abuse, tweaking, reinvention* and *non-conformity.* We scanned the abstracts and full articles and excluded duplicates and irrelevant papers manually. Thus, relevant papers could be determined to 58. We provide working definitions to describe the different types of workarounds.

In a **second step** we conducted a backward search with relevant publications. We concentrated on the most important ones by reading their abstracts and the full papers. We were interested in their connection to the keywords. This led us to a total of 71 papers, which we integrated in our concept matrix.

The **third step** was used to conduct a forward search to identify articles citing the key articles identified in the previous steps. We concentrated on the 20 most cited ones and reduced them with regard to the second step to the most important ones. The reason for this step is grounded in the fact that the plethora of papers interprets workarounds as an unexpected finding and provides them as a result. We are interested in workarounds as a starting point with deeper investigations. After this step our list resulted in 84 papers.

4 Results

In total we identified 84 papers on our search terms. Table 9 shows the types of workaround using the key terms from our literature review. We provide a clear definition to distinguish the different types. To gain insights into the relevant papers, we structured the paper with regard to the type of study (empirical or conceptual), type of workaround, level of workaround (individual, team, organization), industry, country, IS, orientation (technology or process), and intention (positive or negative) (see Appendix B).

Table 9: An Overview of Workaround Types
(Source: Own illustration)

Types	*Definition*
Workaround	Anomalous IS use where actual practices are not consistent with the designed uses and official rules (Azad/King 2012)
Shadow System/IT/work	Software applications or extensions to existing software that are neither developed nor controlled by an organization's central IT department (Fürstenau/Rothe 2014)
Resistance	Behaviors intended to prevent the implementation or use of a system or to prevent system designers from achieving their objectives (Lapointe/Rivard 2005)
Non compliance	Security best practices and policies that are avoided (Jenkins/Durcikova 2013)
Employee/ Workplace Deviance	Voluntary behavior that violates significant organizational norms and, in so doing, threatens the well-being of the organization or its members, or both (Bennett/Robinson 2000)
System Misuse	Perform a behavior that misuse of IS resources (D'Arcy et al. 2009)

Decoupling/ Loose Coupling	Separating formal rules from actual working practices (Azad/King 2012)
Customization	Privately-owned IT resources, such as devices or software that are used for business purposes (Niehaves et al. 2012)
Rule Breaking	Violations of formal rules depending on the interests of specific actors and groups inside and outside the organization (Martin et al. 2013)
Fraud	Ill-intentioned employees use the system for prohibited aims (Bagayogo et al. 2013)
Computer Abuse	Unauthorized, deliberate, and internally recognizable misuse of assets of the local organizational information system by individuals (Straub/Nance 1990)
Tweaking	Deviation from a prescribed work processes by using a system in a slightly different way (Boudreau/Robey 2005)
Reinvention	Practices that can be altered or tailored in order to accomplish specific tasks that were not initially planned or supported (Malaurent/Avison 2011)
Non conformity	Striving for legitimate goals in illegitimate ways (Mainemelis 2010)

The definition of the type provides insights in how the term is used throughout research. We find that the definition may directly address the IS aspect (e.g., anomalous use of IS) or may refer to deviating process behavior (e.g., behavior that violates norms). This distinction helps in understanding whether the workaround misuses IS or if it is related to incongruence between a formal process description and actual working practice. On the other hand, the definitions indicate that the workaround may be associated to harmful behavior on purpose or the intention stems from a beneficial attitude.

Based on the identified literature and the classification framework we were able to derive an ontology that provides the concepts related to workarounds. We followed the methodology for the design of ontologies as recommended by Grüninger and Fox (1995). We used a motivation scenario that helps understanding the motivation for the proposed ontology in terms of its application (Grüninger/Fox 1995). Using this scenario a set of demands may be derived that are integrated in a next step using competency questions. In our case we came up with the following exemplary informal competency questions, e.g., *what are the reasons and the motivation behind workarounds? Which terms are used for workarounds in literature? What is the effect of workarounds?* Next, we specified the terminology by introducing a formal description of the vocabulary related to the tasks and activities (Guarino 1998). Figure 10 presents the findings we derived from conducting the proposed steps. At this stage, the ontology has to be evaluated with formal competency questions, specification of a first-order logic and completeness theorem (Grüninger/Fox 1995) which is not part of this research. We

are rather interested in providing a first attempt for an ontology for workarounds that can be used as a basis for future research.

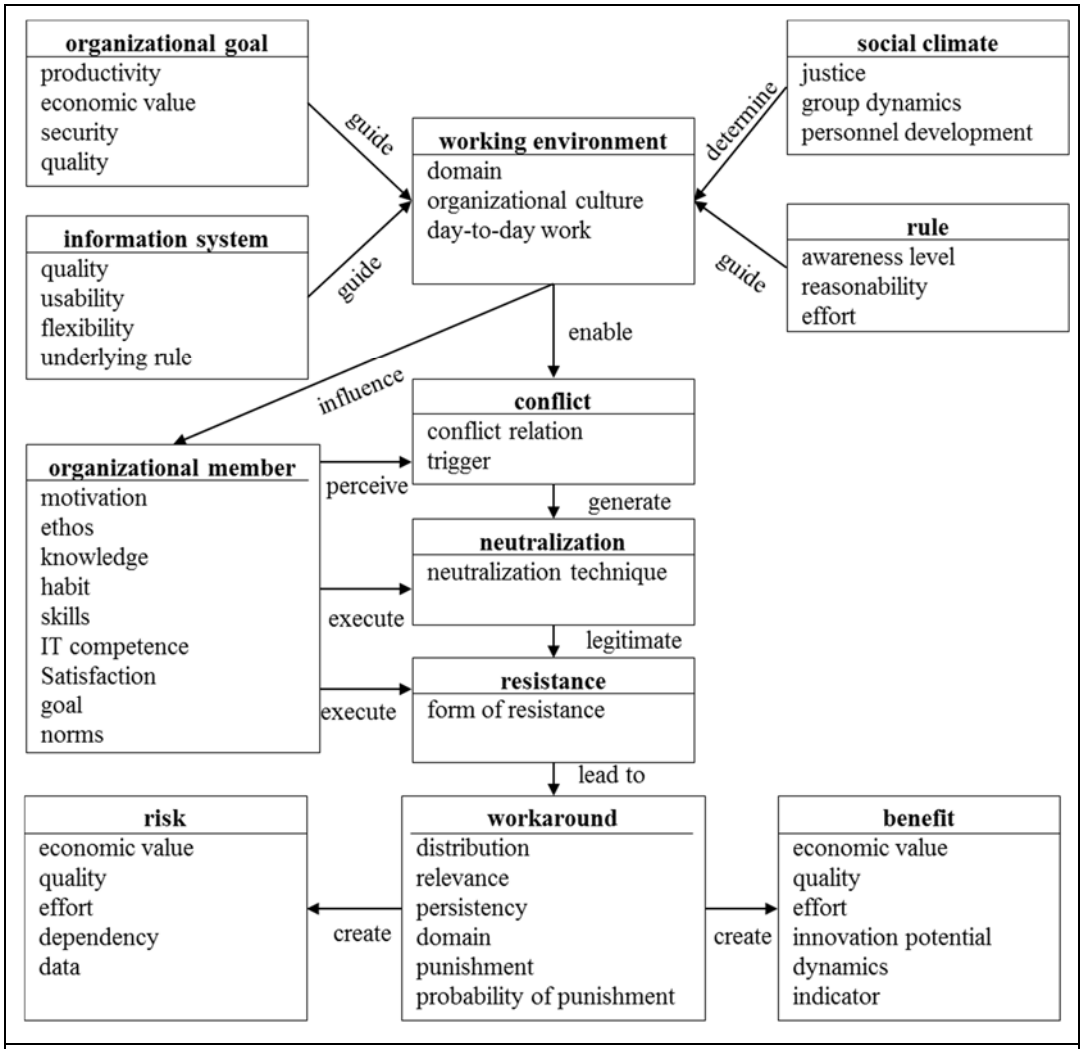

Figure 10: An Ontology of Workarounds
(Source: Own illustration)

The emergence of workarounds is described by a process in which organizational members make their own decisions. In this process, conflicts arise where neutralization techniques are used that may lead to resistance. Resistance in turn leads to workarounds and affects the type. The dynamic relation between working environment and organizational members is based on their dependency. Relevant to the working environment are rules, IS, organizational goals and the social climate. Norms of organizational members are often determined within the social group in which they are located (Azad/King 2012). Often conflicts arise between internal norms and goals of organizational members versus the working environment. These conflicts force individuals to make a decision in line with compliance or non-compliant behavior. Thus, organizational members react to the underlying rule of the IS.

Literature suggests that the majority of these decisions are made on the basis of neutralization techniques (Siponen/Vance 2010). Neutralizations describe the justification of rule breakers

towards themselves or rationalizing an infraction in order to be regarded as reasonable or even correct (Sykes/Matza 1957). Ambiguous rules often lead to neutralization by rejecting responsibility for the rule (Martin et al. 2013). The working environment not only plays a role during the emergence of conflicts, but also during neutralization (Lim 2002). Perceived injustice leads to neutralization by discrediting the victim (Greenberg 1990). In literature neutralization emerges in form of workarounds that occur due to achieving a higher goal, such as maintaining higher productivity (Bulgurcu et al. 2010). As a consequence, neutralization leads to compliant behavior, positive or negative resistance. Those three forms of resistance manifest the intention of the employee (Ferneley/Sobreperez 2006). The nature of the workarounds is ultimately dependent on the nature of the conflict, the nature of the resistance, the working environment and of the skills and norms of the organizational member (Ferneley/Sobreperez 2006). The consequence of workarounds may either provide a benefit for the organization or may lead to a risk. Beneficial workarounds are described as innovation potential, indicator for the strengths and weaknesses of IS or a rule. The risk related aspect of workarounds includes data security, consistency and protection. Although the underlying intention of the organizational member may be positive, engaging in workaround behavior may have negative consequences for the organization (Ferneley/Sobreperez 2006).

5 Discussion

Before discussing our findings certain limitations should be considered when interpreting the results. First, information regarding workarounds is sensitive. We found evidence in literature that organizational members are open to talk about workaround behavior. More than often workarounds are well known in organizations and decision makers are aware of them. Second, our ontology provides a high level of abstraction. In order to build instances of the ontology it is necessary to collect data on workarounds. As workaround behavior is rather a process than a static outcome, it would be interesting to compare different instances of the same workaround during its emergence. Third, with our ontology we are not able to render judgment about whether a workaround is positive or negative. Rather, we were interested in providing an approach on how to collect information about workarounds without a priori judgment.

Following the three gaps we identified during our review, we provide a first attempt to organize the knowledge of the field of workarounds. First, we derive an ontology of workarounds to provide a conceptual consensus. As there is no single correct ontology for any domain we only provide a first attempt towards a consistent basis to investigate workarounds. Building on this basis we encourage researchers to evaluate and reconfigure our ontology of workarounds. We are aware that the design of an ontology is dependent on the creativeness of the designer and interpretation of viable alternatives (Noy/McGuinness 2001). Therefore, our suggestion may only provide a piecemeal representation from other perspectives that have yet not been considered in our analysis. Second, we address the issue of fragmentation by reviewing literature and provide a concept-related representation of our findings. We organize literature with regard to the type of study (empirical or conceptual), type of workaround, level of workaround (individual, team, organization) industry, country, IS, orientation (technology

or process), intention (positive or negative) (see Appendix B). By doing so we are able to show how different types of workarounds are related to each other and how they are discussed throughout literature. Third, we provide an attempt towards reflecting the dynamic instead of static perspective on workarounds. We highlight key concepts that are related to the domain of workarounds. Reflecting the concepts stresses the dynamic nature in which workarounds are situated. Environmental factors influence behavior that determines workarounds - when conditions change, behavior may change as well. This may either be due to changing processes or changing technologies (Leonardi 2011).

6 Conclusion

This study was motivated by providing a holistic understanding of workarounds and their related concepts. We began this study by reviewing literature on workaround behavior and clustered their types. The analysis resulted in a concept centric evaluation where the 15 most frequent workaround types have been presented. We provide an ontology of workarounds which allows the comparability of workaround behavior in IS. This enables organizations to share a common understanding of the structure of workarounds among organizational members.

Our study makes several contributions to IS research. First, we propose that workarounds need to be differentiated with regard to their type. For example highlighting the intention behind the workaround (positive or negative) can provide rich insights on how organizations can control this behavior. Second, technical as well as process workarounds need to be differentiated with regard to their outcome. When organizations seek to prevent workaround behavior, controls for technical workarounds differentiate from those that affect the organizational processes. Third, providing an ontology makes workarounds comparable and may - in a next step - provide patterns on how to react to them. Organizations may tolerate, hinder or use the workarounds that are uncovered with our ontology.

From our findings it follows that there are several avenues for future research. First, the ontology needs to be evaluated with empirical data in order to ensure generalizability. By using interviews and archival data, workarounds may be collected to provide insights about different types. The visualization of incongruence in business processes promises to offer a consistent basis for comparing and analyzing workarounds (Röder et al. 2015). Second, as workarounds describe dynamic behaviors future investigations need to consider and integrate temporality in the analysis. To unpack the black box of workarounds, research may provide insights into how the ontology can integrate the dynamic aspect and help in understanding the evolution. As the development of an ontology is an iterative process the evaluation may include a discussion with experts (Noy/McGuinness 2001). Third, the risks and benefits associated with workarounds have yet not fully been investigated. Still, there is a lack of evaluating incongruence between formal process descriptions and informal working practices. Using our ontology may enhance the understanding of factors that influence this ratio. Risks and benefits are related to workarounds and affect individual decisions of organizational members (Röder et al. 2014a). In different situations the same workaround may result in a positive or negative outcome (Ferneley/Sobreperez 2006). A final area for future study would

be how to control different forms of workarounds from an organizational or managerial perspective. With our findings, we are able to show different types of workarounds and how they are studied in research. In a following step, researchers may built upon these findings and suggest how organizations may gain control on the negative consequences of workarounds while at the same time be open for improving business processes by absorbing the positive side effects.

Publication 2

IT Enabled Agility in Organizational Ambidexterity

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Abstract

The aim of ambidextrous organizations is to balance exploratory and exploitative learning concepts. They innovate through experiments and research, and capture the value of innovations through refinement and continuous improvement. In this paper, we study the relationship of organizational ambidexterity and IT enabled agility. Based on a case study with a German car manufacturer we find that (1) entrepreneurial agility impedes exploitative concepts, (2) adaptive agility impedes exploratory concepts and (3) ambidextrous organizations exhibit structures that allow them to transfer results from exploratory to exploitative activities through IT enabled agility. Our findings suggest that exploitative concepts require IT enabled agility mechanisms that are incompatible with those for exploratory concepts, and oppositely. We found that knowledge transfer between business units often occurs, but is yet not fully integrated from an organizational perspective. We highlight the need for ambidextrous organizations to facilitate permeable boundaries with IT enabled agility by offering a transfer.

Keywords: Organizational ambidexterity, exploratory and exploitative concepts, IT enabled agility

Individual Contribution of Doctoral Candidate: This research builds on the theoretical background of agility and ambidexterity which the doctoral candidate developed based on a literature review. In this paper she conducted and analyzed the interviews that are involved in the publication. The candidate linked both concepts to the interviews and came up with the existing results. She substantially contributed to the introduction, theoretical background, conducted the method, introduced the results and discussed the findings. She included the thoughts and ideas from the co-authors.

1 Introduction

Literature argues that being successfully innovative is largely a function of exploring new competences and exploiting existing competences (Gibson/Birkinshaw 2004). This implies an ability to achieve a trade-off in allocating resources to two kinds of competing activities (March 1991): exploratory activities refer to experiments and research that will define long-term success; exploitative activities refer to refinement and establishing routines that determine short-term success (Levinthal/March 1993). We understand these organizational concepts as the idea that both exploratory and exploitative concepts are associated with knowledge, learning and innovation, albeit of different types (Gupta et al. 2006). Introducing organizational ambidexterity (Duncan 1976) as a structure that helps to simultaneously deal with contradictory elements, the concept of exploratory and exploitative concepts disclose an enduring research area. Following Benner and Tushman (2003) ambidextrous organizations are composed of units that focus on either exploratory or exploitative concepts with an integrated, transparent, and coherent process that links the various units. Contradictory findings on how to organize this balancing process have been introduced with different approaches, e.g. punctuated equilibrium (Gupta et al. 2006), or structural and contextual ambidexterity (Corso/Pellegrini 2007).

Innovative organizations strive to maintain competitive advantage through agility in prevailing business environments (Sambamurthy et al. 2003). Therefore organizations are challenged to implement information technology (IT) as enabler of creating and maintaining a flexible business network (Venkatraman 1994). In a constant state of flux, IT is reshaping the business process of an organization (Swanson 1994). To absorb this potential, IT enabled agility has become a promising factor to produce better outcomes (Sambamurthy et al. 2007) and builds on aspects of being able to respond to environmental dynamics, change and uncertainty (Sambamurthy et al. 2003) (Zain et al. 2005). Thus, IT enabled agility offers structures that help organizations to be ambidextrous (Andriopoulos/Lewis 2009). Comparing the dichotomy aspect of organizational ambidexterity with the polymorphous aspect of IT enabled agility, we ask the research question:

How can ambidexterity be organized through IT enabled agility?

We explore this phenomenon based on an in-depth case study with the car manufacturer AUTO. Basically, AUTO is organized in an ambidextrous manner, i.e., there is a coherent process that integrates and balances exploratory and exploitative concepts. We study the car manufacturer’s efforts in developing an IT solution to prevail sustainable and innovative structures. We found that different combinations of organizational ambidexterity and IT enabled agility are leading to endless cycles of traps. We explain this behavior with incompatible organizational process configurations for exploratory and exploitative concepts. Our findings suggest that organizing for ambidexterity through IT enabled agility links the specific exploratory and exploitative units but at the same time suffers from incompatible structures. Thus, this paper offers first insights into side effects of ambidexterity and links the previously separate streams of literature on ambidexterity and organizational agility.

This paper proceeds as follows. First, we review the theoretical and empirical literature on ambidextrous organizations and IT enabled agility. We establish a research model that links organizational ambidexterity to IT enabled agility and investigate the concepts with an in-depth case study with the car manufacturer AUTO. Finally we discuss our findings and conclude with an ambidextrous agility model.

2 Theoretical Foundation

The theoretical framework of this study is built on how organizations are able to pursue ambidexterity through IT enabled agility. The following section discusses the theoretical foundations used in this research.

2.1 Concept of Exploration and Exploitation

When referring to exploratory concepts, this activity can be seen as the "search, variation, risk taking, experimentation, play, flexibility, discovery and innovation" (March 1991, 71) of new possibilities. Exploitative concepts concentrate on "refinement, choice, production, efficiency, selection, implementation and execution" (March 1991, 71). Building on these definitions, persistent success of a firm is based on the organizational adaptation consisting of both, exploitative and exploratory concepts (March 1991). During this research we understand exploitative and exploratory concepts as relevant activities when new products need to be introduced. The attempt to balance both concepts at the same time often leads to an exploration exploitation paradoxon. This paradoxon results from three assumptions proposed by Gupta et al. (2006). (1) Both concepts compete for scarce organizational resources. The more resources an organization spends on exploitation implies fewer resources left over for exploration, and vice versa. (2) Both concepts are iteratively self-reinforcing. Success in exploration results in more exploration and success in exploitation results in more exploitation. (3) The mindsets and organizational routines needed for exploration are radically different from those needed for exploitation, making the simultaneous pursuit of both all but impossible. Seen from an organizational control perspective, explorative learning concepts require distinctly different organizational control mechanisms compared to exploitative concepts (Gupta et al. 2006). Units engaging in exploratory learning tend to be small and decentralized, with loose cultures and processes, whereas exploitation units are larger and more centralized, with tight cultures and processes (Benner/Tushman 2003). Summing up, an organization that engages exclusively in exploration will ordinarily suffer from the fact that it never gains the returns of its knowledge. An organization that engages exclusively in exploitation will ordinarily suffer from obsolescence (Levinthal/March 1993).

2.2 Ambidextrous Model of Innovation

To achieve a balance in exploratory and exploitative concepts, organizations need to work on a dual mode to be innovative (Duncan 1976). Ambidextrous organizations are composed of multiple, tightly coupled subunits that are loosely linked with each other (Benner/Tushman 2003). With this structure firms can facilitate balancing exploratory concepts and exploitative concepts within one organization and are less prone to failure than firms with a one-sided orientation (Probst/Raisch 2005). To be able to create such a dual structure, techniques need

to be developed that permit business units to be consistently inconsistent as they steer a balance between the need to be small and large, as well as centralized and decentralized (Benner/Tushman 2003). This leads to the assumption that a balance leads not only to steady organizational renewal but also results in a firm's ability to become more innovative (Tushman/O'Reilly 1997). Thus, an agile structure enables ambidextrous organizations to balance resources for exploratory and exploitative activities (Probst/Raisch 2005). Various approaches and case studies illustrate mechanisms for achieving ambidexterity in the innovation process. While the importance of pursuing both types of innovation has often been highlighted (Gupta et al. 2006; Corso/Pellegrini 2007), much more remains to be understood on how ambidextrous organizations coordinate the development of exploratory and exploitative innovation in organizational units (Jansen et al. 2006). The main challenge is to understand and implement the processes by which exploratory and exploitative concepts are integrated in a value enhancing way (O'Reilly/Tushman 2007). In many cases literature regarding ambidextrous organizations discusses the impact of structural or contextual ambidexterity (Jansen et al. 2009). Another approach, the punctuated equilibrium, consists of long convergent periods, punctuated by relatively short and infrequent operations (Tushman/Romanelli 1985). All concepts provide time-related aspects and organizational structures but lack a concrete guideline on how to avoid an exploration exploitation paradoxon when organizing for ambidexterity.

2.3 IT Enabled Organizational Agility

Facing the challenge of rapid and often unanticipated change, organizations need to detect and respond to opportunities and threats with ease, speed, and dexterity. We refer to this as agility, which is seen as a key competitive imperative in research (Tallon/Pinsonneault 2011). In research the aspect of IT as enabler for undertaking strategic changes resulting in organizational agility has been discussed frequently. Sambamurthy (2003) shows that continual innovation is achieved by enhancing business performance through IT. Especially in today's turbulent business environment with unexpected changes in market demand and consumer preferences, IT enabled agility is needed to deal with arising unpredictability (El Sawy/Pavlou 2008). Literature understands the effective use of IT as an enabling method for organizations to sustain the virtuous cycle of adaption (Overby et al. 2006). Based on this finding, we focus on IT enabled agility and differentiate two distinctive types that postulate different ways of responding to market dynamics (Sambamurthy et al. 2007). We refer to them as entrepreneurial agility (Ireland et al. 2003) and adaptive agility (Sheffi/Rice Jr. 2005) each enhanced with IT structures, tools, or concepts. Focusing on entrepreneurial agility organizations anticipate environmental changes and conduct strategic experiments with new business approaches and models (Sambamurthy et al. 2007). This concept represents a firm's stance of seeking to create new resources, ideas, and their applications beyond the boundaries of the firm. In contrast, the other way is to be resilient and adaptive to environmental change in order to maintain competitive parity and competitive leadership. This can be achieved by keeping with the industry's best practices in facing emerging business opportunities and threats. The capability for such a type of market response is adaptive agility. It is also referred to as the capability to cope with uncertainty and rapid recovering from disruption, without fundamentally changing products or processes. With this conceptualization of the two types

of agility, this study aims to reveal the mechanisms by which organizational structures can lead to these two types of agility. Along with Venkatraman (1994) we understand the potential benefit of IT directly related to the degree of change in organizational routines.

2.4 Research Model

Still, the link of pursuing both, exploratory and exploitative concepts and IT enabled agility is missing. Figure 11 presents the general research model which emerged from previous discussed literature. We propose that entrepreneurial agility positively interacts with exploratory concepts and adaptive agility positively interacts with exploitative concepts.

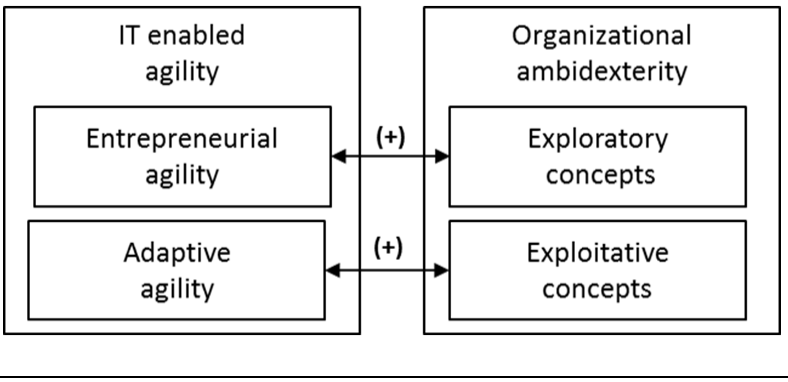

Figure 11: Proposed Research Model
(Source: Own illustration)

3 Research Methodology

3.1 Sampling and Data Collection

This study examines interviews, conducted with 21 employees from a German-based internationally operating car manufacturer. During our research we were able to gain insights in different business units and had the chance to actively participate in different project meetings as practical researchers. For reasons of anonymity, the organization is named AUTO. We selected the organization due to its increasing effort in developing IT solutions to prevail sustainable and innovative structures at the same time. The units in which we collected our data all report to the same chief information officer, but due to their quantity they are organized in separate areas of operation within IT tasks and departments. Therefore, those units follow different IT enabled structures, each aligned with the overall mission of sustainability and innovativeness. The research methodology was implemented as an in-depth case study with employees that had already participated in exploratory and exploitative concepts. We selected the single case study due to their unusual revelatory, extreme examples and opportunities for unusual research access (Eisenhardt/Graebner 2007). By using a case study protocol, reliability was increased (Yin 2009). To structure our interviews we used an agenda where we asked the participants questions about their current concepts within exploratory and exploitative concepts and how organizational structures enable them.

An overview of the face to face interviews conducted within a more than three year lasting time sequence is showed in Table 10. It contains information regarding the role or department of the interviewee, the duration of the interview and the participant's individual work experience within the company. As can be seen, we selected this case study due to AUTOs wide range of different units, participating and engaging in innovation management from different perspectives. We chose those participants as they come from differing units with apparently diverse involvement in rather exploratory or exploitative concepts supported by IT enabled agility. To get access to the employees we used dynamic moments where unique social knowledge helped us to sample possible respondents (Noy 2008).

Table 10: Interviews Conducted at AUTO
(Source: Own illustration)

ID	*Role/Department*	*Duration*	*Experience at AUTO*	*Date*
P1	Innovation Management	49 min	6 years	18.03.2010
P2, P3	Sales Department/Online Marketing	38 min	10 years and 12 years	18.03.2010
P4	Product Marketing	56 min	2 years	30.03.2010
P5	Automotive Online Services	66 min	3 years	30.03.2010
P6	Automotive Features	10 min	5 years	21.05.2010
P7	Product Strategy	51 min	8 years	25.05.2010
P8	Brand and Customer Strategy	46 min	2 years	07.10.2010
P9	Automotive Online Services	31 min	5 years	02.12.2010
P10	Research and Development	26 min	4,5 years	11.01.2011
P11	Research and Development	26 min	3 years	03.02.2011
P12	Research and Development	28 min	7 years	18.01.2011
P13	IT Electronics	69 min	4 years	13.09.2012
P14	Product Development	50 min	2 years	18.11.2012
P15	Quality Manager	100 min	7 years	12.11.2012
P16	Senior Engineer	58 min	10,5 years	27.11.2012
P17	Logistic Department	36 min	5 years	07.01.2013
P18	Innovation Management	40 min	10 years	18.01.2013
P19	Innovation Management	43 min	13 years	01.03.2013
P20	Idea Management	67 min	7 years	25.06.2013
P21	Social Collaboration	37 min	8 years	03.09.2013

3.2 Data Analysis Procedure

All interviews were tape-recorded and anonymized during their transcription. The resulting transcripts from the 21 interviews comprised 275 pages and were integrated into a hermeneutic unit using the software ATLAS.ti (Muhr 2008). The coding procedure was done as follows: We derived a coding scheme for categorizing organizational agility and organizational ambidexterity based on experience from already published literature (see Table

11). The coding procedure resulted in a list of 37 codes. In a next step the first-author conducted an iterative open coding (Strauss/Corbin 1998). The coding process was repeated until no additional tag was allocated and no statements could be assigned to the already existing codes. To increase validity, a student researcher likewise coded the transcripts in a closed and open manner. After discussing and comparing both codings, overall the results were summarized in a list of 69 codes with 389 phrases.

Table 11: Coding Scheme
(Source: Own illustration)

Research Construct	*Coding Scheme and References*
IT Enabled Agility	
Entrepreneurial	• Proactiveness (Green et al. 2008) • Opportunity-seeking (Sebora/Theerapatvong 2010) • Autonomy, innovativeness, risk taking, and competitive aggressiveness (Lumpkin/Dess 1996) • IT Competence (Sambamurthy et al. 2003)
Adaptive	• Reactiveness (Green et al. 2008) • problem-focused coping strategies, uncertain and unpredictable (Sherehiy et al. 2007) • IT Competence (Sambamurthy et al. 2003)
Organizational Ambidexterity	
Exploration	• Breakthroughs emphasis, Loose coupling, Passion (Andriopoulos/Lewis 2009) • Competence, Governance, Networks, Strength of ties, Transitional process (Gilsing/Nooteboom 2006) • Exploratory innovation (Jansen et al. 2006)
Exploitation	• Profit emphasis, Tight coupling, Discipline (Andriopoulos/Lewis 2009) • Competence, Governance, Networks, Strength of ties, Transitional process (Gilsing/Nooteboom 2006) • Exploitative innovation (Jansen et al. 2006)

4 Results

We found evidence for the interaction between entrepreneurial agility and exploratory concepts and between adaptive agility and exploitative concepts. Despite the proposition that these exhibit a positive interaction, we identified different factors leading to traps in several dynamics of organizational paradoxes. Focusing on ambidexterity and agility, we discovered conflicting structures that result in endless cycles of disimprovement. Our analysis resulted in four effects dominating the organizational ambidexterity and IT enabled agility concept (Figure 12). An exploitative focus can trigger a ‘success trap’ in which exploitation drives out exploration, while focusing solely on exploration results in a ‘failure trap’ (Belderbos et al. 2010; Un 2007; Gupta et al. 2006). This paradoxon can also be found in following the

dichotomy approach of an entrepreneurial or adaptive agility structure. We found evidence for incompatible structures when organizations with entrepreneurial agility seek to execute exploitative concepts and organizations with adaptive agility try to operate exploratory concepts. We refer to these antagonistic structures as ‘improvement trap’ and ‘disruption trap’. We try to understand the effect those concepts have on IT enabled agility structures and found to what we refer as transfer phase. Consistent with Argote and Ingram (2000) we found that knowledge transfer between business units often occurs, but is yet not fully integrated from an organizational perspective. The following sections discuss our findings, underlined by representative quotes.

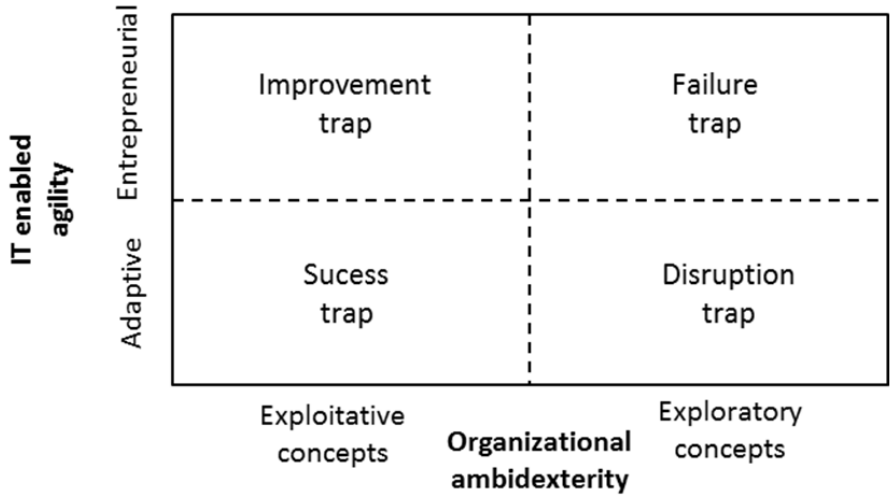

Figure 12: Ambidextrous Agility Model
(Source: Own illustration)

4.1 Success Trap

Adaptive agility and exploitative concepts: Early success is one of the outcomes when focusing exclusively on exploitative concepts. This success naturally reinforces more exploitation along the same trajectory and results in a ‘success trap’ (Gupta et al. 2006; Un 2007). At a first glance, an organization being confronted with a ‘success trap’ should be satisfied with delivering exploitative concepts and adapting to them. But organizations tend to overestimate success (Assink 2006). However, the same mechanisms of learning that lead to improvements also lead to limits to those improvements (Levinthal/March 1993). The following quotes represent the quintessence of our findings confronting adaptive agility and exploitative concepts.

> *"[…] until they have just got to the point that we said we need more structure, there must be a process how to push things, about prioritizing things and simply how to set common goals." (P12)*

> *“So the question is if the colleagues in the R&D department are actually ready and willing to accept ‘not invented here’ things.” (P2/P3)*

In their research Levinthal and March (1993) refer to the tendency to ignore the long run and prefer the short run in organizational learning as myopia. As organizations develop greater and greater competence at a particular activity, they engage more in that activity, increasing this competence but leading to a potentially self-destructive product of learning (Levinthal/March 1993). Focusing on exploitative activities can hinder the firm's long term viability as exploratory activities of new competencies and the development of radical innovations allay (Levinthal/March 1993).

4.2 Failure Trap

Entrepreneurial agility and exploratory concepts: Representative quotes provide insights into the 'failure trap'. The broad range of possible outcomes within exploratory concepts provides a level of failure, which in turn promotes the search for even newer ideas and thus more exploration, thereby creating a "failure trap" (Gupta et al. 2006; Un 2007). To be able to operate solely in exploratory concepts is only possible when entrepreneurial agility prevails. The following quotes represent both constructs found in our case study.

> *"Innovations, such things occur if you get along well with people or just meet with people cross-departmental and often just sit together and [...] everyone contributes." (P4)*

> *"[...] on Mondays, we have a two-hour appointment, you can call it synchronization, it is basically an exchange of ideas and information what happened in this division [...] interdisciplinary." (P11)*

In practice, organizations often underestimate failures (Assink 2006) and the risks of failure (Levinthal/March 1993). Following Levinthal and March (1993), three features can trap an organization in an endless cycle of failure. First, organizations tend to see new ideas as bad ones, so most innovations are unrewarding. Second, the return from any innovation is poor until experience has been accumulated in using them. Third, aspirations adjust downward more slowly than they adjust upward and exhibit a consistent optimistic bias (Lant, 1992).

4.3 Improvement Trap

Entrepreneurial agility and exploitative concepts: Organizations often face the challenge of defensive routines coming along with learning, thus resulting in resistance to change and in self-repeating patterns (Brady/Davies 2004). Actions that result in improving performance are repeated until they become standardized or routine operating procedures (Cyert/March 1963) and finally result in unreflectively behavior and automation. This prevents organizations from adapting to a changing environment (Brady/Davies 2004) and leads to stagnation.

> *"You'll always get reminded automatically by the program to report an innovative idea. So the enforcement that you report, works pretty well". (P15)*

> *"Usually we have small adjustment steps, more energy, and then something new. Therefore, the developer has little room for innovation." (P15)*

> *"There is no fixed structure, as one might know from other areas which already exist a long time. But that is a good thing. Nobody is trying to impose violently any structure before you know that it makes sense. This flexibility and agility has brought [AUTO] quite far forward." (P1)*

The improvement trap shows the incompatible structures reflecting entrepreneurial agility. Automation and unreflective behavior do not accord to entrepreneurial structures resulting in antagonistic consequences. Therefore organizations or business units with prevailing entrepreneurial characteristics suffer when performing in exploitative concepts.

4.4 Disruption Trap

Adaptive agility and exploratory concepts: Most often, disruptive growth opportunities lie outside a company's current technology base and markets (Assink 2006). Therefore a multiplicity of existing routines that are embedded in the organization's values and culture need to adapt. This implies that the challenge for a company lies in recovering from this disruption as a threat to the status quo. We found several quotes which represent the combination of exploratory concepts and adaptive agility.

> *"Actually, we do not discuss innovations which we really want to do. If we need a signature we will get it, if not we take a dummy signature. You just need to find somebody who is quickly signing it." (P18)*

> *"There will never be an idea that passes through all these teams." (P19)*

> *"If we then hawk [with an idea] somewhere, and this is not an official task - and that is really a problem in the business - it is not described as a process. That is more a nice to have and actually is regarded as a hobby but actually it is an important issue. This should be a focus of the company." (P7)*

The 'disruption trap' destroys existing competencies and breaks down existing rules of competition (Lyytinen/Rose 2003). Thus companies with a high degree of adaptive agility suffer from continuous efforts to react to profound change. The adaptive characteristics are incompatible with exploratory concepts.

4.5 Transfer

Based on the categorization of the different traps, we found challenges when ambidextrous organizations misapply IT enabled agility. What came down with this finding was the collective call for more dynamic organizational structures. We identified the need for a transfer between explorative and exploitative concepts within IT enabled agility. The following citations represent the findings.

> *"[…] so far, it is a challenge for such a company because the boundaries and ditches between organizational units cannot be kept in the long run. And this can be seen at different points within our organization." (P2/P3)*

The employees reflect the blur of organizational boundaries at AUTO. This statement supports the existence of a transfer from one unit to another in the context of explorative and exploitative concepts. We identified a trend towards fluid structures enabled with IT.

> *"My feeling would be that from advance development side they should think about parameters they want or what the benefit is they want to show to the customer and the developers. I've experienced it, there was no focus, but they have done something which is very colorful, and the interface has not been defined." (P2/P3)*

The important message in the citation is that during the transfer between business units, concrete descriptions regarding parameters or other information are not specified.

> *"The advanced development does somehow float in space, they decide on their own what they want to do, they can decide for themselves, but ultimately they need it, too. This is actually quite a shame, because ultimately we need support from them as well and that's why no one comes to us and asks, "What would you like to have?" This connection between us, it is in the dark, there is no innovation management in the sense that someone really manages it and once makes it transparent, in the way of: what do they really have and what do we need and how everything gets coordinated." (P18)*

Again this employee points out the problem of absent connections between the subunits. No requirements have to be fulfilled before delivering new products, nor exist responsible employees for managing innovation. With the previous citations, we strengthened the suspicion of a transfer from exploratory to exploitative concepts.

> *"[…] important is an organizational bridge from our department to the Technical Development" (P6)*

> *"What is always missing is actually a person at the front, a power promoter and a clear instruction from above "do it now, and like this". We achieve a certain level with this bottom-up approach, but typically if somehow payment gets active, you will fail and that's why I think that AUTO should basically promote the whole topic of innovation through organizational forms differently." (P4)*

These representative quotes indicate the potential demand for altering current organizational forms and adopt an organizational bridge to facilitate the innovation process. IT enabled agility mechanisms fit either exploratory or exploitative concepts when organizing for ambidexterity. Thus, ambidextrous organizations need to facilitate internal knowledge transfer (Argote/Ingram 2000) to achieve competitive advantage through IT enabled agility.

5 Discussion

Competitive advantage requires the ability to transfer knowledge from one business unit to another (Argote/Ingram 2000). We found evidence in literature and in our data set showing this ability as one of the main challenges in organizational ambidexterity and IT enabled agility. It is indispensable for an organization aiming at competitive advantage to introduce a

multilevel approach, complementary tactics, and learning synergies (Andriopoulos/Lewis 2009). In practice, ambidextrous organizations struggle with the interplay of exploratory and exploitative concepts and how to organize IT enabled agility. However, in order to maximize the success of being innovative, the transfer from one to another phase has high practical relevance. With this research we show that ambidextrous organizations establish incompatible IT enabled agility structures when organizing for innovations. The challenge is to continually adapt the organizational and technological capabilities (Venkatraman 1994) in an adequate manner avoiding antagonistic consequences. By allowing knowledge to transfer between phases, quality will improve and organizations are able to achieve business excellence (Sher/Lee 2004). Therefore, organizations need to foster managerial and technical IT capabilities in order to achieve improved agility (Tallon 2008).

There are several limitations to take into account within this research. External validity suffers due to the fact that a single case study was conducted. In future research we will address multiple sources of evidence (Yin 2009) by adding archive data from AUTO. Research limitation arises because of the obvious fact that the case study was conducted in a specific industry, namely the automotive section. Therefore, caution must be applied given the limitations in industry and location. Resuming the previous limitations, a number of consequences for future research emerge. A multiple case study would provide further insights into structures and concepts of organizational ambidexterity and IT enabled agility. If these findings are consistent with ours, patterns for avoiding the traps could be investigated. This would result in approaches to perform the transfer phase adequately. However, the proposed ambidextrous agility model provides further room for investigation.

6 Conclusion

Although there has been a surge of interest in ambidextrous organizations, research knows relatively little about the correlation with IT enabled agility. The focus of this research was on the difficulty of capturing value from IT enabled agility despite being ambidextrous. This paper supplements research by demonstrating an uninvestigated research theme when delivering ambidextrous concepts in an entrepreneurial and adaptive agility organization. Summarizing, we found that (1) entrepreneurial agility impedes exploitative concepts, (2) adaptive agility impedes exploratory concepts and (3) ambidextrous organizations exhibit structures that allow them to transfer results from exploratory to exploitative activities through IT enabled agility. Our ambidextrous agility model shows the necessity to organize for a permeable organizational structure. In general, the topic of transferring exploratory to exploitative concepts with IT enabled agility is rarely considered in literature. Showing the existence of a transfer, this paper extends past literature that concentrates on either one of the concepts (Assink 2006; Atuahene-Gima 2005). This research contributes to theory by showing that IT enabled agility mechanisms need to be reconsidered when organizing for ambidexterity. Our research supports literature which treats IT enabled agility as an indispensable ingredient in organizational ambidexterity to achieve competitive advantage (Sambamurthy et al. 2007).

Publication 3

A Situational Perspective on Workarounds in IT-enabled Business Processes: A Multiple Case Study

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Abstract

Workarounds are still one of the most puzzling phenomena in business process management research and practice. From a compliance perspective, workarounds are studied as control failure and the cause for inferior process quality. From a process reengineering perspective, however, workarounds are studied as an important source of process improvement. In this paper, we advance recent theory on the emergence of workarounds to resolve this puzzle by analyzing empirical evidence from a multiple case study. Our analysis reveals that employees utilize workarounds based on a risk-benefit analysis of the situational context. If the realized benefits (efficiency gains) outweigh the situational risks (exposure of process violations), workarounds will be perceived as process improvement. Erroneous risk-benefit analysis, however, leads to exposure of the same workaround as control failure. Quite unexpectedly, we found that information systems serve as critical cues for the situational balance of benefits and risks. Our result suggests that process-instance-level workarounds are treated as options that are engaged if the situation permits, in contrast to process-level workarounds that manifest as unofficial routines. We also contribute the notion of situational risk-benefits analysis to the theory on workarounds.

Keywords: workaround, situational context, multiple case study

Individual Contribution of Doctoral Candidate: In the case study the doctoral candidate contributed throughout the publication within the introduction, theoretical background, conducted the method, introduced the results and discussed the findings. As interviewer she conducted the interviews and analyzed them in order to provide profound research results. She included the thoughts and ideas from the co-authors.

1 Introduction

Workarounds as deviations from defined routines in business processes are still one of the most puzzling phenomena in business process management research and practice (Sadiq et al. 2007; El Kharbili et al. 2008; Afflerbach et al. 2013). On a daily basis, managers have to decide whether to tolerate or to contest workarounds. However, research and practice show that workarounds may have vastly different outcomes. They may range from internal shortcomings, e.g., loss of control, facades of compliance, or inferior process quality (da Cunha/Carugati 2009; Bagayogo et al. 2013; Boudreau/Robey 2005) to severe external consequences, e.g., loss of revenue, fraud, or penalties (Hunt/Jackson 2010).

Alter (2014) suggests a theory of workarounds consisting of five 'voices' that reflect the dimensions and integrate extant research on the consequences of workarounds (Augsdorfer 2005; Campbell 2011; Ortbach et al. 2013a; Ansari et al. 2010; Azad/King 2008; Boudreau/Robey 2005; Ferneley/Sobreperez 2006). While this theory provides a structure for analyzing workarounds, we still lack a deep understanding of how and why workarounds occur in organizations (Tucker/Edmondson 2003; Sobreperez et al. 2005; da Cunha/Carugati 2009) (Augsdorfer 2005; Campbell 2011). We further lack an understanding of the role of information systems (IS) in the emergence of workarounds.

We focus our investigation on the outcomes of workarounds in formalized business processes. Formalization is intended to increase control and reduce outcome variation, which makes workarounds in formalized business processes particularly interesting to study. Usually, IS play an important role in establishing formalized processes (e.g., through workflow management systems). Workarounds in less formalized business processes such as ad-hoc or creative processes are usually associated with positive outcomes (Miller/Wedell-Wedellsborg 2013; Kirsch 1996). In contrast, workarounds in formalized processes are usually associated with negative outcomes (Wiesche et al. 2013). Still, managers chose to tolerate this type of workarounds. Following a replication logic, we use Alter (2014) as a framework to empirically investigate a diverse selection of formalized business processes (Eisenhardt 1989; Yin 2009).

We ask the research question: *How does Alter (2014) help in understanding how and why employees enact workarounds in formalized IT-enabled business processes?* We conduct a multiple case study in three organizations to answer our research question. We follow the guidelines by Eisenhardt (1989) for study design, case selection, as well as data access, gathering, and analysis. We found the work of Alter (2014) useful in enhancing our understanding of workarounds. However, our analysis revealed that employees utilize workarounds based on a risk-benefit analysis of the situational context. Quite surprisingly, we found that features of IS play an important role in this risk-benefit analysis.

We structure the remainder of this paper as follows. First, we describe the theoretical foundation for studying our research question. We then explain our multiple case study strategy, describe our sample, and outline our core analytic tenets. In the results section, we present our empirical results on workarounds in our case organizations and the cross-case

analysis. In the discussion, we reflect on our findings and offer theoretical explanations for our observations, discuss implications for theory and practice, and outline limitations. We conclude the paper by highlighting the key results of this paper and present worthwhile avenues for future research.

2 Theoretical Foundation

Early definitions coined workarounds in formalized business processes as “misfits with the idealized representations of work” (Gerson/Star 1986, 266) or as “nonstandard procedures operators devise to compensate for system deficiencies” (Courtright et al. 1988, 1150). Thus, workarounds have been studied mostly from an ex-post perspective as process violations (Cooper/Zmud 1990), technological change processes (Pfaffenberger 1992), resistance to process design (Sobreperez et al. 2005; Bagayogo et al. 2013), the emergence of shadow systems (Boudreau/Robey 2005), and improvisations in processes (da Cunha/Carugati 2009). Other researchers report on different consequences of the same workaround within the same business processes and how organization treat the workaround based on the consequences (Ferneley/Sobreperez 2006; György et al. 2012). More recent approaches define workarounds as goal-driven changes to defined routines in business processes (Alter 2014). The basic assumption in literature is that employees generally tend to resist control based on different goals (Ignatiadis/Nandhakumar 2009; Davenport 1993). Researchers suggest primarily organizational factors that contribute to this resistance such as lack of accountability, drift, and loss of control (Jenkins/Durcikova 2013; Azad/King 2012; Boudreau/Robey 2005).

Additionally, the increasing ubiquity of information systems in business processes aggravates the opportunities for workarounds. Employees engage in workarounds to cope with a perceived poor fit of technology and process (Safadi/Faraj 2010; Vogelsmeier et al. 2008). Information systems also increase the risk of illusion of control, which means that information systems present information that do not reflect the actual process instances (Sobreperez et al. 2005). Similarly, employees exploit information systems to build ‘facades of compliance’, which means that employees use information systems in order to feign compliance (da Cunha/Carugati 2009).

Few studies approach workarounds from a holistic perspective. Martin et al. (2013a) provide a synthetic typology of rule-breaking and enforcement that focuses on organizational deviance but lacks a management perspective. Ferneley and Sobreperez (2006) distinguish harmless, hindrance, and essential workarounds from a user perspective. Alter (2014) is one of the first to suggest a comprehensive theory of workarounds that structures the state of knowledge on workarounds. Alter (2014) develops five ‘voices’ of workarounds to structure phenomena associated with workarounds, types of workarounds, direct effects of workarounds, different perspectives on workarounds, and subsequent organizational challenges and dilemmas related to workarounds (see Figure 13).

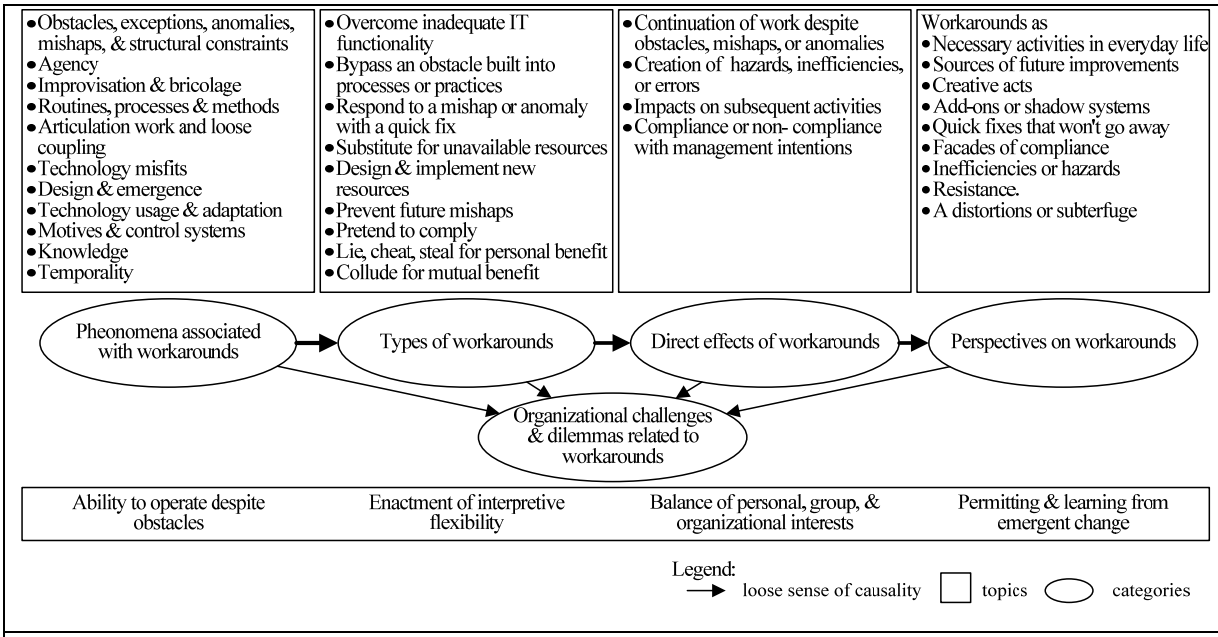

Figure 13: Five Voices of Workarounds
(Source: Alter 2014)

The ‘phenomena’ voice covers the range of antecedents of workarounds, e. g., routines that are perceived as inefficient by employees (Azad/King 2008). The ‘types’ voice provides a classification scheme for workarounds based on the operational objective affected by the workaround, e.g., employees bypass perceived obstacles to safeguard their own efficiency (Saleem et al. 2011). The ‘direct effect’ voice structures consequences and implications of workarounds, e. g., employees do not follow guidelines in order to get their work done (Sobreperez et al. 2005). The ‘perspectives’ voice structures the management perspective on workarounds, e. g., workarounds could be seen as sources of future improvements (Safadi/Faraj 2010). Finally, the ‘organizational challenge and dilemmas’ voice structures organizational challenges that arise from workarounds, e. g., employees seeking a maximum of flexibility in interpreting routines potentially induce loss of control (Campbell 2012).

While Alter’s (2014) theory provides a useful skeleton for investigating workarounds, there are several puzzling issues with workarounds that remain unresolved and provide the research objectives for this research:

First, we lack an understanding of how workarounds emerge. Leonardi (2011) argues that employees engage in workarounds when they perceive a low helpfulness of the routines and policies in an organization. Ansari et al. (2010) differentiate between workarounds in personal-level routines and organizational-level routines. Orlikowski (2000) argues that the recurrent engagement with these routines affect the willingness to engage in workarounds. This is an important issue because Martin et al. (2013a) show that workarounds, which remain uncontested by management, will manifest as unofficial routines.

Second, we lack an understanding of how employees enact workarounds in formalized business processes. While the majority of studies examine workarounds as negative

phenomena that threaten organizational objectives, Alter (2014) also includes positive aspects of workarounds such as process improvements and process innovation (Augsdorfer 2005; Campbell 2011). However, most of these studies take an ex-post perspective. We still know very little about the emergence of workarounds. This is an important issue because such an understanding will help to establish more effective organizational routines (Tucker/Edmondson 2003).

Third, we lack a deep understanding of the role of information systems in the emergence of workarounds. Literature primarily studies the negative effects of information systems in workarounds (Petrides et al. 2004; Baker/Nelson 2005; Koopman/Hoffman 2003). Little is known about the role of information systems in facilitating positive effects of workarounds in formalized business processes (Ferneley/Sobreperez 2006). This is an important issue because such an understanding will help to establish design principles that help to develop more effective information systems.

Thus, in this paper we use Alter (2014) as a theoretical lens to study workarounds in a diverse selection of cases. In doing so, we also contribute to the incremental theoretical development of Alter's theory.

3 Research Methodology

This study used a multiple case design to follow a replication logic, where a series of cases is treated as experiments. Each case serves to substantiate or question the conclusions drawn from the other cases (Eisenhardt 1989; Yin 2009). We considered a multiple case study to be more likely to yield a generalizable, robust, and parsimonious understanding of workarounds. We operationalized the current body of knowledge to structure our analysis and additionally explored workarounds using grounded theory techniques (Strauss/Corbin 1998). We see this hermeneutic approach as particularly useful to substantiate and extend the existing body of knowledge on workarounds.

3.1 Study Design

We selected diverse cases of formalized business processes that differ in terms of domain, regulatory density, routinization, process maturity, and rule breaking culture (Alter 2014; Ortbach et al. 2013a). When crafting our instruments and protocols, we triangulated perspectives on workarounds, including management, employee and IT, and compared multiple sources of data. The most important data sources however were semi-structured interviews since we found workarounds a highly sensitive topic and elaborating on this topic involved a high degree of trust (da Cunha/Carugati 2009). We crafted specific interview questions depending on the context and perspective of the interviewee using both questions that operationalize existing theory and open questions to explore situational conditions in workarounds. We entered the field using flexible and opportunistic data collection methods. In each case, we approached key stakeholders for the workaround topic and followed a snowballing logic to identify further interview partners. In the analysis phase, Alter's theory (2014) guides our within-case analysis. We particularly examined the five voices developed in the framework and identified specific instances of each voice for each workaround in the

case (Table 12). We identified similarities and differences in the cross-case analysis. We sharpened the quality of the predefined constructs by following a replication logic. We identified rationales and explanations for each workaround and particularly focused on the situational context. We further reflected similar and conflicting literature. We reached closure by identifying similar workarounds across cases.

Table 12: Overview of included Cases for this Study
(Source: Own illustration)

	Case 1	*Case 2*	*Case 3*
Description	Common security issues in the health care sector are privacy breaches, especially within information systems.	Fraud causes significant harm to organizations. Organizations implement control mechanisms to prevent incidents and their recurrences.	The innovation management process within the automotive domain is supported by multiple IS, tools, and methods.
Domain	Health Care Industry	Accounting Industry	Automotive Industry
Core Process	Patient Record Process	Accounting Process	Innovation Management Process
Information System	Patient Care Information System, Electronic Health Record, Computerized Clinical Decision Support System	Travel Expense Report System Resource Planning System	Communication System, Ticketing System, Suggestion System, Innovation Platform
Sample	Junior (5) and senior (3) physicians, security officer (1), IT director (1)	Auditor (4), process owner (3), IT architect (1)	Innovation management (5), process owner (8), Sales and Marketing (4), IT architect (1)
Challenge	Physicians balance the potential consequences resulting from a privacy breach and the improvements in effective lifesaving.	Auditors are challenged with an extensive number of false positive fraud incidents and spend high efforts on examining these.	Management enforces formal process to gain oversight of innovation, certain radical inno-vations may not fit these formal process.
Wicked problem	Fear that compliance may hinder lifesaving.	Judgment in testing false positives.	Formalization of innovation management process.
Result	Physicians often ignore privacy guidelines.	Fraud remains undetected.	Most innovations are revealed only in the final stage of the innovation management process.

We selected three cases for our sample (see Table 12). As one of the most studied examples for a domain with flourishing workarounds, we found health care (case 1) to be particularly suitable to start our analysis as physicians talk rather frankly about how they interfere with organizational processes and work around information systems (Safadi/Faraj 2010; Vogelsmeier et al. 2008). In the second case, we focused on accounting processes where workarounds often come with serious consequences for the organization. Finally in case 3, we examined the innovation management process in the automotive domain. We found this process particularly suitable for our research endeavor as innovations often do not fit the intended process but organizations often approach management of innovations in a formalized manner.

Members of the research group conducted interviews with relevant stakeholders, including physicians and IT employees in the first case, auditors, process owners, and IT architects in the second case, and innovation managers, process owner, sales and marketing, as well as IT architects in the third case. Overall, we conducted 12 interviews in case 1, 6 interviews in case 2, and 20 interviews in case 3. We tape-recorded, anonymized, and transcribed all 38 interviews in 352 pages of text. The average interview time was 54.64 minutes (case 1), 42.76 minutes (case 2), and 83.71 minutes (case 3). The average job experience in their role was 12.82 years in case 1, 5.25 years in case 2, and 6.67 years in case 3. Table 1 provides a short description of the case, states domain and sample, outlines the workaround context by illustrating the challenge within the organizational process, synthesizes the wicked problem that the involved parties face, and the consequence from this situation.

Following recommendations for multiple case studies (Eisenhardt 1989; Yin 2009), we used the theory of workarounds (Alter 2014) for the confirmatory analysis and focused on the situational aspect of workarounds in the exploratory analysis. We wrote individual case write-ups that triangulated all data and used Alter's five voices (2014) as coding scheme for the interviews. In each case, we identified workarounds and coded each characteristic with the corresponding voice. Our analysis involved 238 codes in total, on average 7.5 per workaround in case 1, 13.25 codes per workaround in case 2, and 6.8 codes per workaround in case 3. We applied the guidelines of open coding and identified categories related to dynamics of workarounds without forcing existing concepts from the literature onto the data (Strauss/Corbin 1998). In our cross-case analysis, we identified similarities in workarounds in different cases and identified the situational aspects of workarounds across all three cases.

4 Results

4.1 Workarounds in Health Care

In the context of health care, we examined how physicians in hospitals use information systems. We examined several workarounds in case 1. The first workaround - *download data* - we observed in the health care case involved physicians who copy patient records from the secure information system onto private storage systems. The hospital implemented an information system in order to store and process all patient records. Physicians do not need to download any confidential information from the system. However, physicians copy patient

records onto USB sticks or send it via e-mail. They send records to colleagues to ask for their opinion or take the patient record home for further investigation. We found that this workaround changed depending on the physical infrastructure (whether the USB port was activated or not) and system functionality (whether the physician was able to copy data from system). The second workaround – *data access reason* - occurs when physicians access patient records: When opening a patient record in the system, physicians are asked to provide a reason for accessing this particular file. Thereby, management was able to trace access to patients' records. We observed that physicians leave this field blank or fill in replacement characters. Other physicians copy and paste reasons form other records or include abstract descriptions such as 'important'. This occurs particularly often in routine cases, e. g., during ward rounds or when admitting new patients. We found that in situations that are considered normal and routine such as ward rounds, physicians do not provide real arguments. When a physician works on a different ward or accesses records from patients who are not in his regular set of patients, an explicit reason is included in the field. The third workaround – *password security* – refers to situations when physicians do not ensure the confidentiality of their passwords. Passwords are stuck to the screen, hidden beneath the keyboard or openly shared with other team members. We observed cases in which the initial password set by the administrator was not changed at all. The IT experts even estimated, that most of the physicians do not change their initial password. We observed, what we referred to as 'VIP flag' indicator as driver of this workaround. The hospital information system comprised a field that marked certain patients as important. As long as this field was not marked, passwords security was not considered important among physicians. The fourth workaround – *standard password* – refers to a standard password that allows users access to all functions and data. The standard password was intended for emergency situations, but is often also used when physicians do not have access to certain functions, when employees work on different wards or when interns are trained in a ward.

For each workaround, we identified the five voices to fully understand how the workaround occurred. Table 13 provides an example of how we mapped the concepts to the interview data in the case of our hospital case. Regarding the phenomenon associated with the workaround, we found different occurrences. We coded the fact that sensitive patient data is distributed with the 'technology usage and adoption' characteristic, because we found differences between the intended and actual use of technology. Similarly, we identified the temporary use of the standard password as 'temporality'. We identified the voice type of workaround as 'bypassing an obstacle' when physicians download information from the system and thereby bypass organizational guidelines and when using the standard password in regular day-to-day situations. We identified 'pretend to comply' when physicians enter irrelevant information in the data access reason field and when physicians share their passwords. The voice effect of the workaround was 'non-compliance with management intentions' in all four cases, for example when ambiguous data access reasons prohibit traceability of patient record access reasons. The perspective voice was considered as 'inefficiencies or hazards' for the download data workaround as the defined process within the system hinders physicians in their day-to-day work. Finally, the organizational challenge voice is different across all cases. In the download data case, the challenge 'enactment of interpretative flexibility' lies in creating

awareness among physicians. The challenge of 'balance of interests' occurs in the standard password workaround, where the differentiation between emergency and standard process is highly influenced by stakeholders' interests. Table 16 provides an overview of characteristics of all workarounds. In the first three columns, we introduce the case domain (health, accounting and automotive), the name of the workaround and a short description. The next five columns, combined as 'Five Voices', represent our coding based on Alter (2014). We introduce the workaround in general (*italic text in cell*) and the classification according to Alter's (2014) five voices (underlined text in cell). In the last column, we highlight the 'Enactment Criteria' which refers to IS that serve as critical cues for the situational balance of benefits and risks.

Table 13: Illustrative Workaround in Health Care
(Source: Own illustration)

Workaround	*Illustrative quote*	*Code (italic) and corresponding voices (underlined)*
Download data	"If someone has a PC and wants their USB port to be unlocked then they has to sign with me that they is also responsible for the consequential costs, e.g. if they introduce a virus or the like. However, this PC can also be used by someone else who brings his USB as well […] And then we've had the case that a student introduced something contaminated for him. And I tell him, this is your PC, I have your signature. And he tells me, but I wasn't here at that time, I have proof that I was in the OR."	*create awareness among physicians /* enactment of interpretive flexibility *process hinders daily work /* inefficiencies or hazards
	"And it has happened before that our company was mentioned in the paper or that we attracted negative attention from the state data protection commissioner. Because data from this institute suddenly appeared on the Internet. That's the worst case, of course."	*patient sensitive data distributable /* non-compliance with management attentions

4.2 Workarounds in Accounting

The second case deals with observations of employees obtaining fraud in the enterprise software sector (Table 14). The first workaround – *supplier effort* – represents the case in which the supplier side uses split payment accounts as a way to avoid additional effort when charging the organization with bills. Suppliers with an invoice extending the amount of $12,000 need to fill out an additional form so that the organization can create a data log and tag the supplier as registered for further payments. In this concrete case, the supplier already knew about the threshold and provided two separated invoices each amounting to $6,000 to avoid filling out the form. By doing so, the quantity of split payment accounts is boosted, which leads to greater efforts from an organizational perspective as the challenge lies within identifying concrete invoices afterwards. This workaround is only possible due to the

information on which threshold the organization uses as trigger for saving the supplier information being available to the supplier. The second workaround – *shell account* – is used to obtain money from the organization surreptitiously. Employees store incorrect account numbers in the system to initiate transfers to shell accounts and organizations. Outliers or irregularities are the only way for the organization to identify potential fraud cases. To be able to exclude false positives, e.g., suppliers who have changed their account number and therefore appear in irregularities, auditors have to recheck the data manually. The third workaround – *facilitate invoice* – deals with issues in which employees use split payment accounts instead of stock accounts. This is the case when stock accounts are not traceable on the first attempt in the system. Employees are frustrated and see the detection of the right account as hindrance of their work. Therefore they use the option to book the invoice as split payment entry as facilitator. Knowing the threshold is located at $12,000 they are able to split the invoice into several withdrawals. From an organizational perspective, the number of executed workarounds rises when the threshold is increased. Keeping the amount to a minimum and checking for reoccurring withdrawals is an attempt to prohibit this workaround. Within the fourth workaround – *trickster* - fraud occurs when managers embezzle money for their own benefit. In the concrete case, the manager found an accomplice in a supplier and was able to defalcate funds using unnoticed repayments. The organization lost a large amount of money. After some years, the incident was detected when paper-based documents were found, containing all the information.

Table 14: Illustrative Workaround in Accounting
(Source: Own illustration)

Workaround	*Illustrative quote*	*Code (italic) and corresponding voices (underlined)*
Facilitate invoice	"Of course that's a kind of routine as well. If I get handed a bill that's lower than $12,000 that I'm supposed to enter and I look for the core dataset and can't find it, then I'll use the one-time supplier. That's a kind of routine that, like I said, is only based on the value limit."	*use split payment account optionality /* obstacles, exceptions, anomalies, mishaps, and structural constraints *unsuccessful attempts to find stock account /* bypass an obstacle
	"Yes, because simply put, I think by now we're talking about 24,000 core datasets that are being maintained in our system. Many of those are virtually unused by now. For many of those it was realized that they were used for one year and then no one needed them anymore […] if the goal is now supposed to be the reduction of the core datasets, the logical conclusion is: more entries using the one-time supplier […] However, you always have either too many entries using the one-time supplier or too many core datasets."	*optionality leads to overrun /* facades of compliance

Each workaround identified in this case was mapped to the five voices (see Table 16). To provide insights on how we preceded the classification will be explained. In the case of the enterprise software workarounds, we found fraud to be the predominant factor. Having a closer look at the phenomena associated with the four workarounds, we coded two characteristics, namely 'obstacles, exceptions, anomalies, mishaps, and structural constraints' and 'technology misfit'. Obstacles are represented on the one hand by a high effort to save supplier information and on the other hand by difficulties when tracing stored information. As technology misfit we used the fact that it is possible to enter incorrect or different account numbers and the possibility to execute repayment. In investigating the type of workaround we coded the detail that employees initiate bank transfer to shell accounts or organizations as 'lie, cheat, steal for personal benefit'. We did so because the characteristic of this code represents the underlying concept of fraud. The same type was applied when employees use the support of suppliers to perform private repayment, resulting in illegal transactions. Both workarounds with obstacles as phenomena have been coded with the type 'bypass an obstacle'. They try to overcome the hindrance by using split payment accounts when the attempt to find stock account fails or they break down the amount to enter the bill. Focusing on the effect, again we found two characteristics. 'Continuation of work despite obstacles, mishaps, or anomalies' applies when suppliers and employees use split payment accounts instead of stock accounts. 'Non-compliance with management intentions' can be attributed to the workarounds in which employees do not conform to regulations. The perspective in which both fraud workaround cases were classified is identical as well. We used the characteristic 'inefficiencies or hazards' as perspective to explain illegal transaction. The aspect 'facades of compliance' is used when amounts are split to fit the threshold of split payment accounts. 'Balance of personal, group, and organizational interests' and 'enactment of interpretive flexibility' have been identified as organizational challenges. The dilemmas regarding the split payment accounts are facing the flexibility vs. control mismatch. Referring to balance, we find deviations in personal and organizational interests.

4.3 Workarounds in Automotive

We examined the innovation management process in one automotive organization for workarounds (case 3). The first workaround – *innovation camouflage* – refers to innovators who enter their innovative ideas in information systems to handle change requests. They do not use the defined formal process for collecting innovations within the organization. Innovators use this process because it is less complex and requires less information. From former innovations, they learned that new innovations require laborious top management approval and thus, disguise innovations as change requests increase the chances of getting the innovation implemented. We found that the decision to consider this workaround is influenced by the manner in which the innovative idea fits in with the innovation management process. The easier the idea can be entered into the innovation management process, the higher the chances are of actually using this process. The second workaround – *standard application* – occurs within the IT department when implementing innovative services. The department using the innovative service often requires certain functionalities that are unique to their setting. Consider for example a service that requires a specific certification for operation. The IT department is challenged with an individual certificate that requires

individual support and does not meet the standard platform configurations. The IT department thus implements standard certificates, but pretends to implement individual certificates. We found that the IT department exercises this workaround when the service department is not able to determine whether a standard application is implemented or not. The third workaround – *reap resources* – occurs during the planning of new applications. When estimating calculation and storage capacity for new applications, employees often exaggerate numbers. In our example, exaggerations reached almost 400% of the actual capacity needed. When asked about their motives, interviewees answered that they do not trust other departments that use the same capacities. Since everybody exaggerates, the whole capacity will be reduced by a certain percentage. If they would not exaggerate, their actual capacity would be reduced. We found that the lack of trust between departments encourages this workaround. Finally the fourth workaround – *functionality integration* – occurs in the implementation of new applications. Organizational guidelines state that functions in new applications cannot use other new functions in order to reduce dependencies. Programmers implementing new functions A and B that are supposed to use one another are often implemented with a new function C that proxies the corresponding functionality. We found that programmers use this workaround when they feel confident that the functions are working properly.

Table 15: Illustrative Workaround in Automotive
(Source: Own illustration)

Workaround	*Illustrative quote*	*Code (italic) and corresponding voices (underlined)*
Reap resources	"The person responsible for hardware brought matter to a head. He had to develop the function host, on which all 20 functions would run in parallel, and he wanted to know in the first months how much computing time everyone needed […] and then everyone put a proper markup on their function and as a result we had 400% CPU load. Of course there was a huge uproar then […] therefore my opinion: it can only work if everyone trusts one another. That the system component developers don't have to be afraid that some kind of hardcore functions are created by the function late in the game, and at the same time the function developers mustn't be afraid of being pinned down to their promises."	*resource specification overestimated* / knowledge *trust in correct resource specification of all stakeholders* / balance of interests

For each workaround, we identified the five voices (summarized in Table 16) to fully understand how the workaround occurred. Table 4 provides an example of how we mapped the concepts to the interview data. Regarding the phenomenon associated with the workaround, we found different occurrences. We coded the act of disguising innovations in change requests as 'deviations of routines, processes, and methods', as innovators ignore organizational routines and processes when using different information systems. In this case, the type voice is categorized as 'bypass an obstacle' as the adopted process increases the chances of getting the innovation implemented. The effect voice differs across workarounds.

We found impacts on subsequent activities in the innovation camouflage workaround when the innovative idea is considered as extension of an existing product and in the reaping resources case when the deadlock of too much occupied capacity occurs. In the functionality integration workaround, we coded the effect as ‘continuation of work’ as the missing integration of functionalities hinders programmers in doing their job. In case 3, the façade of compliance perspective dominated our sample workarounds. In the innovation camouflage case, employees are redesigning their innovative idea as an extension to an existing product, and the new function C in the functionality integration workaround formally fulfills the guidelines of not directly interacting with other new functions. The organizational challenge voice differs from ‘interpretive flexibility’ by defining the boundary between change request and innovation to ‘balancing personal, group, and organizational interests’ when establishing trust in the case of reaping resources.

4.4 Cross-case Analysis

We compared our cases to identify similarities and differences. We observed similar patterns of behavior in the password security workaround in health care and reaping resources on innovation. While the former occurred in the context of access provisioning, the latter occurred in computing capacity allocation. However, both were caused by different organizational conditions. In the hospital, the hindering factors of compliance motivated physicians to gain additional access rights. In the innovation case, the pro forma gathering was motivated by a lack of trust among organizational units. Similarly, the innovation camouflage workaround in the innovation case and the invoice facilitation workaround in the accounting case bypass obstacles by disguising innovations as change requests and by bypassing existing stock accounts. Both workarounds are conducted in order to reduce efforts, but have different effects (changes in final products vs. non-transparent vendor lists).

Across all cases, we found that specific instances of the workarounds were fundamentally different depending on the situation. In the workaround of physicians who downloaded patient records from the system, we found that physicians either followed the standard procedure and processed data only within the system or downloaded and shared records outside of the system. We found that the workaround was influenced by a technical barrier, which either hindered or allowed certain behavior.

We found that activating the USB port depended on the hierarchical role and network of the employee who uses this computer. The IT employee could not convince senior hospital management to not activate their USB port. Hence, the chance of downloading data workarounds on this particular computer rose. Similarly, in the invoice facilitation workaround, the traceability of the supplier within the information system influenced the decision of exercising the workaround. The innovation camouflage workaround was influenced by how the innovation fits in with the intended innovation management process. The easier the innovation could be integrated into the system, the more likely the intended innovation management process was used.

Upon further examination of these influences, we found that employees utilize workarounds based on a risk-benefit analysis of the situational context. Employees are fully aware of the

consequences of their workaround behavior. Such consequences range from positive aspects such as efficiency gains to negative aspects such as exposure of process violations. Only if the realized benefits outweigh the situational risks, the workaround will be conducted.

5 Discussion

In this research, we used Alter's theory of workarounds to study workarounds in health care management, accounting processes, and innovation management (Alter 2014). While the theory enhanced our understanding of the workarounds, our analysis revealed three advancements:

First, we contribute to a more nuanced understanding of how workaround emerge. In line with Ansari et al. (2010) we differentiate workarounds in process-level routines and process-instance-level routines. We show that workarounds in process-level routines (e. g., setting a standard password known to colleagues) will be enacted once while workarounds in process-instance-level routines will be enacted based on situational factors (e. g., the VIP flag). While Orlikowski (2000) argued that recurrent engagement with these routines affect the willingness to engage in workarounds, we show that the particular situational factors determine whether a workaround will be enacted. This contributes to our knowledge of how workarounds manifest as unofficial organizational routines (Ortbach et al. 2013a). Workarounds on a process-level manifest quickly as unofficial routines. In contrast, workarounds on a process-instance level manifest as options that will be engaged if the situation permits. The distinction of process-level workarounds and process-instance-level workarounds may also serve as an explanation for the dynamics in organizational routines (Lenz/Reichert 2007; Gasser 1986).

Second, we contribute to a more nuanced understanding of how employees enact workarounds. We found that employees engage in situational risk-benefit analyses before enacting workarounds. Employees calculate the potential benefits, e. g., in terms of efficiency gains and the situational risks, e. g., the exposure of process violations. Depending on this calculation, employees will either conduct workarounds (when benefits outweigh risks) or follow the defined process (when risks outweigh benefits). However, when employees misjudge the situation in their risk-benefit analysis, the workaround is exposed as control failure and management has to step in and punish for not following the defined processes. Most interestingly, risk-benefit analyses are being done once for process-level routines and repeatedly in each situation for process-instance-level routines. This contributes to our knowledge about how different perspectives on workarounds may overlap and create organizational conflicts. Risk-benefit analyses may serve as an explanation of the so-called 'balancing loop' of the ongoing process of balancing organizational problem and employee reaction (Tucker/Edmondson 2003). Furthermore, the risk-benefit analysis may serve as an important feedback mechanism in organization improvement (Keating et al. 1999).

Third, we contribute to our understanding of the role of information systems in the emergence of workarounds. We understand IS as an enabler of business processes, which help organizations to support their key business activities. During the risk-benefit analysis, employees are looking for indicators that help them to identify risks and benefits of enacting

the workaround in a particular process instance. We refer to them as *cues*. Our prime example of such a cue is the VIP flag in the hospital. Cues have emerged to realize the efficiency gains from violating business process design and to mitigate risks from doing so. Quite unexpectedly, we found that information systems serve as catalysts for workarounds by providing effective cues for the situational risk-benefit analysis. In contrast to literature where information systems are used to forfeiting surveillance (Sobreperez et al. 2005; da Cunha/Carugati 2009), we find a more enabling role of information systems: Information systems provide information that help employees to make well-grounded decisions on the risks and benefits of enacting a workaround (Lenz/Reichert 2007).

This study advances our knowledge of workarounds in formalized business processes in several ways. First, we establish the usefulness of Alter's theory of workarounds (2014) by empirically substantiating the five voices. We found the theory particularly useful for identifying the relevant dimensions for analyzing workarounds. However, we suggest carefully defining the scope of the characteristics of each voice in order to avoid overlaps. We further found that with the notable exception of the perspective voice, the current voices largely neglect the positive role of workarounds (Campbell 2011; Augsdorfer 2005). Second, we introduce the concept of risk-based analysis in workaround behavior. We further extend knowledge on how and why workarounds occur. Third, we provide arguments for differentiating between process-level workarounds and process-instance-level workarounds. Fourth, we outline the importance of cues in workaround decision-making for process-instance-level workarounds and suggest that information systems play an important role in designing and implementing these cues. Fifth, we outline an enabling effect of information systems on workarounds by asserting and extending knowledge for workaround decision making.

This study has practical implications as well. Before applying the findings to practice, more research is needed to replicate and extend the current findings. Assuming that further research validates our findings, our analysis suggests that managers should differentiate between process-instance-level workarounds and process-level workarounds. While the former allow the implementation of certain cues to influence workaround behavior, the latter point to bad process design and often require redesigning the process. For process-instance-level workarounds, managers should tolerate employees' risk-benefit analyses and even provide additional information for decision-making.

We acknowledge that there are several limitations to our study. Our analysis was based on only 38 interviews in three organizations. Given the exploratory nature of the study and our broad interest in workarounds, this research presents only a first step toward understanding the emergence of workarounds in organizations. We further acknowledge that, while comprehensive and well-grounded in literature, the theory of workarounds may not be as useful as other theories. Further research might study workarounds from an bureaucratic perspective (Ortbach et al. 2013a; Gouldner 1954).

Table 16: Workarounds in the Health, Accounting and Automotive Industry
(Source: Own illustration)

	Workaround	Description	Five Voices					Enactment criteria
			Phenomena	Type	Effect	Perspective	Org. Challenge	
Health	Download data	Physicians copy patient data from the secure information system	Sensitive patient data gets distributed / technology usage and adaptation	Physicians download data form system / bypass an obstacle	Patient- sensitive data distributable / non- compliance with management intentions	Process hinders daily work / inefficiencies or hazards	Creating awareness among physicians / enactment of interpretive flexibility	USB port partially a ctivated
	Data access reason	Physicians do not provide reason for accessing patient	Request for data access does not check for content / motives and control systems	Physicians insert irrelevant information / pretend to comply	Overcome traceability / non-compliance with management intentions	Checking not enforced by system / sources of future improvements	Distributing correct interaction / permitting and learning from emergent change	Anomal behavior/ access
	Password security	Physicians do not ensure confidentiality of password	Log ins are shared / improvisation and bricolage	Physicians share passwords / pretend to comply	Prohibit data access documentation / non- compliance with management intentions	Too complex to keep password in mind; fear of forgetting password in important situations / necessary activities in everyday life	Emphasis on importance of password handling / ability to operate despite obstacles	x
	Standard password	All employees in the ward use standard passwords	Standard password for emergency situations / temporality	Possibility to use stationary password is used in general / bypass an obstacle	Prohibit data access documentation / non- compliance with management intentions	Option to ease daily tasks / inefficiencies or hazards	Definition of exceptional cases / balance of personal, group, and organizational interests	VIP flag
Accounting	Supplier effort	Split payment accounts as facilitator – supplier perspective	High effort to save supplier information / obstacles, exceptions, anomalies, mishaps, and structural constraints	Breakdown order to pass split payment analysis is (less than 12.000$) / bypass an obstacle	Registered suppliers pass split payment analysis / continuation of work despite obstacles, mishaps, or anomalies	Suppliers facilitate invoicing / facades of compliance	Dealing with problem specifications / enactment of interpretive flexibility	Supplier information stored in system
	Shell account	Store deviating account number	Enter deviating account number / technology misfit	Initiate bank transfer to unofficial account / lie, cheat, steal for personal benefit	Violated law/regulations / non-compliance with management intentions	Harm company by steeling / inefficiencies or hazards	Preventive system / balance of interests	x
	Facilitate invoice	Split payment accounts as facilitator – employee perspective	Use split payment account optionality / obstacles, exceptions, anomalies, mishaps, and structural constraints	in vain attempts to find stock account / bypass an obstacle	Stock account is not used but multiple split payment transactions / continuation of work despite obstacles, mishaps, or anomalies	Optionality leads to overrun / facades of compliance	Dealing with unambiguous assignment / enactment of interpretive flexibility	Supplier in system traceable
	Trickster	Managers defalcate funds	Illegal repayment / technology misfit	use supplier to perform private repayment / lie, cheat, steal for personal benefit	High expenses / non-compliance with management intentions	Harm company by stealing / inefficiencies or hazards	Preventive system / balance of interests	x
Automotive	Innovation camouflage	Innovations are treated as change requests	Desired innovation as change request / routines, processes and methods	process provides opportunity to extend product / bypass an obstacle	Modifies original service/product / impacts on subsequent activities	Possibility to integrate other innovations / facades of compliance	Boundary between change request and new innovation / enactment of interpretive flexibility	Fit of innovation in process
	Standard application	IT department pretends to implement standard application	Implementation requirement not realizable with standardization / improvisation and bricolage	standardization needed for future maintenance / pretend to comply	Implementation looks like conformity / continuation of work despite obstacles, mishaps, or anomalies	Pretend to include intend requirement / facades of compliance	Justification of implementation / ability to operate despite obstacles	Transparency and detection probability
	Reap resources	Pro forma gathering of resources during planning phase	Resource specification overestimated / knowledge	overestimation to defend own function / prevent future mishaps	Overestimation leads to “dead lock” / impacts on subsequent activities	Fear to lose rights for additional capacity / resistance	Trust in correct resource specification of all stakeholders / balance of interests	Degree of innovation and uncertainty
	Functionality integration	Bypassing requirements by additional component	Functionality only possible within custom design / routines, processes, and methods	implementation of additional functionality to provide data / pretend to comply	Requirement not considered / continuation of work despite obstacles, mishaps, or anomalies	Easier to test/implement / facades of compliance	Deal with problem specifications / balance of interests	Personal knowledge

6 Conclusion

We contribute to a more nuanced understanding of workarounds as one of the most puzzling phenomena in business process management research and practice. We advance Alter's theory on workarounds (2014) to resolve this puzzle by analyzing empirical evidence from a multiple case study. While we found Alter's theory useful in enhancing our understanding of the workarounds, the analysis revealed that employees enact workarounds based on a risk-benefit analysis of the situational context. We contribute to a more nuanced understanding of how workaround emerge by differentiating workarounds in process-level routines and process-instance-level routines. During the risk-benefit analysis, employees look for indicators that help them to identify risks and benefits of enacting the workaround in a particular process instance, which we refer to as cues. We found that information systems serve as important cues that guide this risk-benefit analysis. For future research, we suggest to further examine the distinction between process and instance workarounds, the role of cues in workaround enactment, and how IT can facilitate or inhibit this enactment.

Publication 4

Why Managers Tolerate Workarounds – The Role of Information Systems

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Abstract

Workarounds as deviations from defined routines in business processes challenge standardization and thus the performance improvements expected from information systems. Literature associates workarounds predominantly with performance losses. Only few studies report on performance improvements from workarounds. However, what characterizes situations in which managers tolerate workarounds to yield potential performance improvements? This study examines situations in which managers are able to decide whether to tolerate or to prohibit workarounds. We report on a multiple case study in two organizations and use existing research on workarounds to structure our analysis. Building on this, we show that expected efficiency gains, exposure to compliance risk and perceived process weakness have an effect on the willingness of management to tolerate workarounds. We develop a model that illustrates important aspects of situations that influence this willingness and outlines the role of information systems in understanding workarounds.

Keywords: Workaround, tolerance, routinization, standardization, management

Individual Contribution of Doctoral Candidate: Within the publication the doctoral candidate contributed to the introduction, theoretical background, conducted the method, introduced the results and discussed the findings. As interviewer she conducted the interviews and analyzed them in order to provide profound research results. She included the thoughts and ideas from the co-authors.

1 Introduction

An important reason for organization to implement information systems (IS) is to standardize business processes, which results in performance improvements (Münstermann et al. 2010; Bala/Venkatesh 2007; von Stetten et al. 2008). Workarounds as deviations from defined routines in business processes challenge standardization and thus threaten the performance improvements from IS (Ignatiadis/Nandhakumar 2009; da Cunha/Carugati 2009; Alter 2014). Workarounds result in loss of control (Lapointe/Rivard 2005), reduced productivity (Bagayogo et al. 2013), and deviations from the intended business process purpose (Ciborra 2000). While this negative perspective on workarounds predominates literature, there are also studies that show positive aspects of tolerating workarounds (Alter 2014)

Several empirical studies outline benefits from tolerating workarounds on organizational performance. Miller and Wedell-Wedellsborg (2013) argue that radical innovations may need to violate existing organizational standards and processes in order to succeed. Huuskonen et al. (2013) show improvements in daily operations due to misaligned IS. McGann et al. (2008) report on the implementation of an information systems in a manufacturing plant and experienced workarounds as process improvements. Similar examples occur in public sector organizations as well (Campbell 2011).

Hence, managers respond differently to workarounds based on their situational context (Mainemelis 2010). Some workarounds are tolerated by management, others are prohibited. In three cases across different industries, Pittenger et al. (2011) show that managers tolerate noncompliant behavior as long as organizational standards and processes are hindering employee value creation. In contrast, in a hospital, management enforces the standardized processes of IS in order to reduce medication errors (Yang et al. 2012). Other researchers report on challenges of workarounds that have different consequences within the same business processes and thus have to be treated differently (Ferneley/Sobreperez 2006; Györy et al. 2012).

In this context, it is unclear how managers decide on tolerating or prohibiting workarounds (da Cunha/Carugati 2009). While there are several promising theoretical models that encounter this issue, they lack empirical validation. Bagayogo et al. (2013) propose a model that combines acceptance and resistance with individual and organizational impacts. Similarly, Martin et al. (2013) suggest a theory of bureaucratic rule-breaking, but call for empirical research in understanding the role of workers, management, and external pressures. Building on creativity and deviance literature, Mainemelis (2010) suggests a model for ambivalent noncompliant behavior with uncertain consequences and suggests to explore the role of managers in treating these noncompliant behavior based on contextual and situational characteristics.

In this research, we examine managers' decision making in tolerating and prohibiting workarounds. We answer the research question of *which factors influence manager's decision on tolerating or prohibiting workarounds?* We conduct a multiple case study (Yin 2009) in two organizations and examine workarounds, which were not purely negative but also had

positive consequences for the organization. We used a process theory (Alter 2014) that comprises a thorough review of the literature to structure our analysis and use analytical induction to uncover new constructs and relationships that enrich our understanding of managerial workaround decision making. By applying the managerial perspective on understanding workarounds in IS settings, we (1) develop a model to explain managers' willingness to tolerate workarounds, (2) show that workarounds have an ambivalent character which influences management decisions, and (3) show that IS are often used as 'scapegoat' when managers are brought to justice when tolerating workarounds.

We identified three types of factors - expected efficiency gains, exposure to compliance risk, and process weaknesses - that influence managers' willingness to tolerate workarounds. We add a distinction between employee and management perspective to the theory of workarounds (Alter 2014) by analyzing organizational risks and benefits as a basis for managerial decision making. We contribute to the existing body of knowledge on managerial workaround decision making by outlining the role of IS.

2 Theoretical Foundation

Early definitions coined workarounds as "misfits with the idealized representations of work" (Gerson/Star 1986, 66) or as "nonstandard procedures operators devise to compensate for system deficiencies" (Courtright et al. 1988, 1150). Thus, workarounds have been studied mostly from an ex-post perspective as resistance to process design (Sobreperez et al. 2005), or improvisations in processes (da Cunha/Carugati 2009). More recent approaches define workarounds as goal-driven changes to defined routines in business processes (Alter 2014). The basic assumption in literature is that employees generally tend to resist because of conflicting goals (Ignatiadis/Nandhakumar 2009). Researchers suggest primarily organizational factors that contribute to this resistance such as lack of accountability, drift, and loss of control (Jenkins/Durcikova 2013; Azad/King 2012).

Additionally, the increasing ubiquity of IS in business processes aggravates the opportunities for workarounds. Employees engage in workarounds to cope with a perceived poor fit of technology and process (Safadi/Faraj 2010). IS also create an illusion-of-control risk, that is, the information provided by an IS may not reflect the actual process instantiation. (Sobreperez et al. 2005). Similarly, employees exploit IS to build 'facades of compliance', which means that employees use IS in order to feign compliance (da Cunha/Carugati 2009).

Alter (2014) is one of the first to suggest a comprehensive theory of workarounds that structures existing research on workarounds. Workarounds emerge either from obstacles to getting the work done or from goal misalignment of stakeholders. Alter (2014) develops five 'voices' of workarounds to structure phenomena associated with workarounds, types of workaround, direct effects of workarounds, different perspectives on workarounds, and subsequent organizational challenges and dilemmas related to workarounds (see Figure 14). Those different dimensions integrate extant research on the consequences of workarounds (Martin et al. 2013; Ferneley/Sobreperez 2006).

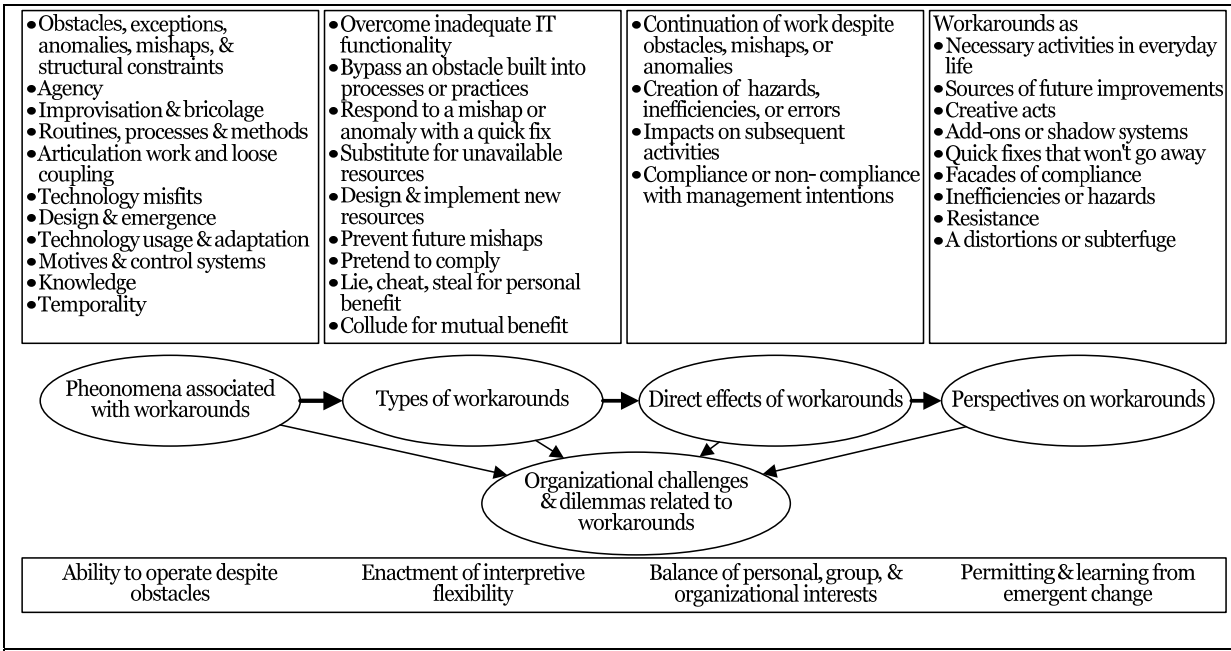

Figure 14: Five Voices of Workarounds
(Source: Alter 2014)

The ‘phenomena’ voice covers the range of antecedents of workarounds. The ‘types’ voice provides a classification scheme for workaround based on the operational objective affected by the workaround. The ‘direct effect’ voice structures consequences and implications of workarounds. The ‘perspectives’ voice structures the management perspective on workarounds. Finally, the ‘organizational challenge and dilemmas’ voice structures challenges that arise from workarounds.

While Alter’s (2014) theory provides a useful skeleton for investigating workarounds, there are several shortcomings in research on workarounds that remain unresolved: (1) we lack an understanding of how managers decide to tolerate or prohibit workarounds. Understanding this phenomenon is a prerequisite for more effective organizational routines (Tucker/Edmondson 2003). (2) While the majority of studies examine workarounds from an employee perspective (Ignatiadis/Nandhakumar 2009), several studies outline the need of applying a managerial perspective. (3) Bagayogo et al. (2013) outline the challenge of misaligned business processes and IS. They find that noncompliant resistance such as workarounds may not only have negative consequences, but may even be beneficial. However, the authors do not examine how managers treat workarounds. Building on creativity and deviance literature, Mainemelis (2010) suggest a model for ambivalent noncompliant behavior with uncertain consequences and suggests to explore the role of managers in treating these noncompliant behavior based on contextual and situational characteristics. Similarly, Martin et al (2013) suggest a theory of bureaucratic rule-breaking, but (4) call for empirical research in understanding the role of workers, management, and external pressures. Finally (5), we lack an understanding of the role of IS in managing

workarounds (Ferneley/Sobreperez 2006). Investigating the role of IS in workarounds will help to establish design principles that help to design them more effective.

3 Research Methodology

In this study we used a multiple case design (Yin 2009), which we considered to be more likely to yield a generalizable, robust, and parsimonious understanding of workarounds. We used Alter's (2014) theory as framework to structure our analysis and additionally explored managerial workaround decision making using grounded theory techniques (Strauss/Corbin 1998).

3.1 Study Design

We selected diverse cases that differ in terms of domain, regulatory density, routinization, process maturity, and rule breaking culture (Alter 2014; Martin et al. 2013). When crafting our instruments and protocols, we triangulated perspectives on workarounds, including management, employee and IT, and compared multiple sources of data. The most important data sources however were semi-structured interviews (da Cunha/Carugati 2009). In each case, we approached key stakeholders for the workaround topic and followed a snowballing logic to identify further interview partners. In the analysis phase, we used Alter's theory (2014) to guide our within case analysis. We identified similarities and differences in the cross-case analysis.

We selected two cases for our sample (see Table 17). As one of the most studied examples for a domain with flourishing workarounds, we found health care (case 1) to be particularly suitable to start our analysis as physicians talk rather frankly about how they interfere with organizational processes and work around IS (Safadi/Faraj 2010). In the second case we studied a supply chain from two perspectives, namely the manufacturer and consulting perspective. Employees are challenged to provide and manage the needed information among suppliers. Overall, we conducted 22 interviews and tape-recorded, anonymized, and transcribed them in 231 pages of text (see Table 17).

Table 17: Case Overview
(Source: Own illustration)

	Case 1	*Case 2*
Domain	Health Care	Supply Chain
Description	Common security issues in the health care sector are privacy breaches, especially within information systems.	The reliability on supplier information is essential in supply chain management.
Interviews	10	12
Sample	Junior (5) and senior (3) physicians, security officer (1), IT director (1)	Management Consultants (7) and Retailers (5)
Average Time	54,64 min	61,28 min
Average Job Experience	12,82 years	8,45 years

Following recommendations for multiple case studies (Yin 2009), we used the existing theory of workarounds (Alter 2014) for the confirmatory analysis and focused on the managerial perspective on workarounds in the exploratory analysis. We wrote individual case write-ups that triangulated all data and used Alter's five voices (2014) as coding scheme for the interviews. In each case, we identified workarounds and coded each characteristic with the corresponding voice. Our analysis involved 152 codes in total, on average 7,5 codes per workaround in case 1, and 4,8 codes per workaround in case 2. We applied the guidelines of open coding and identified factors related to managerial workaround decision making without forcing existing concepts from the literature onto the data (Strauss/Corbin 1998).

4 Results

4.1 Workarounds in Health Care

In the context of health care, we examined how physicians in hospitals use information systems. The first workaround – *download patient record* - we observed involved physicians who copy patient records from the secure information system onto private storage systems. The hospital implemented an information system in order to store and process all patient records. Physicians do not need to download any confidential information from the system. However, physicians copy patient records onto USB sticks or send it via e-mail. They send records to colleagues to ask for their opinion or take the patient record home for further investigation. The second workaround – *maintain standard password* – refers to a standard password that allows users access to all functions and data. The standard password was intended for emergency situations, but is often also used when physicians do not have access to certain functions, when employees work on different wards or when interns are trained in a ward. Besides, this workaround includes the fact that physicians do not change their initial standard password.

For each workaround, we identified the five voices to better understand what constitutes the workaround. Table 18 provides an example of how we mapped the concepts to the interview data in the case of our hospital case. We focus on one workaround as representation for the health case and chose *download patient record*. We coded the fact that sensitive patient data is distributed with the 'technology usage and adoption' characteristic because we found differences between the intended and actual use of technology. We identified the voice type of workaround as 'bypassing an obstacle' when physicians download information from the system via USB port and thereby bypass organizational guidelines The voice effect of the workaround was 'non-compliance with management intentions' as patient sensitive data gets distributable. The perspective voice was considered as 'inefficiencies or hazards' because it hinders physician in their daily work. Finally, the organizational challenge voice is 'enactment of interpretative flexibility' and lies in creating awareness among physicians.

Table 18: Workarounds in the Health, Accounting and Automotive Industry
(Source: Own illustration)

	Work-around	Description	Five Voices				
			Phenomena	**Type**	**Effect**	**Perspective**	**Org. Challenge**
Health Care	Download patient record	Physicians copy patient data via USB from the secure information system	*sensitive patient data gets distributed /* technology usage and adaptation	*physicians download data form system /* bypass an obstacle	*patient sensitive data distributable /* non-compliance with management intentions	*process hinders daily work /* inefficiencies or hazards	*create awareness among physicians /* enactment of interpretive flexibility
	Maintain standard password	All employees in ward use standard password	*standard password for emergency situations /* temporality	*possibility to use stationary password is used in general /* bypass an obstacle	*prohibit data access documentation /* non-compliance with management intentions	*option to ease daily tasks /* inefficiencies or hazards	*definition of exceptional cases /* balance of personal, group, and organizational interests
Supply Chain	Orders based on unofficial forecasts	retailer use own data for forecasts because supplied data is of bad quality and lack transparency	*mistrust existing forecasts /* knowledge	*replace official data with own /* bypass an obstacle	*improve overall predictions for this supplier /* impacts on subsequent activities	*counterbalance deviations in demands /* future improvements	*increase transparency of forecasting /* permitting and learning from emergent change
	Spreadsheet-based product data management	fashion companies use hands-on solution to collect supplier information by sending excel sheet	*high effort to maintain supplier information /* obstacles, exceptions, anomalies, mishaps, and structural constraints	*complex tool to maintain supplier information /* overcome inadequate IT functionality	*tool to maintain supplier information is not used but excel sheet /* continuation of work despite obstacles, mishaps, or anomalies	*lower effort to maintain supplier information /* facades of compliance	*reduce complexity to increase information traceability /* balance of interests

4.2 Workarounds in Supply Chain

The first workaround we could identify – *orders based on unofficial forecasts* – deals with retailers who use their own data to undertake forecasting statistics due to bad quality of supplier data. By doing so, retailers expect more accurate calculations as suppliers often disguise their forecast in favor of their own distribution. They can increase the accuracy of their predictions by using their own data. We found that the decision whether the provided forecast is used, depends on the relative importance of the customer in the overall supplier portfolio. As second workaround – *spreadsheet-based product data management* – we identified the fact that a hands-on solution is used to collect supplier information. The fashion companies send an excel sheet to the suppliers with request for completing it and therefore source their own work out. The fashion companies switch to excel sheets when collecting information regarding product descriptions, product numbers, etc. Furthermore they request for further information, as the standard tool does not include all the necessary information.

Again in this case, we identified the five voices (Table 18) to structure the workarounds and discuss one of them. The phenomenon associated with *orders based on unofficial forecasts* was coded as ‘knowledge’. Employees use their own experience to propose forecasts as they mistrust the supplied ones. The type ‘bypass an obstacle’ has been used and ‘overcome inadequate IT functionality’. We did so because the employees perceive the poor forecast as an obstacle in doing their work properly. We linked the voice direct effect to ‘impacts on subsequent activities’, thus it can result in improvement of the overall predictions. The perspective voice ‘future improvement’ has been linked to this workaround. The modification of the forecasts enables a more precise production and results in improvement. ‘Permitting and learning from emergent change’ is linked to the organizational challenge voice. This means that the forecast calculation is more accurate and transparent for the company because of their mistrust in others.

4.3 Cross-case Analysis

We compared our cases to identify similarities and differences. While the found workarounds differed in characteristics such as phenomenon or organizational challenge, all of them have in common that they have antagonistic consequences. That means that they are associated with organizational risks and organizational benefits simultaneously (Table 19). In the health care case, the physicians downloading patients’ records may lose these, which will result in privacy loss. On the other hand, the organization benefits from the physicians taking work home as more work can be done. Similarly, in the supply chain case, the orders that are based on unofficial forecasts may lead to economic loss due to misaligned orders. However, the organization may benefit from better forecasts as they capture the experience of the buyer in forecasting.

Table 19: Ambivalent Aspects of Workarounds
(Source: Own illustration)

Case	*Workaround*	*Organizational risk*	*Organizational benefit*	*Ambivalent managerial handling of workarounds*
Health Care	Download patient record	Privacy loss due to leaked patient records	More work done by physicians by taking work home	Despite available and implemented technology, USB ports not fully deactivated
	Maintain standard password	Loss of segregation of duty	Integrating distributed information due to shift work and mobile work assignments	Despite hospital wide policies, physicians and nurses can still keep the initial password
Supply	Orders based on unofficial forecasts	Economic loss due to misaligned orders	Capture the experience of the buyer in forecasting	Despite official forecasts, employees order based on their own analysis
	Spreadsheet-based product data management	Inconsistency and inaccuracy of information in information system	Capture the variety of different product categories	Despite standard information systems, employees use flexibility of spreadsheets

Across all cases, we observed what we refer to as ambivalence (Table 19). In all four workarounds, management is able to implement certain measures that effectively prohibit the workaround from happening. In the hospital, technology exists to entirely deactivate the USB port. When all USB ports were deactivated, no downloading of the patient data would be possible. In addition, firewall settings could easily be changed to prohibit email being sent to outside the hospital. Similarly, in the supply chain case, the official forecast could be obligatory for placing orders. The IS for placing orders could even automatically draw its forecast data from the official forecast sources.

Upon further examination of this ambivalence, we found factors influencing management's decision to implement measures that would fully prohibit the workaround from happening. We found factors that induce management to tolerate workarounds (Table 20). We grouped them under the label of expected efficiency gain factors. We also found factors that influence management to refrain from tolerating workarounds (Table 21). We grouped them under the label of exposure to compliance risk factors. Finally, we found factors that influence the effect

of the compliance risk on management's willingness to tolerate workarounds. We grouped these documentation related factors under the label of perceived process weakness factors.

Table 20: Expected Efficiency Gains Increase Managerial Willingness to Tolerate Workaround
(Source: Own illustration)

Factor	*Description*	*Effect on managerial willingness to tolerate workaround*
Increase process quality	„Basic product master data of a product that is normally defined by the manufacturer and again how does this data then get from the manufacturer to the supplier in a proper format? So the reseller basically gets data from many different manufacturers to automatically align with the master data system."	+
Shortcuts	„Because we have many PJs, meaning students that help in the ward for a time, they don't get passwords of course. However they are there to make your work easier. So for quickly printing some data or occasionally writing a letter, they have our passwords. The nurses have them as well."	+
Work life balance	„If I walk into a hospital and tell them I don't want the USB ports to be accessible anymore, the senior physician that I've known for 20 years tells me: 'You're forcing me to write my scientific reports, my presentations, etc. here at the hospital. Then I won't see my family at all'."	+
Improved process throughput time	„Here however, if the administrators create a password in the beginning if your name is Anton Smith then the login is Smith and the password Anton. And you can change it yourself afterwards but many colleagues simply keep it because the time savings are bigger [than security threats] at that time."	+
Supply chain visibility	„I think it's more about high volume information and similar topics, where perhaps there is more transparency at one supplier than at others."	+

The expected efficiency gain factors induce management to tolerate workarounds. We found that the spreadsheet-based approach to product data management increases product meta-data and thus improves process quality when the data set did not comprise more information than the employees could manage. This factor has a positive effect on management's willingness to tolerate workarounds. Maintaining standard passwords in the hospital allows nurses or students to help physicians with bureaucratic tasks and thus provide shortcuts to existing processes. The shortcut factor has a positive effect on management's willingness to tolerate workarounds. Further factors include work life balance, improved process throughput times, and supply chain visibility (Table 20).

Table 21: Exposure to Compliance Risk Reduces the Managerial Willingness to Tolerate Workaround
(Source: Own illustration)

Factor	*Description*	*Effect on managerial willingness to tolerate workaround*
VIP patients	„Also at the university hospital, it can of course happen that you get a special person and those are then encrypted. They'll set a so-called VIP indicator during admission and then you can't see who it is any more. That's for Michael Schumacher and similar people.	-
Deviations in revenue	„Of course that reaches the end customer a lot faster today (...) Of course that has a direct influence on retail figures, meaning sales figures, because I mean, you could see that with <retail company I with scandal in the past>, with <retail company II with scandal in the past>, wherever there was a scandal sales collapsed and I think that's just something manufacturers in the retails sector have to deal with."	-
Legal consequences	„So formally the employee that misused his user rights has to have a hearing with HR because there's the suspicion that he acted against his employment contract. Privacy laws as well as criminal laws have the offense of disallowed access of data if data is secured by a password or locked. So it's not even necessary that someone passes information along, even disallowed reading is relevant already."	-
Life-critical treatment	„That can end in catastrophe very quickly because in the outpatient department you're responsible for many areas not only the ER but also the ward. And sometimes you simply need quick access to everything."	-

The exposure to compliance risk factors influence management to refrain from tolerating workarounds. In the hospital, the fact that a well-known person is treated in the hospital reduces management's tolerance of workarounds. We found that when VIP patients are treated in hospitals, the consequences from privacy losses are unreasonably higher than from regular patients. Thus, management is not willing to tolerate workarounds when VIP patients are involved. In the supply chain case, we found that 0rders with imprecise forecasts quickly affect organizational revenue. Thus, management is not willing to tolerate individual forecast predictions. Further exposure to compliance risk factors includes ensuring quality standards, legal consequences, access monitoring, punishment, and life-critical treatment (Table 21).

The perceived process weakness factors influence the effect of the exposure to compliance risks on management's willingness to tolerate workarounds. We found perceived weaknesses in business processes that allow the workaround to happen. In the hospital, the process of documenting patients' data in an electronic file in the hospital information system has the weakness of allowing employees to download data to portable devices. Thus, they can download files from the system. In the supply chain case, the purchasing department uses official forecasting data for placing purchase orders. However, the purchase order is filled manually by the employees. In all four workarounds, we found that information systems do not properly implement the intended business process. The resulting perceived process

weaknesses allow physicians in the hospital case to take patient records home. In the supply chain case, employees can use their own forecast data for placing purchase orders.

Table 22: Perceived Process Weaknesses Promote the Managerial Willingness to Tolerate Workaround
(Source: Own illustration)

Factor	*Description*	*Effect on managerial willingness to tolerate workaround*
VIP patients	„Also at the university hospital, it can of course happen that you get a special person and those are then encrypted. They'll set a so-called VIP indicator during admission and then you can't see who it is any more. That's for Michael Schumacher and similar people.	*moderates relationship with 'Exposure to compliance risk'*
Deviations in revenue	„Of course that reaches the end customer a lot faster today (...) Of course that has a direct influence on retail figures, meaning sales figures, because I mean, you could see that with <retail company I with scandal in the past>, with <retail company II with scandal in the past>, wherever there was a scandal sales collapsed and I think that's just something manufacturers in the retails sector have to deal with."	
Legal consequences	„So formally the employee that misused his user rights has to have a hearing with HR because there's the suspicion that he acted against his employment contract. Privacy laws as well as criminal laws have the offense of disallowed access of data if data is secured by a password or locked. So it's not even necessary that someone passes information along, even disallowed reading is relevant already."	
Life-critical treatment	„That can end in catastrophe very quickly because in the outpatient department you're responsible for many areas not only the ER but also the ward. And sometimes you simply need quick access to everything."	

5 Discussion

In this research, we used Alter's theory (2014) to study workarounds in a health care organization and a supply chain management organization. While it is useful for understanding the complex structure of workarounds, our study established a distinct managerial perspective on workarounds (Mainemelis 2010; Martin et al. 2013). We found that an organizational risk benefit analysis influences the willingness to tolerate workarounds from a management perspective (Figure 15). We showed that information systems play an important role in this setting, as they standardize routines and increase accountability. Our results suggest that workarounds should be interpreted not only in terms of compliance but also in terms of performance improvements (Pittenger et al. 2011; Campbell 2012). The tendency to tolerate workarounds rises if, e.g. they better fit employees' task environment (Huuskonen/Vakkari 2013). This perspective finds support in seeing workarounds as opportunity to take the initiative to develop or deploy creative tactics and anticipate barriers (Pittenger et al. 2011). In our supply chain case the fact that the quality of supplier information can be improved by handing over this process to them is an example for gaining efficiency. We thus propose:

> P1: Expected efficiency gains have a positive effect on a manager's willingness to tolerate workarounds.

We argue that management chooses process alternatives in order to yield expected efficiency gains from the workaround while limiting exposure to compliance risks (da Cunha/Carugati 2009). In literature, we found several cases in which compliance had somehow an effect on the execution of workarounds (Ferneley/Sobreperez 2006). Employees who conformed to sets of systemic rational-legal rules are rewarded, whereas non-conformity is punished. As shown in our case study, management is aware of physicians executing workarounds and monitors data access in health care. This argument leads to the proposition that:

> P2: Exposures to compliance risks have a negative effect on a manager's willingness to tolerate workarounds.

Our study established perceived process weaknesses as an important aspect of understanding workarounds. In our cases, managers would have been able to prohibit workarounds, for example by deactivating USB ports or preventing standard passwords. However, managers chose not to exercise such options (Martin et al. 2013). Instead, managers develop complex explanations of why they chose to tolerate workarounds. In line with research we argue that often IS are blamed when the final outcome is not what was expected (Campbell 2012). Humans blame IS for errors, process deviations, or inferior process quality (Markus/Keil 1994; Koppel et al. 2008; Bates et al. 2001). In particular, managers blame technical shortcomings, security restrictions and low responsiveness in the IT department when tolerating workarounds. This argument suggests that:

> P3: Perceived process weaknesses mediate the effect of exposure to compliance risks on a manager's willingness to tolerate workarounds.

We contribute to the body of knowledge by establishing a first understanding of the role of IS in the emergence of workarounds. We show that perceived process weaknesses caused by IS create situations of deniability that increase managers' interpretive flexibility (Sobreperez et al. 2005). Literature characterizes IS as vehicles to forfeiting surveillance (da Cunha/Carugati 2009). In contrast, our study shows that IS also serve as a 'scapegoat' for managers that tolerate workarounds.

We contribute to a more nuanced understanding of why managers tolerate workarounds. Our analysis suggests that workarounds have ambivalent consequences from a managerial perspective: expected efficiency gains compete with exposure to compliance risks. We thus propose that the factors that contribute to expected efficiency gains increase managerial willingness to tolerate workarounds while the exposure to compliance risks reduce managerial willingness to tolerate workarounds. Perceived process weaknesses, however, moderate the relationship of compliance risks and managerial willingness to tolerate workarounds. Figure 15 provides an overview of the suggested research model.

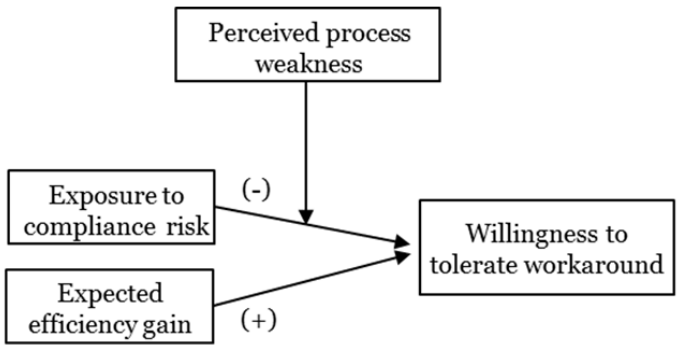

Figure 15: A Model of Managerial Willingness to Tolerate Workarounds
(Source: Own illustration)

We acknowledge several limitations to our study. Our study is based on only 22 interviews in two organizations. Given the exploratory nature of the study, this research presents only a first step toward understanding manager's handling of workarounds. Further research should examine workarounds that do not violate policies and thus could easier be seen as a source of improvement. Furthermore, this research has a static perspective on business processes. Applying a dynamic perspective on business processes would highlight the evolution of tolerated behavior into workarounds when policies or systems change. While Alter's theory of workaround is useful in structuring workarounds, future research might study workarounds from a bureaucratic perspective to establish a dynamic understanding of workarounds (Martin et al. 2013; Gouldner 1954).

6 Conclusion

This study advances our knowledge of workarounds in several ways. First, we document the usefulness of Alter's theory of workarounds (2014) for structuring and understanding workarounds. Second, we show that workarounds have an ambivalent character, challenging management in deciding whether to tolerate or prohibit the workaround. Third, using IS as a 'scapegoat' makes management decision deniable. Our study also extends Alter's theory of workarounds (2014). We provide a model of managerial willingness to tolerate workarounds and derive three factors from our cases that influence this willingness. Expected efficiency gains increase management's willingness to tolerate workarounds while exposures to compliance risks reduce management's willingness to tolerate workarounds. More importantly, we show that perceived process weaknesses caused by IS facilitate workarounds. Those process weaknesses add the factor of deniability and enable managers to place emphasis on the expected efficiency gains. In this way, IS serve as 'scapegoats', as managers can blame the IS for not preventing workarounds. Our analysis highlights the role of IS in the emergence of workarounds in modern IT-enabled organizations.

Publication 5

Workaround Aware Business Process Modeling

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Abstract

Workarounds are an omnipresent part of organizational settings where formal rules and regulations describe standardized processes. Still, only few studies have focused on incorporating workarounds in designing information systems (IS) or as a part of management decisions. Therefore, this study provides an extension to the Business Process Modeling Notation (BPMN) by conducting a metamodel transformation, which includes workarounds. As a result, the *Workaround Process Modeling Notation* (WPMN) (1) leads organizations in designing workaround aware systems, (2) supports managers in deciding how to deal with workarounds, and (3) provides auditors with visualizations of non-compliance. We exemplify how this technique can be used to model a workaround in the process of accessing patient-identifying data in a hospital. We evaluated the model and find it particular suitable as an empirically grounded BPMN extension.

Keywords: Business Process Modeling, Workarounds, Process Deviation

Individual Contribution of Doctoral Candidate: The doctoral candidate contributed to the introduction, theoretical foundation as well as the background regarding the Business Process Modeling Notation (BPMN) and the extension towards the Workaround Process Modeling Notation (WPMN). She took a leading role in the application example and the discussion as well as the conclusion. She included the thoughts and ideas from the co-authors.

1 Introduction

An extensive body of research provides advances in understanding workarounds as part of business processes (Alter 2014; Ferneley/Sobreperez 2006; Azad/King 2012). Workarounds are described as alternative work processes and are seen frequently as a mismatch between the expectations of technology and actual working practices (Ferneley/Sobreperez 2006). They can occur when users bypass a process, practice obstacle or requirement (Campbell 2012), respond to a mishap (Koppel et al. 2008), or pretend to comply (Boss et al. 2009). Several examples in literature express the prevailing impulse of users to overcome inadequate IT functionality (Kim/Kankanhalli 2009). Therefore, theoretical models that summarize different effects and consequences of workarounds are wide-spread throughout research (Alter 2014; Ansari et al. 2010). Overall, workarounds are the result of a consideration of risks and benefits associated with the input and outcome (Kim/Kankanhalli 2009). As the benefit and risks or costs of workarounds are hard to measure (Petrides et al. 2004), it is essential to push research towards understanding their effect on business processes (Ferneley/Sobreperez 2006).

In general, business process management (BPM) has received widespread attention by organizations offering them a means of optimizing their processes in a manner that aligns with their business objectives (Becker et al. 2009). Literature agrees when discussing the necessity of a comprehensive understanding of business processes and its positive impact on an effective and efficient BPM (Becker et al. 2009). Using a holistic approach to analyze and design business processes in a structured, coherent and consistent way is crucial for organizations (Bocciarelli/D'Ambrogio 2011). In this way, BPM helps in understanding, documenting, modeling, analyzing, simulating, executing and continuously changing end-to-end business processes in light of their contribution to business performance (Recker et al. 2006). One of the most common process modeling languages is Business Process Modeling Notation (BPMN). Organizations using BPMN seek to analyze, predict and improve their business processes in order to gain a competitive advantage (Bocciarelli/D'Ambrogio 2011). Recently, attention has been paid to design process modeling grammars that provide a means for handling the process complexity and flexibility of work systems (Rosemann 2006; Sadiq et al. 2007; Becker et al. 2009; Köhler 2011). The field of research regarding modeling of workaround behavior within business process is still scarcely explored (Nadhrah/Michell 2013).

Thus, in this paper we broaden the understanding of workaround aware business process modeling. We ask the research question: *How can workarounds be modeled in order to learn from process deviations?* We do this to understand workarounds as an omnipresent part of business processes, regardless of whether they have a positive or negative influence. Organizations that are able to model workarounds can use this approach to understand, improve, adapt and redesign their business processes to benefit from living processes gained from practice. Hence, with this study: (1) We support system designers with information regarding potential workarounds that can occur in their business processes, resulting in workaround aware system design. (2) We provide managers with a more informed

understanding of workarounds to help them decide whether to tolerate, hinder or embrace them. (3) We visualize non-compliance to improve the support of business process auditors.

We structure the remainder of this paper as follows. First, we introduce workarounds and related work to describe the theoretical foundation for studying our research question. We then introduce workarounds in process modeling using a theoretical construct and a metamodel. To exemplify the notion of workaround aware business process modeling, we use data from a case study conducted in the health care domain. We conclude the paper by highlighting the key results and present worthwhile avenues for future research.

2 Theoretical Foundation

2.1 Workarounds

In research, workarounds are frequently seen as first-order solutions to problems (Tucker/Edmondson 2003) and informal practice for handling exceptions to normal work flow (Kobayashi et al. 2005). The misfit between enactments of power that confront organizational members in their daily work can result in acts of deviance (Lawrence/Robinson 2007). In this research we extend this view and see workarounds as process deviations that are ambivalent and related to information systems (IS) (Röder et al. 2014a). The ambivalent character understands workarounds as both inventive solutions and challenging alternatives within a work system (Petrides et al. 2004). As actors may often work to achieve multiple and sometimes conflicting goals (Ferneley/Sobreperez 2006), the workaround can be best understood as the outcome of a situational risk-benefit analysis (Röder et al. 2014a). From an employee perspective, they are executed when the deviation results in an increase in the outcome and a decrease in the input (Kim/Kankanhalli 2009). This is the fact when, for example, the time to execute a certain process can be reduced while the result can actually be improved. Besides, much more often workarounds are triggered by IS as a part of a broader work system. In this work system, “human participants and/or machines perform work using information, technology, and other resources to produce specific products/services for specific internal and/or external customers” (Alter 2013). Reducing process variability and thus workarounds, IS further aim to prevent potential losses for gains in efficiency (Azad/King 2008). Several researchers have studied the phenomena of workarounds throughout various organizational settings with different outcomes (Alter 2014; Koopman/Hoffman 2003; Sobreperez et al. 2005). Still, it is the core issue about improving and hindering perceptions of workaround behavior which keeps theorist and practitioners busy. Overall, literature distinguishes different types of workarounds. Table 23 provides an overview of examples of existing workaround types (Alter 2014).

Table 23: Examples of Workaround Types
(Source: Alter 2014)

Type	*Source*	*Description of Business Process*	*Summary of Workaround*
Overcome inadequate IT functionality	Print Industry (Button et al. 2003)	Track full process with IS by respective worker	Operators record the progress of their work on paper tickets instead of system as it is conflicting with the activities involved
Bypass an obstacle built into processes or practices	Health Care (Azad/King 2008)	Medication dispense needs to await formal approval order and needs to follow concrete process steps	Nurses disconnect orders from awaiting approval and dispense restricted medication immediately when needed
Respond to a mishap or anomaly with a quick fix	Health Care (Timmons 2003)	Complete care plan by 3 hours after physical admission	Care plans are not completed in specified time frame as nurses perceive system useless as long as patients are happy
Design and implement new resources	IT environment (György et al. 2012)	Using IT to exploit user-driven innovation and identify potential improvements	Employees use private mobile devices as shadow IT

Avoiding IS and using paper forms instead, Button (2003) investigates the print industry and how lacking system flexibility and deficiencies leads to workarounds which continue leading to other workarounds. He proposes that employees may resist but at the same time conform, to management control. The employees did not circumvent control by not using the IS, instead they report on paper and add notes about system failures. Azad and King (2008) found that formal prior-approval procedures are not followed in hospital processes. Within health care, patients' well-being stands above all bureaucratic procedures. Instead of awaiting the approval, nurses dispense medication immediately. Timmons (2003) provides nurses' perception of reporting systems in hospitals. In his research he shows that miscommunicated reasons for the purpose of a reporting system result in resistance. Physicians do not execute their audits frequently and are demotivated since nobody else reports. "They were not able to resist the implementation, but were able to resist the surveillance" (Timmons 2003). György et al. (2012) study the inability of IT departments to fulfil business needs and focus on user-driven fulfilment of requirements, which they call Shadow IT.

2.2 Business Process Modeling

In this research we understand business processes as "the combination of a set of activities within an organization with a structure describing their logical order and dependence whose objective is to produce a desired result" (Aguilar-Saven 2004). Any process is governed by a series of rules that define what to do and when (Nadhrah/Michell 2013). With modeling

techniques those business processes are an attempt to be visualized for creating effective and efficient use of organizational resources. In today's dynamic and competitive business environment, process models are subject to frequent and unavoidable change (Davenport 1993). They are used to increase awareness and knowledge of business processes, and to deconstruct organizational complexity (Recker 2010). The graphical articulation of activities, events or states, and control flow logic as part of process modeling is used to discover existing processes, and document them in a way that helps managers in making improvement or change decisions. Limitation of process models is most frequently felt in their inability to cater to unanticipated cases (Sadiq et al. 2007). Especially when adapting manifestations and consequences that arise in practice, real-world challenges are difficult to model for organizational documentation and process improvement (Indulska et al. 2009). In the BPM context, the Business Process Modeling Notation (BPMN) is a standard for the representation of business processes (OMG 2011) and will be subject of this research. Prior work has already focused on several aspects from dynamic process interpretations to flexible system design in practice (Table 24).

Table 24: Related Work for Modeling Deviations
(Source: Own illustration)

Source	*Context and Focus*	*Identified Problem*	*Proposed Solution*
Becker et al. (2009)	Process modeling lacks approaches for highly creative environments with high levels of flexibility	Existing modeling approaches are restricted to processes that are well-structured and predictable	Approach to process analysis that aims at the identification and specification of creativity in business processes
Nadrah and Michell (2013)	Understand healthcare information systems as they cause rather than cure problems	Capture social aspects of behavior/motivation and the means to measure the effort and benefit of workarounds	Normative approach for modeling workarounds with their motivation, constraints, and consequences
van der Aalst et al. (2005)	Case handling in business process support requires decisions by knowledgeable worker	Case handling as a new paradigm for supporting knowledge-intensive business processes	Main entities of case handling systems are identified and classified in a meta model

Köhler (2011)	Modeling methodology for dynamic process solutions	Need to shift from an explicit modeling of predefined end-to-end processes to an agile design approach	Introduce modeling elements of business object life cycles, business rules, and business activities
Bocciarelli et al. (2011)	Extending BPMN with non-functional properties of business processes	Non-functional properties are not included in BPMN	Lightweight BPMN extension for the specification of properties that address performance and reliability

In their research Becker et al. (2009) focus on process modeling in creative domains and introduce a conceptual process modeling grammar for processes in creative environments. Using pockets of flexibility as a basic construct, they build on the concept derived from Sadiq et al. (2001). This construct focuses on flexibility as an ad hoc workflow presentation, where dynamic, adaptive and flexible workflows prevail. Thus, both papers (Becker et al. 2009; Sadiq et al. 2001) focus explicitly on processes in which creativity and flexibility is perceived as improving. Other than this, our goal is to describe deviations in processes where it is not clear if the workaround is either improving or hindering the business process. Nadrah and Michell (2013) provide a normative method to analyze workarounds in a healthcare environment. By doing so, they offer guidelines to organizations on how to deal with workarounds. Nevertheless, their process illustration neglects the distinction between formal process standards and the workaround execution. Instead, they provide two separate models to explain the deviations from the process. In their research van der Aalst et al. (2005) describe case handling as a paradigm for supporting flexible and knowledge intensive business processes. The use of case handling refers to situational decisions in which authorized employees have to consider corresponding workflow process definitions. Thus, deviations of unexpected behavior are not part of their research. Furthermore, Köhler (2011) provides a methodology for modeling dynamic BPM solutions. It includes business rules, actors, and life cycles in a loosely coupled system, interacting through message exchanges. Bocciarelli et al. (2011) focus on the extension of BPMN and provide an approach to integrate non-functional properties, e.g., performance and reliability, in their construct. They study the effect that those adaptions have on the overall performance prediction at design time. Still, all mentioned attempts to integrate process variability miss the comprehension of the risk-benefit analysis as a part of the workaround execution.

3 Introducing Workarounds in Business Process Modeling

3.1 Business Process Modeling Notation (BPMN)

We choose BPMN as being one of the fastest spreading business process languages (Recker 2010) with a design that is understandable for both business professionals and IT-specialists

(Müller/Rogge-Solti 2011). Figure 16 describes the graphical modeling elements that BPMN uses to represent business processes.

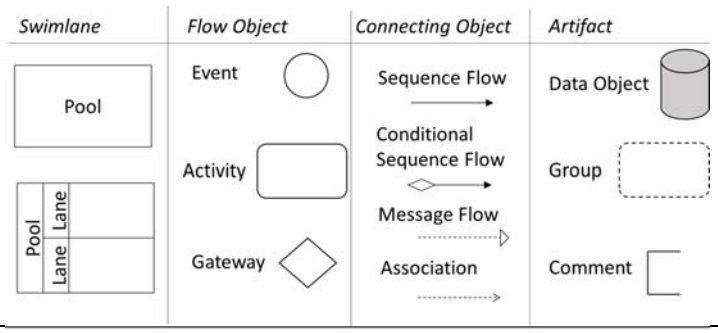


Figure 16: Relevant Constructs of BPMN 2.0 Modeling Elements
(Source: OMG 2011)

Pools and lanes are used to structure different organizational units (pools) and roles or functions within those units (lanes). Three connecting objects set three categories of flow objects (events, activities, and gateways) in relation to each other. Within the same pool, sequence flow is used to indicate the order in which the activities are performed - including sequence flows that have to fulfill a condition before traversing (part of BPMN 2.0). Message flows are used between pools to model communication with other organizations. Associations relate artifacts (data objects, groups or comments) to other modeling elements (Müller/Rogge-Solti 2011). With BPMN 2.0 this basic model has been refined and enhanced to strive for a new level of integrating business-user-friendly modeling (OMG 2011). Still, the proposed elements do not cover the possibility to integrate the risk-benefit analysis as part of workaround behavior.

As a BPMN process is graphically represented by use of BPD, we rely on the conceptual model to introduce workaround aware business process modeling (Bocciarelli/D'Ambrogio 2011). Graphs are used for execution semantics, nodes are flow and arcs are connecting objects (Bocciarelli/D'Ambrogio 2011). The core elements of BPD and their relationship are illustrated in Figure 17. The main class BusinessProcessDiagram relates all other elements and is used to represent a specific business process (Rodríguez et al. 2007). Each of the modeling elements is related to the main class.

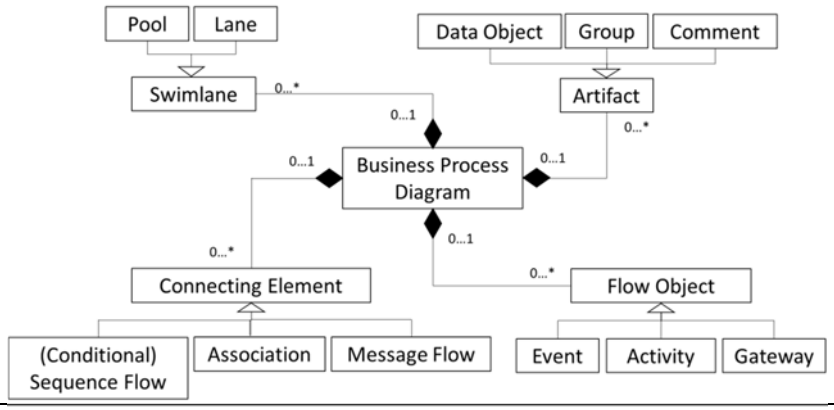


Figure 17: BPMN Modeling Elements
(Source: OMG 2011)

3.2 BPMN Extension

The two research streams of workarounds and process modeling have been viewed largely independent of each other. Therefore we provide progress towards an integrated workaround aware business process modeling. After introducing the main elements and the BPD metamodel we follow the metamodel extension (Bocciarelli/D'Ambrogio 2011) (Figure 18).

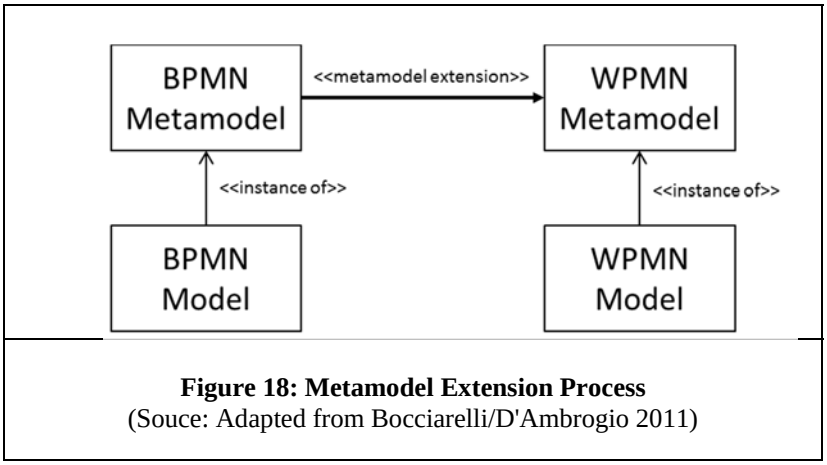
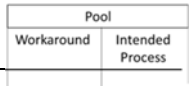
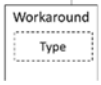
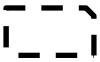


Figure 18: Metamodel Extension Process
(Souce: Adapted from Bocciarelli/D'Ambrogio 2011)

Extending the BPMN metamodel means adding new metaclasses and meta-associations to it. We follow the guidelines of the OMG Meta Object Facility (MOF), which is an object-oriented framework for describing meta-objects (OMG 2011). As the metamodel itself is a valid instance of the MOF metametamodel, extending the BPMN metamodel means defining a new modeling language by instantiating a new MOF model. We name the new model Workaround Process Model and Notation (WPMN).

Table 25: Constructs of Workarounds
(Source: Own illustration)

Constructs	*Description*	Example	*Representation*
Workaround	Process steps that are related to the workaround	Circumvent monitoring (Ferneley/Sobreperez 2006)	
Type	Differentiation of workaround types	Overcome inadequate IT functionality (Kim/Kankanhalli 2009)	
Risk-Benefit Analysis	Situational factors influence risk-benefit decision	Necessary activity in everyday life (Petrides et al. 2004)	
Situational Factors	Attributes that influence the risk-benefit analysis	Knowledge about easier way (Ferneley/Sobreperez 2006)	
Workaround Activity	Activities which guide the workaround process	Enactment of interpretive flexibility (Ignatiadis/Nandhakumar 2009)	
Business Rules	Rules or policies that determine the standard process	Compliance or non-compliance with management intentions (Sadiq et al. 2007)	
Consequence	Local and broader consequences	Impacts on subsequent activities (Boudreau/Robey 2005)	

We use the process theory of workarounds (Alter 2014) in order to extend the metamodel, which helps us to understand in which context a workaround is executed and how it has to be integrated in a modeling technique. Table 25 provides an overview of the factors that need to be considered when analyzing workaround behavior. This includes the workaround, which consists of all the process steps that are related to the deviation, as circumventing monitoring (Ferneley/Sobreperez 2006). We refer to the type with regard to the differentiation of Alter (Alter 2014) which includes (1) overcome inadequate IT functionality, (2) bypass an obstacle built into processes or practices, (3) respond to a mishap or anomaly with a quick fix (4) substitute for unavailable resources (5) design and implement new resources, (6) prevent future mishaps, (7) pretend to comply (8) lie, cheat, steal for personal benefit and (9) collude for mutual benefit. The risk-benefit analysis to work around a process is influenced by several factors that in sum lead to the execution. If the benefit overweighs the risks, then a workaround seems to be appropriate in this certain situation (Petrides et al. 2004). Situational factors determine risks and benefits of a workaround, e.g., knowing an easier way to do the work (Ferneley/Sobreperez 2006). Hence, workaround activities are enacted when e.g., interpretative flexibility prevails (Ignatiadis/Nandhakumar 2009). In this context, business rules represent formal guidelines, which are worked around. As a result employees may stick to compliance or be non-compliant (Sadiq et al. 2007) depending on their workaround behavior. The *consequences* that appear can have impacts on subsequent activities (Boudreau/Robey 2005) or even cause other workarounds to achieve a certain goal.

The core characteristics of the process environment have been identified after analyzing the existing workaround with the theoretical construct. We build on this process preparation to be able to integrate workarounds in formal business process representation. The BPD metamodel is extended by adding the required metaclasses (Figure 19).

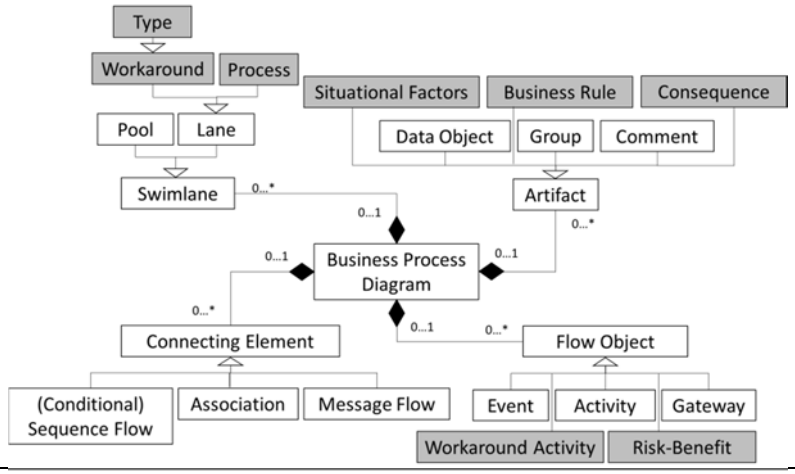


Figure 19: Business Process Diagram (BPD) Meta-model Extension
(Source: Own illustration)

As we focus on processes in which workarounds are executed, the greyed-out constructs have been added to the meta-model. We see the type of workaround as a lane construct existing together with a predefined process. Cause and decision are connected to flow objects, whereas motivation, business rules and consequences are generalizations of artifacts.

4 Application example

In this section we introduce an example from practice in order to test our proposed meta-model extension. With respect to the meta-model transformation method we will introduce an instance of the derived BPD meta-model extension, which we call Workaround Process Modeling Notation (WPMN).

4.1 Case description

The example is based on a case study in the health care sector where common security issues are privacy breaches, especially within information systems. As subject we studied the work system of administering patient data in the patient care information system (PCIS). Our sample included ten semi-structured interviews: five junior and three senior physicians, one security officer and one IT director. Members of the research group conducted the interviews with respect to health care processes in practice. The average interview time was about 55 minutes. We found that physicians balance the potential consequences resulting from a privacy breach and the improvements in effective patient care. They fear that compliance may hinder lifesaving and therefore often ignore privacy guidelines. We identified several workarounds that are executed within the health care domain, but will focus on one example to illustrate our proposed BPMN extension. The workaround - *drag data* - involves physicians

who copy patient records from the secure information system onto private storage systems. The hospital implemented PCIS in order to store and process all patient records. Physicians must not download any confidential information from the system as it is prohibited by the data privacy law. Furthermore, medical confidentiality can no longer be guaranteed when data is downloaded from the secure system onto external storage. However, physicians copy patient records onto USB sticks or send them via e-mail to other physicians or to their private accounts. They do this in order to ask colleagues for their opinion or in order to work from home.

4.2 WPMN Example

We introduced WPMN as a first approach to integrate workarounds in business process modeling. With the meta-classes derived earlier, we seek to model the 'drag data' workaround (see Appendix C). This example can be categorized into the type 'bypass an obstacle built into processes or practices' (highlighted in green). Physicians perceive the process a hindrance, because they are not allowed to download patient data from the secure system. As basic lane and pool construct we differentiated between the physicians and the IT department, which in turn is responsible for the authorization and patient record system. After logging into the PCIS, physicians are able to access patient records that are stored in the system. As a precondition they need to have access authorization to the system and to the patient data. After the system indicates the needed data, physicians are, for example, able to edit the data. In some situations the physicians download the secure data in order to share it with other physicians or to get more work done when taking the data home. This process is part of our workaround construct visualized as a lane. They break the data privacy law and can no longer guarantee medical confidentiality. To indicate high privacy concerns with a certain patient, hospitals implemented 'VIP flags'. This flag serves as an indicator to determine whether the workaround can be tolerated. As long as the flag is not activated and the patient is an average person, data security and medical confidentiality is not considered important among physicians. As soon as the 'VIP flag' is activated, the risks that come along with the workaround outplay the potential benefits. After evaluating whether to execute the workaround or not, the deviating process is integrated back into the standard process.

4.3 Evaluation

When we applied WPMN to a first use case in health care we found that the modeling of workarounds helps in understanding the overall business process. We evaluated the model and found it particular suitable for our example. Thus, we are able to support managers to come to a better informed decision on whether to tolerate, hinder or embrace workarounds. As we build our model on extensions of the standard BPMN elements, deviations can be modeled as a part of a process using the lane construct. WPMN implies a high emphasis on these workaround parts as they can be understood as a source of improvement or foundation for implementing indicators like the 'VIP flag'. The comment artifact concerning motivation, business rules and constraints provide additional transparency throughout the process. Prior research has identified shortcomings in supporting the articulation of business rules in BPMN (Recker 2010), but has already been addressed by several approaches (Köhler 2011). We extend this finding by addressing the need to understand a process as not only focusing on

what has to be done (rule), but actually what really is done (practice). We face challenges when including different perspectives on workarounds and how risks and benefits are balanced as an individual perception guides this analysis.

Hence, in the context of workarounds, formal structures that cope with process specifications are important to understand as well as the effect and consequence of non-compliant behavior (Sadiq et al. 2007). Especially to illustrate parts of the process that are connected to workaround behavior, additional concepts had to be introduced. The ambiguous character of workarounds can be addressed by using context information which enhances the relevance of labeling (Mendling et al. 2010) and addresses the risk-benefit consideration (Röder et al. 2014a). Furthermore, we confirm prior literature that assumes that costs and benefits determine to whether a workaround is executed (Petrides et al. 2004). Before employees actually execute a workaround they evaluate whether the risks or benefits prevail (Röder et al. 2014a). Thus, in each situation the workaround is observed depending on different factors that influence the decision. As an example situations where the workaround decreases the input an employee has to bring and increases the outcome, the probability is high that it will be executed (Kim/Kankanhalli 2009). If IS are implemented in a way such that they serve as gatekeeper to tolerate the workarounds that improve business processes and prohibit the ones who hinder them, their role within the business process can be interpreted from a new perspective (Röder et al. 2014a). Introducing indicators to emphasize higher risk associated with the workaround, employees can rely on practical processes that are tolerated by organizations. In certain cases when a workaround is harmful, the risks outweigh the benefits and the standard process needs to be followed.

5 Discussion and Conclusion

Workarounds comprise information gaps or inadequate system functionalities that need to be resolved when considering improvements in business processes (Petrides et al. 2004). Literature proposes that workarounds encode rich knowledge about the needs of the users and the required customizations of the IS (Safadi/Faraj 2010). With our research we provide a first approach to gather this information and model process deviations in BPMN. The evaluation of the ‘drag data’ example shows how the WPMN as an extension of the BPMN can be used to understand and analyze workaround behavior within a certain business process. Organizations are able to use workarounds as a foundation for implementing indicators to tolerate those for improving and to prohibit those that hinder.

We identified requirements to understand and represent workarounds graphically and tested our proposed modeling technique with an example from health care. This improves the support of process evaluation, as the graphical representation provides a comprehensive description of workarounds. Still, the proposed modeling approach is not able to include different perspectives on workarounds as the perception relies heavily on personal factors and may include several organizational members (Lawrence/Robinson 2007). Nevertheless, we believe that organizations that use WPMN are able to obtain a good understanding of completely new ways of conducting their business processes and that the design allows exploratory control (Schermann et al. 2012). Hence, with this study (1) we support system

designers with information regarding potential workarounds that can occur in their business processes, resulting in workaround aware system design. (2) We provide managers with a more informed understanding of workarounds to decide whether to tolerate, hinder or embrace them. (3) We visualize non-compliance to improve the support of business process auditors. Overall, it is important to note that the possibility to model workarounds relies on the willingness of organizational members to talk about their behavior and is thus dependent on credible sources of information (Wiesche et al. 2013).

However, this study has some limitations. Most notably, the proposed approach has been applied to only one process from health care. In health care, business processes have a high rate of uncertainty and are challenged with emergency situations which vote bureaucratic regulations down (Koppel et al. 2008). In our future research we will concentrate on industries where low uncertainty and high standardization prevail. It is planned to collect examples for each type of workaround across different industries. Further, we plan to use existing approaches, for example, method engineering, for modeling situational methods and tools (Brinkkemper 1996) to deepen the understanding of workarounds in business processes. Furthermore, we plan to extend the construct of types of workarounds to provide recommendations on how to model each one in particular.

Publication 6

Extending BPMN 2.0 to explicate workarounds in business process models

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Abstract

This paper presents a conceptual modeling notation extension of BPMN 2.0 to explicate workarounds. The Workaround Aware Business Process Model Notation (WPMN) enables business process managers to explicate and evaluate incongruent practices in the context of formal business process models. We derive ontological constructs of workarounds from literature and integrate them into the BPMN 2.0 meta-model. We evaluate the modeling notation with the model construction and model interpretation approach recommended by Siau (1996). We conduct a model assignment and two focus groups to ensure ontological expressiveness. The evaluation shows that modeling workarounds leads to a 'workaround aware' understanding of business processes whereby organizations are aware of process deviations from formal descriptions. By explicating workarounds, organizations are able to uncover, explicate, and evaluate incongruent practices in the context of formal business process models. The identification of process deviations leads to the possibility of discussing the consequences of workarounds with stakeholders and to identify business process variations that are less prone to workarounds.

Keywords: Workarounds, Business Process Model and Notation (BPMN)

Individual Contribution of Doctoral Candidate: Within this paper the doctoral candidate contributed to the introduction, the theoretical background and within the method she created the conceptual modeling language extension and supported the second author during the evaluation. She autonomously wrote the discussion and contribution of the paper. She included the thoughts and ideas from the co-authors.

1 Introduction

Business process managers rely on formal business process descriptions, usually in the form of semiformal business process models, to inform and direct the standardized execution of business processes (Münstermann et al. 2010). Gains in efficiency or productivity associated with formal business process descriptions are contingent upon the congruence of formal business process description and actual business process execution (van der Aalst 2013). As organizations need to deal with a rapidly changing environment, business process modeling needs to integrate dynamic, adaptive and flexible process descriptions (Beverungen 2014). While research in this area has attempted to address these changing requirements, a comprehensive approach to integrate process descriptions is missing (Becker et al. 2009; Pesic/van der Aalst 2006). In order to address this challenge, we assimilate literature regarding process deviations and refer to workarounds as incongruent executions of business processes that may manifest as dominant but tacit patterns of business process execution (Azad/King 2012). Without explicating workarounds, formal business process descriptions carry the risk of communicating an illusion of control (Langer 1975).

Consider the following real-world scenario from the healthcare domain:
A hospital implemented an integrated patient record system to store and process all patient data. The hospital has strict policies to ensure confidentiality. Still, physicians sometimes copy patient records onto USB sticks or send them via e-mail to other physicians or to their private e-mail accounts. They do so in violation of hospital policy and data privacy laws. When confronted, the physicians justify this incongruent and even illegal behavior with a professional work ethos. They share the records with colleagues for medical consultation or intend to work on patient cases at home – always to the benefit of the patient. Punitive and reputational damages from lost USB sticks or accidentally exposed patient records might outweigh the productivity gains of the integrated patient record system.

This scenario shows how formal descriptions are prone to workaround behavior when certain situations call for an alternate way of executing work practices. Depending on the situation, organizational members rationalize their decision to work around formal business process descriptions based on a risk-benefit analyses where they weigh the efficiency gains against any potential losses (Röder et al. 2014b). When workaround scenarios are integrated into business process modeling, a multiplicity of possible alternate working practices are visualized which in turn can lead to more realistic work descriptions. Attempts to integrate workarounds in formal business process modeling are limited (Sadiq et al. 2001). Widely adopted business process modeling notations including the Business Process Model Notation 2.0 (BPMN 2.0) do not allow business process managers to specifically explicate workarounds. When modeling the above described real-world scenario, we were confronted with four challenges. It is not obvious: (1) which activities belong to the standard process and which to the workaround, (2) how to integrate the risk-benefit analysis with its situational factors, (3) how to model the possible positive and negative consequences of the workaround behavior, and (4) how to provide additional information (e.g., violated business rules) for managing the workaround. In order to integrate these challenges, BPMN needs to be stretched

out of shape if a process owner wants to represent this workaround. By explicating workarounds, business process managers can uncover, clarify, and evaluate incongruent practices in the context of formal business process models. This leads to the possibility of discussing the consequences of workarounds with stakeholders and identifying business process variations that are less prone to workarounds.

This research was motivated by the need to explain incongruent practices as the description of formal business processes in organizations are subject to resistance, deals, side effects, and the properties of the IT landscape (Beverungen 2014). We derive tentative yet easily understandable constructs from reviewing literature and extending the meta-model of BPMN 2.0. We call this extension the Workaround Aware Business Process Model Notation (WPMN). We propose a conceptual modeling notation that is consistent with the ontological criteria suggested by Wand and Weber (1993): construct deficit, redundancy, overload and excess. Using this approach, the constructs in existing methods are evaluated by matching them with ontological constructs. We show that WPMN is particularly suitable to explicate workarounds by uncovering and evaluating incongruent practices in the context of formal business process models. This research uses a model assignment and two focus groups to ensure the ontological expressiveness of the conceptual modeling notation extension. As a result, WPMN helps to document, analyze, and communicate workarounds. By adding workarounds to common modeling languages we complement established methods to document system's structure and operation. WPMN alleviates the risk of an illusion of control by supporting decision makers in deciding whether to prevent, tolerate, or adopt workarounds to improve incongruent formal business process models.

This paper proceeds as follows. First we review the literature on workarounds and existing approaches to model workarounds. We then introduce WPMN as a method for including workarounds in process documentation. WPMN is evaluated using an assignment for students in a master's program and two focus groups. We conclude with a discussion of the potential benefits and implications of WPMN.

2 Theoretical Background

In practice, business process modeling offers the possibility to visualize relevant work processes by using semiformal constructs (van der Aalst 2013). Recent research has begun to analyze phenomena such as process flexibility and unpredictable process variations (Pesic/van der Aalst 2006; Pentland et al. 2011). In their research, Pesic and van der Aalst (2006) rely on the fundamental paradigm shift for flexible process management and propose a declarative approach in order to specify what should be done without specifying how it should be done. Following this attempt, the basic idea about agility in business process modeling is to leave room for individual users to maneuver so that they can make decisions and work in a variety of ways (Pesic/van der Aalst 2006). Reflecting on their findings, we argue that providing users the possibility to achieve certain goals without a sequence of necessary steps may cause them to lose focus. It may still be necessary to provide alternatives in the form of best practice to support users in case they are uncertain or lack knowledge about how to perform certain

tasks. Pentland et al. (2011) on the other hand, approach the necessity to integrate the paradoxical tension between stability and change by modeling routines which are, according to these authors, continually changing. Nevertheless, their attempt at modeling flexibility in routines misses an approach to visualize the processes that they are interested in. Existing approaches only provide blurred guidelines for modeling deviations without perceiving them as possible alternatives. Rather, these approaches are seen as an opportunity for users to achieve their goals. Thus, business process modeling needs to provide the possibility to integrate consolidated knowledge comprising knowledge gained through executing daily working tasks.

During our research, we found that limitations for integrating flexibility in business process modeling challenges the visualization of actual working practices. One can argue that simply adding informal annotations may be a way to integrate process deviations. If the recommendations for ensuring ontological expressiveness (Wand/Weber 1993) are to be followed, then several specifiactions need to be fulfilled: construct deficit, redundancy, overload and excess. Adding informal annotations in order to deal with unexpected information that is not yet integrated in the formal language is undesirable. Although existing research provides attempts to integrate dynamics and variations, investigations of this phenomenon are fragmented and largely independent of types and concepts. Therefore, we were interested in providing a comprehensive approach which would enhance business process modeling. Turning on the concept of workarounds provides a promising ground to cover existing process deviations as a first order construct (Röder et al. 2016). We built our research on the ontology of workarounds (Röder et al. 2016) in order to derive a classification framework for identifying the limitations of existing modeling attempts. We analyzed literature and summarized the findings related to modeling dynamics and flexibility in organizational processes. The aim of this analysis was to enhance the extension of an existing modeling attempt with constructs that need to be considered.

Table 26 provides an overview of related research and how these findings contribute to the integration of workarounds in existing modeling approaches. We address the shortcomings of each paper in order to provide a comprehensive and realistic extension. Based on our findings, we provide tentative constructs that need to be integrated into a business process modeling language in order to integrate workarounds.

Table 26: Literature Overview of Existing Workaround Constructs
(Source: Own illustration)

Source	*Contribution*	*Shortcoming*	*Tentative constructs*
Nadhrah/Michell (2013	Normative approach for capturing social aspects of behavior in healthcare	Mixture of formal process description and unofficial work procedure	**Separation** of standard and workaround process
Azad/King (2012	Institutionalization of workarounds as an equilibrium of top-down and bottom-up constraints		**Separation** of standard and workaround process

Borthick (2012	Control set for fraud detection in continuous auditing	Missing separation of different types of process deviation	Focus on fraud as one specific **type** of workaround
Alter (2014	Five voices of workarounds		Overview of workaround phenomena, **type**, effect, perspective and challenge
Pesic/van der Aalst (2006	Declarative language: anything is possible unless constraints are specified	Positive and negative aspects of process instances is neglected	**Risks and benefits** are not considered
Safadi/Faraj (2010	Overview of research on organizational change IT in healthcare		**Cost and benefit** analysis of acquiring new technology
van der Aalst et al. (2005	Meta model of case handling for knowledge-intensive processes	Highlighting the impact of organizational and environmental factors is missing	**Situational factors** determine differences for identifying cases
Azad/King (2012	Institutionalization of workarounds as an equilibrium of top-down and bottom-up constraints		Workarounds are used to resolve **situational factors**
Köhler (2011)	Integrate modeling elements for dynamic properties	Activities related to process deviations are not explicit identifiable	Dynamic **activities** characterize the modeling of flexibility
Ferneley/Sobreperez (2006	Compliance, resistance, workaround model		Risk resistance expressing itself in workaround **activity**
Rodríguez et al. (2007	Modeling secure business process in early phases	Process constraints do not cover business rules	**Business rules** restricted to security
Ortbach et al. (2013a	Typology and conception of rule-breaking		**Rule-breaking** as organizational-level activity
Sadiq et al. (2001 Becker et al. (2009	Pockets of flexibility to model change and flexibility	Knowledge regarding consequences not integrated	**Consequences** as consistently positive
Boudreau/Robey (2005	Concept of improvised learning for changes in technology enactment		Technologies can produce novel and unanticipated **consequences**

We found a mixture of formal process descriptions and unofficial work procedures in the research papers. For purposes of our study, we kept each sequence separate but combined them in one process model. This arrangement enables the distinction of formal process

description and unofficial work procedure without the necessity to switch between different models. Research investigating flexibility in process modeling distinguishes between the two procedures. Existing literature focuses on a special type of workaround, for example fraud, rather than providing a comprehensive approach. We propose that the theory of workarounds can be used to differentiate the different **types of workarounds** in order to cluster similar behavior (Alter 2014). The types of workarounds include those that: (1) overcome inadequate IT functionality, (2) bypass an obstacle built into processes or practices, (3) respond to a mishap or anomaly with a quick fix, (4) substitute for unavailable resources, (5) design and implement new resources, (6) prevent future mishaps, (7) pretend to comply, (8) lie, cheat, steal for personal benefit, and (9) collude for mutual benefit.

When organizational members decide whether to engage in workaround behavior they pursue a **risk-benefit** analysis. Current research only mentions this analysis as a side effect instead of integrating different positive and negative aspects of process instances. We propose to integrate possible risks and benefits when modeling workaround behavior. This analysis is influenced by several **situational factors** that, in sum, lead to the execution of workarounds. If the benefit of using a workaround outweighs the risks, then a workaround seems to be appropriate in this particular situation (Petrides et al. 2004). According to literature, situational factors determine the risks and benefits of a workaround (Ferneley/Sobreperez 2006). Workaround **activities** are enacted when interpretative flexibility as a form of minimal critical specification prevails (Ignatiadis/Nandhakumar 2009). Thus, organizational members engaging in workaround behavior execute specific activities that can be described as process deviation. The context in which the deviation occurs needs to be investigated in order to be able to understand the interdependences of the activities. In this context, the deviant activities work around **business rules** which represent formal guidelines. When organizational members do not follow established rules, unknown consequences may occur. Learning from these consequences produces knowledge about the workaround behavior which is not yet included in modeling languages. **Consequences** describe the effect, result, or outcome of the workaround and may involve achievement of a particular goal or impact on subsequent activities (Boudreau/Robey 2005). The consequences of a workaround can positively or negatively affect both the activity at hand and fellow employees.

3 Method

Our research creates a meta-model extension of BPMN 2.0 that addresses the challenges revealed in the previous review of existing literature and current practice. After analyzing the tentative constructs, we derived ontological constructs needed to integrate workarounds in business process modeling.

3.1 Creation of a conceptual modeling language extension

Extending an existing modeling notation through a meta-model extension has several advantages (Bocciarelli/D'Ambrogio 2011; Becker et al. 2009). First, the development of redundant notation constructs is avoided. Second, a meta-model extension facilitates the adaption by experienced modelers as they can leverage their developed knowledge.

Additionally, by extending an existing modeling notation the implementation of the new notation constructs into existing software tools is easier. Finally, the new models are to a certain extent compatible with legacy models. This paper builds upon BPMN 2.0 because BPMN 2.0 has become a de facto standard for graphical process modeling (Recker 2010). Other widely used notations, such as activity diagrams from UML and event driven process chains (Becker et al. 2010; Harmon/Wolf 2014), could have also been chosen. However, various studies show that BPMN is superior to other notations in regards to conceptual coverage and usability (Becker et al. 2010; Nysetvold/Krogstie 2006). For a detailed description on the constructs related to BPMN 2.0, please see Appendix D.

3.2 Evaluation of a conceptual modeling language extension

There are two approaches to evaluate modeling notations: the model construction and model interpretation approach (Siau 1996). In this study, we use both approaches in order to evaluate WPMN. Model construction is used to force engagement in both broader conceptual thinking and to focus on problem-solving activities (Batra/Davis 1992). Model construction involves the building of a model based on a given case description (Siau 1996). The interpretation of modeling notations involves the interpretation of information provided in the model. In our work, a previously developed model was provided to practitioners as a means of evaluating the constructs.

For the evaluation we refer to ontological concepts for conceptual modeling notations (Wand/Weber 1993; Siau/Rossi 2011). Using these methods, a set of rigorously defined ontological constructs describes all types of real-world phenomena that a modeling grammar user may choose to have represented in a conceptual model of an IS domain (Recker 2010). Wand and Weber (1993) derived the following constructs that determine ontological expressiveness:

1. Construct deficit: There is an ontological construct without mapping to any modeling construct
2. Construct redundancy: There is one ontological construct with a mapping to two or more modeling constructs
3. Construct overload: There are two or more ontological constructs with a mapping to the same modeling construct
4. Construct excess: There is a modeling construct without mapping to any ontological construct

In a first step, we conducted a test of WPMN by giving a **modeling assignment** to 11 master students with background knowledge in BPMN. We did this to be able to evaluate the possibility to model and understand the workaround constructs. We developed a “best practice” for the case described at the beginning of this research (*Download Data* in Health Care). Furthermore, we derived a scoring method with regard to the constructs for ontological expressiveness (Wand/Weber 1993) that assigns one point for each of the following six criteria: (1) separating the workaround from the standard process, (2) naming the workaround type, (3) stating the violated business rules, (4) modeling the risk-benefit analysis, (5) incorporating the situational factors, and (6) illustrating the possible consequences. Points

were deducted for modeling errors. Additionally, we used a questionnaire to gain further insights on the construction of the model. The students received a two page description of the basic constructs of WPMN along with a process example before they started the modeling task. We asked them to model the previously described health care case *Download Data* using a case description. Each student created a WPMN model and answered a survey. The evaluation of these models is based on a scoring method related to the "best practice" solution and the workaround constructs (each correct construct was rated with a score).

The artificiality of this evaluation which limits the generalizability or external validity of the results may be a concern. Thus, we use two **focus groups** in a second step. The objective of the two focus groups was to explore the comprehensibility and practical relevance of WPMN. We explicitly use the responses of the participants to identify their needs, expectations and problems when modeling with WPMN. This information is intended to aid us in exploring and clarifying the views of the participants and in guiding them to generate their own questions and pursue their own priorities (Kitzinger 1995).We follow the recommendations by Rosemann and Vessey (2008) for conducting the applicability check solution which includes seven steps: (1) planning the applicability check, (2) selecting the person to conduct the check, (3) ensuring that participants are familiar with the research object under examination, (4) designing the materials for conducting the check, (5) establishing an appropriate environment for conducting the check, (6) conducting the check, and (7) analyzing the data. As a well- established design criteria, we use the ontological deficiencies for step 7 in order to analyze our data (Wand/Weber 1993).

We first conducted interviews to collect information regarding workarounds the participants executed in the hospital. Based on these interviews, we were able to present the visualization of a workaround that the two focus groups (FG1 and FG2) were familiar with. We explained how WPMN can be used in order to illustrate actual working practices and how they deviate from standard processes. The focus groups were guided by the question, "Can WPMN be used to model workaround behavior in practice?". Both focus groups included three professionals from the health care domain. FG1 included a senior physician, technology manager, and case manager. FG2 included a technology manager, physician, and senior physician (Table 2). To conduct the focus group we approached the first physician and provided him with insights from our research. His interest in evaluating the modeling notation led him to ask colleagues with different professional backgrounds to participate in the focus groups. Apart from the technology managers, the participants did not have extensive experience in business process modeling.

Table 27: Composition of Focus Groups
(Source: Own illustration)

Focus group	*Domain*	*Duration*	*Participants*	*Experience with business process modeling (1-7 Likert scale)**
1	Health care	55 min	Senior physician 1 (SP1)	7
			Technology manager 1 (TM1)	1
			Case manager (CM)	1
2	Health care	72 min	Technology manager 2 (TM2)	6
			Physician (P)	1
			Senior physician 2 (SP2)	3
	Average Experience			3,2

* 1 = very poor to 7 = excellent

We tape recorded the focus group discussions and transcribed the conversations and took notes on participant interaction. We analyzed the results from the focus groups and gained insights into the comprehensibility and the relevance in practice of WPMN.

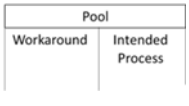
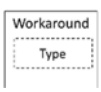
4 Practice Benefits of WPMN

With our results, organizations are able to uncover, explicate, and evaluate incongruent practices in the context of formal business process models. Organizations are able to use WPMN as a first step for analyzing incongruent work practices. The purpose of the meta-model extension is to enable business process managers to model workarounds and as a means of supporting their formal business process descriptions.

4.1 Description of WPMN constructs

We use the previously described constructs in order to extend the meta-model to help us understand in which context a workaround is executed and how it should be integrated in a modeling technique. Table 28 provides an overview of the constructs that need to be considered when analyzing workaround behavior. Following our constructs, we address: (1) which activities belong to the standard process and which to the workaround, (2) how to integrate the risk-benefit analysis with its situational factors, (3) how to model the possible positive and negative consequences of the workaround behavior, and (4) how to provide additional information (e.g., violated business rules) for managing the workaround.

Table 28: Modeling Grammar Constructs of WPMN
(Source: Own illustration)

Constructs	*Description*	*Representation*	Source
Workaround	Separation of the workaround from the intended process in order to visualize the deviation		(Nadhrah/Michell 2013) (Azad/King 2012)
Type	Differentiation of workaround types in order to compare prevailing workarounds		(Borthick 2012) (Alter 2014)

Risk-Benefit Analysis	The result of the analysis determines whether the workaround is conducted or not in order to highlight the associated risks and benefits		(Pesic/van der Aalst 2006) (Safadi/Faraj 2010)
Situational Factors	Situational factors that influence the risk-benefit analysis in order to provide information on environmental influences		(van der Aalst et al. 2005) (Azad/King 2012)
Workaround Activity	Workaround process consists of a set of workaround activities in order to separate formal from actual activities		(Köhler 2011) (Ferneley/Sobreperez 2006)
Business Rules	Rules or policies that are violated by following the workaround in order to highlight the non-compliance		(Rodríguez et al. 2007) (Ortbach et al. 2013a)
Consequence	Local and extended consequences that show the effect of the workaround behavior		(Sadiq et al. 2001) (Becker et al. 2009) (Boudreau/Robey 2005)

For a detailed description of the meta-model extension for WPMN, we refer to Appendix E where we explain how we extended BPMN with the identified constructs.

The shortcomings of the previously described health care case can now be integrated (Figure 20). With WPMN we are able to (1) differentiate the standard process and the workaround process, (2) integrate the risk-benefit analysis with situational factors, (3) model the possible positive and negative consequences, and (4) provide additional information (e.g., violated business rules) for managing the workaround.

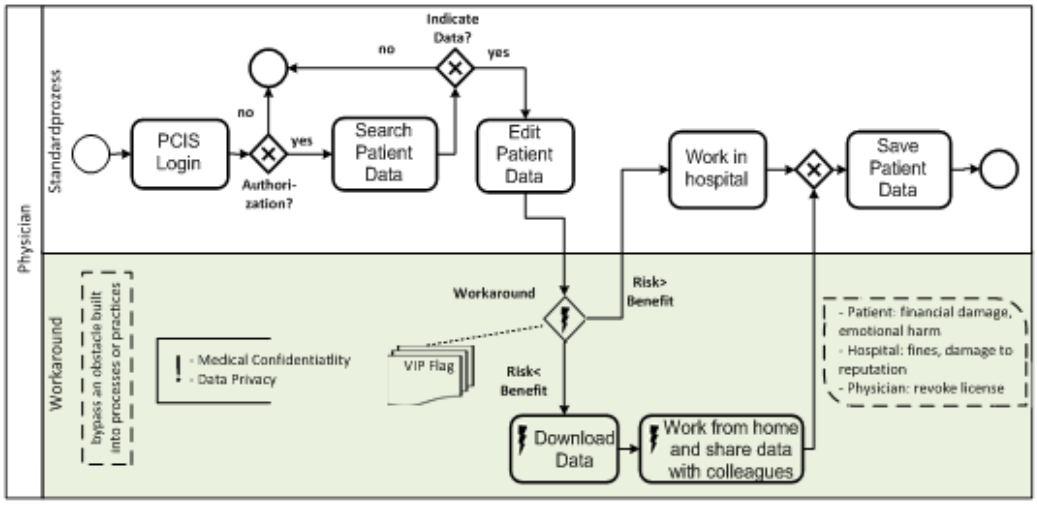


Figure 20: Workaround Aware Business Process Model Notation (WPMN) Example
(Source: Own illustration)

Figure 20 shows how the use of WPMN provides a representation of the workaround we introduced at the beginning of this paper. The following section evaluates the conceptual modeling notation we developed.

5 Evaluation of WPMN

We evaluated WPMN in two ways. First, with a modeling assignment involving Master's students in information systems, the aim of the modeling assignment was to show the possibility to model and understand the workaround constructs. Second, we obtained comments from two focus groups comprising technical experts and physicians. We used data from the two focus groups to show the comprehensibility and practical relevance of WPMN.

5.1 Modeling Assignment

Data generated from the modeling assignment were used to evaluate the possibility to model and understand workaround constructs. A total of 11 Master-level students majoring in information systems participated in the modeling assignment. Table 29 shows the score for each student's WPMN model and for a self-rating of prior experience with the model. The analysis of the models shows that regardless of their level of experience with modeling, students are able to explicate workarounds. This leads us to the assumption that non-professionals are able to visualize their work practices when using WPMN.

Table 29: Comparison of experience with modeling and performance of assignment
(Source: Own illustration)

Participant	*Score**	*Experience with modeling (1-7 Likert scale)*
S1	5	4
S2	4	5
S3	4	no experience**
S4	6	no experience**
S5	5	5
S6	3	no experience**
S7	6	1
S8	3	4
S9	6	4
S10	5	2
S11	4	no experience**
Average	4,6	1,8

* Range between 0 and 6, where 6 represents the maximum score
** 1 = very poor to 7 = excellent; no experience was not included in the calculation for the average

We also asked questions regarding the use of WPMN; this questionnaire was answered by the students after the modeling assignment. The following comments represent the students' answers to the open questions we asked (Table 30).

Table 30: Answers to the Open Questions
(Source: Own illustration)

supports current design	questions current design
"In my opinion, the evaluation whether risks outweigh the benefits or the benefits outweigh the risks is the main question when searching for workarounds." (S3)	*"I cannot imagine that people publish those kinds of processes, at least where I currently work as working student." (S11)*
"WPMN creates a basis for discussing how a process can be improved." (S1)	*"Where do I place the different constructs?" (S10)*
"Good to visualize alternate processes and related risks." (S5)	

One student claimed that the risks and benefits of the alternate business process are the main issues of visualizing workarounds. The students observed that WPMN is suitable when discussing process improvements and to visualize the related process risks. Thus, non-professionals are provided with a tool that enables them to demonstrate and discuss alternate process paths. We were also able to gain critical feedback from the students. One student noted that in his/her current position as a working student, no one would publish workarounds. Experiences during our research showed that physicians are open to different options to providing information on how to achieve organizational goals in a more effective way. Furthermore, WPMN does not provide information regarding where to place constructs, for example the business rule. The aim of WPMN is not to provide a "one-size-fits-all" solution for arranging the constructs in a single manner. Rather, we are interested in whether

nonprofessionals are able to visualize existing information without any restrictions regarding the arrangement.

5.2 Focus Group

The two focus groups were conducted to show the comprehensibility and practical relevance of WPMN. In the following, we provide quotes from our focus groups. First, we covered statements with regard to the practical relevance of WPMN. Second, we provide insights into the discussions about the related constructs.

The practitioners discussed situations in which WPMN would be useful and came up with practical examples (Table 31). The visualization of workarounds seems suitable when informing new colleagues about how actual working practices take place. In some cases, there is no alternative to a workaround to get a task done. In this situation, there should be a possibility to return to the standard business process as early as possible. The practitioners suggest integrating possible exit strategies in the modeling extension because the exit strategies enable physicians to understand how to return to the formal process description in the case of a workaround. A disadvantage of visualizing publicly identified workarounds is that the transparency about alternate processes prevents physicians from creating their own workarounds. Rather than finding new solutions, decision makers can provide alternate paths that help to achieve the goals that are aligned with the organization. One of the physicians was not committed to the use of WPMN as he/she already knows how to work around the existing system. This strengthens the motivation to visualize workarounds. Physicians are aware of alternate paths and organizations may use WPMN to leverage their knowledge and receive efficiency gains by integrating them.

Table 31: Practical Suggestions from Practitioners for using WPMN
(Source: Own illustration)

supports current design of WPMN	exceeds current design of WPMN
“This [WPMN] might be very useful for somebody new, an employee during on-the-job training, for example, in order to say ‘ok, here are the systems, this is the bypass we created - look at it so you’ll be up to date’ that would be reasonable.” (FG2, SP2)	*“So let us assume that you would present me a model of a system that we use on the ward, then I would say, ‘Yes, I understand the model it makes sense’ but I knew that before. So for me personally, that would not be necessary.”(FG2, SP2)*
„And it must be possible to derive an approach on how to exit [the workaround].“ (FG1, CM)	
„With this [WPMN] you additionally prevent the emergence of personal workarounds (…) then there might be an (…) official workaround of the specialty department, but problems emerge if (…) somebody says: I’ll use my own way. (…) However if you have defined: it usually goes like this; there is the approved workaround.“ (FG1, CM)	

The participants talked about the risk-benefit construct as a possibility to provide transparency (Table 32). This construct may enable decision makers to make well-informed decisions about whether to tolerate or prevent certain workarounds. The issue discussed by participants relates to missing information on how the risks and benefits are derived and what they include. The comparison of the risks and benefits illustrates situations in which a workaround may be more beneficial than the formal process or vice versa. Knowledge about risks and benefits of workarounds enables decision makers to improve their process descriptions.

Table 32: Quotes from Participants on the Risk-benefit Construct
(Source: Own illustration)

supports current design of WPMN	exceeds current design of WPMN
"The danger of something happening without being aware of it is present, therefore the comparison is clear, risk is smaller than benefit. This risk has to be written down and estimated, there are even ISO [International Organization for Standardization] standards for this purpose and as soon as risks are known, you can send them to the compliance manager and then he will say "perfect, work done". Thus, the decision at the beginning is the most crucial one, the decision on whether I execute the workaround or the standard process." (FG2, TM2)	*"What is included in this risk-benefit analysis? (…) Maybe this must be depicted in more detail here." (FG1, TM1)* *"The question is what is meant by risk?" (FG1, SP1)*

According to one of the participants, the situational factor construct is similar to an existing construct (Table 33). After evaluating this concern, we found that this issue is not a construct overload because the BPMN symbol for a document (which is used in WPMN) is different. As situational factors often refer to data objects, we think the symbol is most suitable. One of the participants understood the situational factor as the possibility to design technology in order to show that the formal process is more suitable than conducting a workaround. This leads us to the assumption that organizations may use WPMN to implement technologies that are aware of workarounds and are able to influence the decision of the users.

Table 33: Quotes from Participants on the Situational Factor Construct
(Source: Own illustration)

supports current design of WPMN	exceeds current design of WPMN
"So there is the possibility to influence the behavior. For example, by providing technologies to influence the decision so that there is no workaround and thus show it is actually more practical if I stick to the official way and then the line [in the model] goes back up [to the standard process]." (FG2, TM2)	*"This symbol that you are using here [points to situational factors] is actually already used by the standard [DIN 66001]. This symbol stands for document. Traditionally, two of these symbols behind each other express several documents. I would stick to the standard." (FG1, TM1)*

6 Discussion

This study investigated elements of a conceptual modeling notation to visualize workarounds as incongruences between planned and actual execution of formal business process models. We explore a tentative design of the Workaround Aware Business Process Model Notation (WPMN) to illustrate incongruences as part of BPMN 2.0. Our evaluation shows that the modeling of workarounds leads to a 'workaround aware' understanding of formal business process where incongruence may be illustrated. This illustration leads to communicable process instances that may be used in order to compare and categorize dominant workarounds in certain domains. Based on long-term considerations, WPMN provides a longitudinal approach where workarounds can be tracked and are best understood as dynamically evolving systems.

Before we discuss the implications of our research, some limitations of our work should be identified. First, we use BPMN 2.0 as a basis for the meta-model extension which may limit the generalizability of our design. With BPMN 2.0 we chose one of the leading modeling notations that serves as a de-facto standard for graphical process modeling (Recker 2010). By following our description of the meta-model extension, researchers can replicate our study and the evaluation. Second, WPMN provides a tentative design in which consequences represent a complex part of business process execution. The integration of consequences challenged our research in regards to deriving a suitable construct as some consequences may be evident immediately after physicians work around formal structures, others may not be evident until weeks or months later. We display the possible workaround consequences to provide transparency for business process managers when deciding how to deal with workarounds. Third, we only focus on the health care domain for evaluating the usefulness and usability of WPMN and only with one workaround. Our results would benefit from further empirical testing in which WPMN can be applied to other real-life process modeling settings. However, in addition to integrating practitioners with background knowledge in our study, we also included students with no background knowledge of health care processes who were able to model a health care workaround as well. Fourth, our evaluation of WPMN has revealed a minor ontological deficiency when it comes to model situational factors. This does not reduce the overall usability of WPMN as the concern expressed by the practitioner was evaluated and does not seem to pose a threat.

This paper makes three theoretical contributions to this topic. First, WPMN provides the possibility to illustrate the interconnection of business process models and work practices. In the case of the health care domain, workarounds commonly occur. In other domains, however, it might not be as easy to gain information regarding process incongruences. As a starting point, workaround behavior may be grounded in the process of identifying optimization potentials or within process mining approaches. In literature, the congruence of formal business process descriptions and actual business process execution is associated with efficiency gains (van der Aalst et al. 2005). We show that WPMN supports the illustration of workarounds and thus highlights congruence or incongruence of actual working practices with formal business descriptions. In turn, efficiency can be increased by understanding

incongruence and by using the actual working practices as a source of business process improvement. We encourage researchers to use actual working descriptions to investigate how specific workarounds occur and evolve over time.

Second, we build on the concept of workaround design systems (WDS) that complements established methods to document systems structure and operation (Alter 2015b). With our research, we provide the possibility to illustrate workarounds in order to enable business process managers to support the implementation of 'workaround aware' systems. This awareness enables researchers to understand IS not only as technological artifacts but also as work systems in which organizational members interact and purposefully adapt them. Due to the lack of approaches related to anticipating, designing or preventing workarounds, WPMN provides a fruitful first step towards the integration of efficient process incongruences (Alter 2015b). Illustrating the incongruence of formal process descriptions and business process execution helps in understanding the effect of business processes and IS although it is nearly impossible to anticipate all possible workarounds. The knowledge of the effect of workarounds on business processes and IS enables future research to analyze the effect of incongruences due to evolution on organizational performance.

Third, with WPMN we derive a tentative approach to describe and visualize workarounds as a basis for a descriptive theory. Our study is a first step towards an analytic theory serving to support researchers in analyzing 'what is' rather than explaining causality or attempting predictive generalizations. This means that business process managers can turn workaround behavior into real value that enables more efficient processes within their organization. We follow the concept of process mining and argue that the visualization of workarounds presents an interface between process models and event data (van der Aalst 2013). A clear definition of constructs is needed to both explain and predict how and why workarounds occur. This research provides one of the first attempts to link knowledge of process deviations to the design and development of new IS artifacts (Alter 2015a). Therefore, with WPMN we are able to offer a framework for analyzing workaround data within an organizational context.

This paper has several practical contributions as well. First, we provide a tool to visualize organizational workarounds for organizational members. For example, we support auditors, risk and compliance managers with an approach to explicate non-compliant behavior at different levels of execution (Conforti et al. 2013). This allows managers to reflect on business rules and routines with regard to their reasonability. Second, we are able to provide system designers with guidelines on how to design systems that are more sensitive to workaround-proneness. By deriving reusable workaround patterns from the model instances, designers may develop "workaround aware" systems. Third, the visualization of workarounds supports management in communicating and comparing workarounds. A manager's decision on how to deal with workarounds (tolerate, prevent or facilitate them) can be supported by providing the actual process instances that employees execute rather than the formal process description. We turn on the identified shortcomings of existing approaches and show how the extension of BPMN can close this gap by integrating additional constructs. WPMN uses the separation of the workaround and process lane, differentiation of workaround types, a risk-benefit construct, the introduction of situational factors, visualization of workaround

activities, incorporation of existing business rules and the potential consequences of breaking those rules.

Because this topic is in an early stage of theory development, there are numerous possibilities for future research. For example, there is a need to focus on how to create mutual awareness among organizational members of workaround behavior and how workaround behavior influence organizational business processes. Recognizing new and important information by investigating process deviations offers insights on how workarounds can be used in order to improve existing business processes. Leveraging the knowledge of organizational members who are aware of alternate paths may enable organizations to improve performance. Second, researchers may more closely investigate how to measure risks and benefits of business process deviations and their effect on organizational performance. Little is known about how to measure costly alternatives to formal process descriptions. Greater understanding of these alternatives can enable organizations to make wel-informed decisions on whether to tolerate, prevent or use the workaround as improvement to existing practices. Third, WPMN includes business rules as a part of the notation which may have different interpretations in different contexts. In our research we treat business rules as the obstacle that is worked around. Many workarounds of business processes do not involve business rules at all, i.e., they may involve skipping steps or performing steps in different order. Fourth, we assume that there is only the possibility to decide to conduct or not to conduct a workaround. Following the theory of workarounds (Alter 2014) this decision is separated into designing possible workarounds and selecting among the possible workarounds. Future research can address this multilayered perspective in illustrating the steps with WPMN.

7 Conclusion

In this paper, we present a novel extension to BPMN 2.0 that enables business process managers to visualize workarounds in business process models. We suggest a tentative design called WPMN and report initial qualitative evidence on the usefulness and usability.

Explicating workarounds in business process modeling notations enables business process managers to uncover and evaluate incongruent work practices in the context of formal business process models. WPMN allows managers to describe and discuss the consequences of workarounds with stakeholders and enables organizations to identify business process variations that are less prone to workarounds.

Efficiency gains are contingent upon congruence between formal descriptions and actual execution of business processes. With WPMN, organizations are able to provide a comprehensive view of workarounds that is in line with ontological expressiveness (Wand/Weber 1993). Illustrated workarounds can be used to improve business processes and design workaround aware information systems. This might lead to a continuous improvement of actual working practices and eventually yield higher organizational performance.

This paper suggests a visualization of incongruent organizational behavior that might be useful for organizational researchers. The formal design of WPMN enables researchers to

compare workarounds across organizations, for instance in case studies. We are confident that WPMN helps researchers to uncover invariant and variable characteristics of workarounds. The identification of tentative concepts provides a first step towards a theory development for workarounds.

Publication 7

Embracing a Relational View of Workarounds: An Affordance Perspective

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Abstract

Understanding workarounds in organizational processes is critical for adoption and diffusion research. Still, existing literature treats workarounds as an outcome rather than starting point. A plethora of studies reports on workarounds across different industries and across all organizational processes. The challenge in workaround research is that incongruence between formal processes and actual working processes produces various outcomes which are not controllable using a standard approach. Therefore, we advance the understanding of workarounds by proposing affordance theory as viable lens for investigation. Using a multiple case study we find that affordances are multifaceted, evolve during their actualization and that they can be used to control processes. The relational view shows that the actualization of affordances leads emergent workarounds to their institutionalization.

Keywords: Workarounds, institutionalization, affordances, actualization.

Individual Contribution of Doctoral Candidate: The doctoral candidate contributed to the introduction, theoretical background, the method, the results, the discussion and the conclusion. She conducted the interviews that are used as a base for introducing the examples. She analyzed the data and derived examples to visualize the results. She included the thoughts and ideas from the co-authors.

1 Introduction

Information systems (IS) research assumes that partial or different use of technology is surprisingly when investigating the acceptance and diffusion of technologies (Faraj/Azad 2012). Any form of adaption, modification or workaround is interpreted as unexpected finding and is presented as an outcome rather than a starting point. Research assumes that organizational members have needs that are covered by implementing IS in an organizational context. Following this presumption, technologies offer a set of features that meet the users' need and if adopted correctly strengthen the technology-as-designed perspective (Faraj/Azad 2012). In practice we find different cases. Organizational members tend to use IS in unexpected ways when they face challenges in their daily work such as cumbersome processes that seem too slow (Ferneley/Sobreperez 2006), when information required to complete a task is not available (Davison/Ou 2013), or when personal goals conflict with organizational goals (Azad/King 2012). We refer to the goal-oriented adaption of IS in unintended ways as workaround behavior that may institutionalize and become persistent (Azad/King 2012). Users that engage in workaround behavior challenge system designers by interacting with the system in a way that was not planned (Germonprez et al. 2011).

In order to understand how and why goal-directed actors work around IS a lens is needed that considers a relational view on IS and users. We propose affordance theory for describing a type of relationship between a technical object and a specific user that identifies what the user may be able to do with the object, given the user's capabilities and goals (Markus/Silver 2008). Affordances provide strong clues to the operations of artifacts as the user knows what to do just by looking (Norman 1988). Affordances of technology can be broadly defined as the ways in which technology offers or supports certain things (Leonardi 2011) and are relevant for people's interactions (Gaver 1991). The concept of technology affordance refers to an action potential, that is, to what an individual or organization with a particular purpose can do with IS (Majchrzak/Markus 2012). As users of IS are dependent on situational factors and interactions are a dynamic factor, they are critical for understanding workarounds (Majchrzak/Markus 2012). We are interested to investigate the properties of IS that trigger the emergence of workarounds. Therefore, we ask the following research question: *How can affordances advance our understanding of the institutionalization of workarounds?*

The paper unfolds as follows. First, we describe the theoretical foundation of workarounds and affordances. Then, we present the method we used to conduct our research, and present the empirical findings from the data. Next, we outline limitations of our research and discuss our findings with regard to existing literature. Finally, we draw a conclusion on how affordances can be used to understand the institutionalization of workaround behavior.

2 Theoretical Background

In literature workarounds have been investigated with respect to different research streams: resistance (Ferneley/Sobreperez 2006), workplace deviance (Robinson/Bennett 1995), shadow IT (Silic/Back 2014), etc. Recently published literature describes workarounds as goal-driven changes to defined routines in business processes (Alter 2014). We define

workarounds as anomalous use of IS where the actual practices are not consistent with the designed uses and official rules (Azad/King 2012). The reasons why workarounds are pursued range from incongruent goals (Ignatiadis/Nandhakumar 2009) to a misfit between technology, process and culture (Ansari et al. 2010). Misfit occurs when IS poorly support the defined process (Safadi/Faraj 2010) or certain steps cannot be performed at all due to hindering obstacles (Vogelsmeier et al. 2008). Workarounds are fostered by organizational phenomena such as lack of accountability and drift, but also future improvement (Jenkins/Durcikova 2013; Azad/King 2012; Boudreau/Robey 2005). Workarounds are predominantly seen as threats rather than opportunities (Debono et al. 2013). The concept of workarounds as source of improvement (Patterson et al. 2002), creative flexibility (Miller/Wedell-Wedellsborg 2013), or adaption to inefficiencies (Debono et al. 2013) casts a positive light on this phenomena. Thus, workarounds may occur when users engage thoughtfully with IS in a way that makes the underlying business process more effective (Alter 2014). As IS enable users to enact them in different ways, understanding participants' perspectives on the technology is critical (Boudreau/Robey 2005). Any adaption or modification of IS need managerial interventions directed at the context in which the system is being used (van Offenbeek et al. 2013). Therefore, organizations need to understand the user, the user's tasks, and the context in which the user accomplishes tasks and goals (Karat et al. 2000). In this research, we aim to deeper investigate workarounds and understand them as a starting point rather than as an unexpected finding (Faraj/Azad 2012).

Literature has paid little attention on what IS mean to users and how they fit with their daily tasks and activities (Faraj/Azad 2012). A promising perspective on workarounds is provided by affordance theory. In line with Markus and Silver (2008, 626) we define affordances as "the possibilities for goal-oriented action afforded by technical objects to a specific user group". Research regarding affordances is two-fold. One theory grounds in affordances as properties of an artifact that can be designed (Gibson 1979). The other theory grounds in affordances as emergent properties in a dynamic actor–environment system (Norman 1988). The existence of different interpretations of affordances (action possibility vs. perceived suggestion) (McGrenere/Ho 2000) has challenged IS research and existing theories.

On the one hand Gibson (1979) introduces the term affordances to explain how animals perceive their environments where surfaces and objects offer certain possibilities for action. On the other hand literature adds a subjective perspective on affordances where they support and create a representation of people's interaction (Norman 1999). We understand affordances as actionable properties between an artifact and an actor (Zhang 2008). Affordances are objective properties of the environment and have nearly deterministic consequences for action (Jung/Lyytinen 2014). They provide key characteristics that make it more or less likely that a practice will be adapted (Ansari et al. 2010). Affordances do not cause behavior but make certain behavior possible (Withagen et al. 2012). In his research Leonardi (2011) finds that when a user perceives that IS offer affordances, the user will look to change the routines to take advantage of that affordance. Affordances are always perceived by a user that interprets a system through personal goals of action. As IS already come with built-in physical affordances, designers primarily can control only perceived affordances

(Norman 1999). Thus, affordances emerge dynamically from a specific actor–environment system (Jung/Lyytinen 2014). Stoffregen (2003) argues that affordances should include both enablers of and limits on behavior. Derived from literature Strong et al. (2014) provide conclusions from ecological psychology for investigating IT-associated organizational change with an affordance-based theory. First, affordances are relational. They are not a property of the system or of the user but describe relations between the abilities of the actor and features of the environment. Second, affordances offer potential action. They exist without any user actualizing them. Third, affordances are not limited. They are enabling but also constraining and offer certain action possibilities but others not. Fourth, affordances are goal directed. The potential actions that users actualize are goal directed and depend on actor characteristics. In our study we interpret affordances not as a consistently rigid set of operations of artifacts but rather interpret them as evolving during a process of interpretation and change due changing processes and work behavior.

3 Method

For understanding the role of affordances in workarounds we conducted an exploratory case study (Eisenhardt 1989). We strengthened the rigor of the study by following a theoretical sampling strategy where we used a qualitative approach to collect information regarding the dynamics of workarounds (Glaser/Strauss 1967). To ensure construct validity, we used semi-structured interviews, on-site observations of the organizations and included secondary data (Yin 2009). In this research, we draw on two cases from health care and the innovation domain (Table 34) and provide a detailed description of our research context (Dubé/Paré 2003). The selection of the research sites was guided by the principles of similarity and variability suggested by Kirsch (1997). We chose the health care and innovation domain. First, similarity is given as we chose two cases where workarounds are a pervasive and well-known element. Second, variation in this selection is provided as the cases differ in terms of their organizational characteristics. We were interested in how organizational members adapt IS in order to achieve their goals in an uncertain environment. In health care, high levels of uncertainty exist and key decision makers within the hospital determine the processes. The innovation domain requires high knowledge, is exposed to office automation and provides opportunities for knowledge makers. Workarounds in the innovation context promise to succeed in faster cycles and result in more effective outcomes. We focused on health care as first case and recruited the innovation domain as next case to replicate our findings. By following a replication logic we are able to ensure external validity (Yin 2009). We were able to gain insights in the daily activities of the organizational members of each domain by interviews, observational data (off record talks, meetings, etc.) and secondary data collection (archival data, presentations, etc.). During our data collection we developed a case study protocol which allows us to strengthen the reliability of our findings (Yin 2009).

As one of the most studied examples for a workaround known domain, we found health care (case 1) to be particularly suitable to start our analysis as physicians talk rather frankly about how they disregard organizational processes and work around IS (Vogelsmeier et al. 2008; Safadi/Faraj 2010). We conducted interviews in a hospital and focused our questions on

workarounds where non-compliance with formal process descriptions prevails. In the second case, we examined the innovation management process in the automotive industry (case 2). We found this process particularly suitable for our research endeavor as innovations often do not follow the intended process. Organizations often approach management of innovations in a formalized manner. Especially, the automotive domain provides an interesting ground for research, where the business model from solely producing cars shifts to a more holistic concept that offers services for supporting mobility.

A student assistant transcribed all 28 interviews. To ensure quality assurance, we cross checked the transcribed records with the interviewees and verified them with our observations and secondary data. In order to analyze the transcripts we used an initial coding technique to identify causes, context, contingencies, consequences, conditions, and covariance for each workaround (Glaser 1978). With this coding scheme we were able to concentrate on the evolution of workarounds and the role of IS. The coding process was iterative and included both, the initial coding scheme and an open coding. One of the authors and a student assistant independently coded the transcripts and provided a coding report. The report consisted of a list of codes, the related quotes, emerging concepts and the further aggregated categories. We resolved disagreements with a consensus approach and validated the new codes. We selected categories and dimensions in order to look for within-group similarities coupled with intergroup differences (Eisenhardt 1989). As a result we found 10 workarounds in case 1 and 12 workarounds in case 2 (see Appendix F for a list of all workarounds). Our final coding comprises 254 codes in total, with an average of 7.5 per workaround in case 1 and 8.25 codes per workaround in case 2. Due to page restrictions we concentrate on one workaround for each case and chose the most informative ones where we were able to gain rich insights into the process of the workaround evolution.

Table 34: Case Overview
(Source: Own illustration)

	Case 1	*Case 2*
Description	Common security issues in the health care sector are privacy breaches, especially within IS.	The innovation management process within the automotive domain is supported by multiple IS, tools, and methods.
Domain	Health Care Industry	Automotive Industry
Core Process	Patient Record Process	Innovation Management Process
IS	Hospital information system (HIS)	Innovation Platform
Interviews	10	18
Sample	Junior (5) and senior (3) physicians, security officer (1), IT director (1)	Innovation management (5), process owner (8), Sales and Marketing (4), IT architect (1)

Case study 1 took place in a German hospital where occupation groups from different backgrounds work together. In our study both physicians and IT personnel were interviewed

to gain a holistic perspective on the implementation of IS. We were able to gain insights in daily working procedures from both groups and how they interact with the hospital information system (HIS). In total we interviewed 10 organizational members of the health care domain: five junior and three senior physicians, as well as one security officer and one IT director.

The hospital we included in our study has a close relation to research where the majority of the projects that have been developed evolve from the pilot and funding phase into efficient and health economic sensible structures and processes. Due to the close relation to externally funded research, clients in the pharmaceutical industry and the integration of the federal German health system, the hospital is vulnerable to violations. The challenge for the hospital lies in balancing the complex security requirements with the latest advances in medical techniques that can be quickly integrated into patient treatment procedures. In this correlation, potential threats may include the violation of scientific rules, data manipulation, corruption in the procurement process, sloppiness during inspections and illegitimate accounting. The organizational members that are related to the processes we were interested in are physicians (senior, junior and subinterns), nurses and IT personnel. For the purpose of our research we were interested in the HIS as it is a comprehensive, integrated information system designed to manage all aspects of a hospital's operation, such as medical, administrative, financial, and legal issues and the corresponding processing of services. Besides the focus on administrational needs, HIS provides a common source of information about a patient's health history. HIS enables physicians and nurses to electronically store patient data. In order to edit the data the personnel need to login with a username and a password and the patient needs to be assigned to them.

Case study 2 was conducted within the innovation management of a large German automotive manufacturer which we call AUTO. In the innovation case we interviewed different organizational members that generate radically new ideas and use existing approaches for incremental ideas. In order to gather all ideas, the organization implemented an innovation platform for creating the "next big idea". We were interested in how organizational members from different business unit use the platform for supporting their ideas. In total we interviewed 18 organizational members from different business units regarding their innovation generation: Five innovation managers, eight process owners, four sales and marketing employees and one IT architect.

The shift from solely operating as an automobile manufacturer towards providing mobility services challenges the organization. Especially the high competition among manufacturers drives the organization to achieve ambidexterity - balancing exploratory and exploitative innovations. The concept proposes to achieve a trade-off between creating new knowledge and using existing knowledge. The organizational members are urged to come with ideas that provide innovations that enable technological progress and incremental changes. From an organizational perspective there are several roles organized in a hierarchical manner: business unit manager, department manager, team leader, and employee. Each business unit has a clear focus on the contribution to the core business but needs to generate innovations as well. The IS we were interested in is an innovation platform that is used to generate, discuss and

like ideas. The organization seeks to change the innovation culture within the hierarchical structures by providing a platform for ideas and thus, be more innovative. Organizational members can post innovative ideas on the platform and add keywords, additional data (picture, file, link) and a short description. In turn, colleagues may comment on the ideas, ask questions and like them. As a result, top ranked ideas are chosen to be introduced in the next steering committee meeting for which the submitter needs to prepare a business case.

4 Results

4.1 Workaholic Workaround

Analyzing the data from our first case, we found incongruence in the formal process description and actual working practice which we call *Workaholic Workaround (*Table 35*)*. Physicians use HIS to write their electronic health reports (EHR) on the medical status of patients. They need to login to HIS and use the patient data from the EHR for updating reports. Those reports are stored in a physical file in the EHR.

Table 35: Description of Workaholic Workaround
(Source: Own illustration)

Characteristic	*Workaround*
Task	Writing report on medical status of patient
Actors	Physicians and IT Security Officer
Formal Process Description	• Login HIS and use the patient data for updating reports • Report is stored in physical file in EHR
Workaround Behavior	Instead of writing the report at the computer station at work, physicians download patient data on private USB drive and write the report at home

Physicians do not follow the indented process. They login the system and download all relevant data for writing reports on private USB drives. Physicians take the USB drive home and write the reports on their personal computer. On the next day the report is copied back to the HIS. When asked about their motives, they said that they want to see their families and facilitate their work-life-balance. As a consequence the hospital is not able to guarantee the security of the patient information. USB drivers may be lost and the private computers do not have high security standards as the hospital has (private network). Using WPMN, we are able to visualize the intended process and the workaround behavior (Figure 21) (Röder et al. 2015).

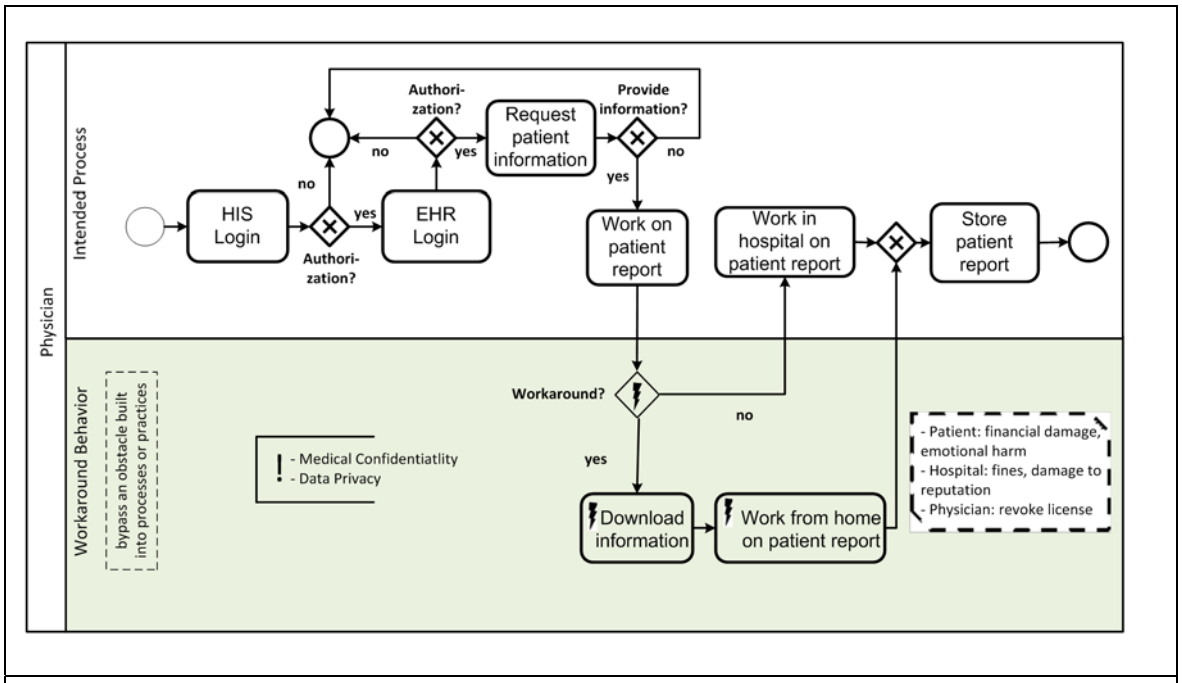

Figure 21: Intended Process and Workaholic Workaround
(Source: Own illustration)

In order to gain control of the patient information, the IT Architect implemented a feature in the HIS to identify critical patient information. He implemented a VIP flag which marks particular sensitive patient data. The hospital may guarantee that critical information is not exposed to any privacy breaches as physicians know which patient information is sensitive. The evolution of this workaround is presented in Figure 22 where the emerging workaround is institutionalized after the organization implemented a VIP flag in the system.

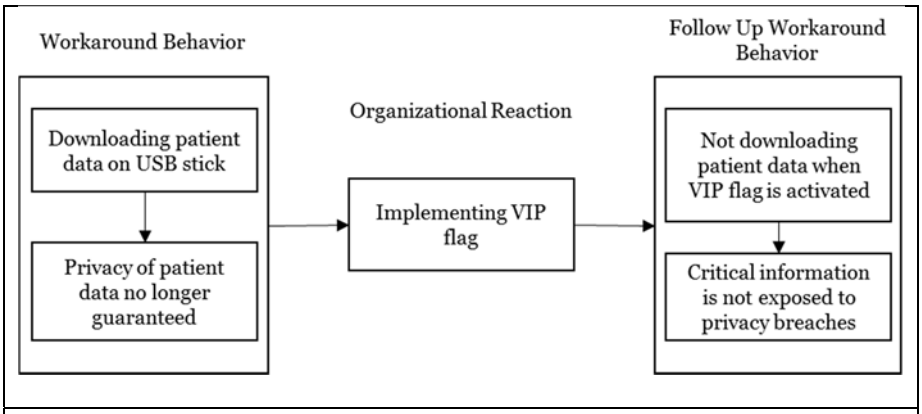

Figure 22: Evolution of Workaholic Workaround
(Source: Own illustration)

4.2 Broken ID Card Workaround

The insights we could gain the second case resulted in detecting the *Broken ID Card Workaround* (Table 36*).* AUTO developed formal processes for IS access verification. The workplaces are located in open plan offices. Therefore, it is exceedingly important that

organizational members authenticate at the system. They need to insert a personalized ID card in the computer and provide a password to verify their account. The policies of the organization regulate that organizational members need to logoff in order to ensure that no other person uses the account while not being at the desk. This is crucial as the R&D department owns sensitive data that is not meant to be accessed by unauthorized people.

Table 36: Description of Broken ID Card Workaround
(Source: Own illustration)

Characteristic	*Workaround*
Task	User verification and computer logoff
Actors	Organizational members and IT Security Officer
Formal Process Description	• Organizational members need to insert ID card in the computer to verify account • Organizational members need to pull ID card out of the computer to logoff
Workaround Behavior	Organizational members leave their ID card in the computer when leaving the workplace

Organizational members do not follow this intended process. They leave their desk and do not logoff the computer when they have a meeting somewhere else. As the ID card is not only used to authenticate at the system but also for physically access, employees request a second card. They leave one card in the computer and take the other card with them. When asked about the reason they said it is too time consuming. The risk for the organization is that unauthenticated people may use the computer while the organizational members are not at their desk. The organization can no longer make an individual accountable for behavior that is not aligned with organizational goals. Figure 23 shows the intended process and the workaround behavior in WPMN (Röder et al. 2015).

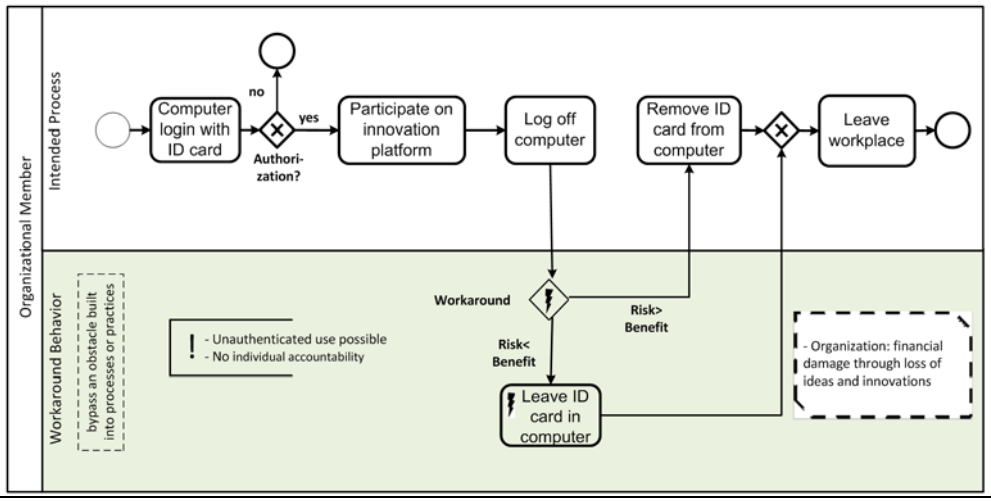

Figure 23: Intended Process and Broken ID Card Workaround
(Source: Own illustration)

In order to gain control on the authentication, the IT Security Officer collected the ID Cards that were left at the computer when leaving the desks. The IT Security Officer enforces the intended process by escalating the behavior to the management and reporting about the workaround. As a reaction, the organizational members manipulated the computer by inserting the card in the slot and breaking the part that overlaps. Therefore the card is not visible any longer but they are permanently logged in the system. Afterwards the employees report to the IT department that they lost their ID card and requested a new one where both cards are still valid. The organization is not able to control the workaround instead the control leads to other workarounds and therefore to a loss of control (Figure 24).

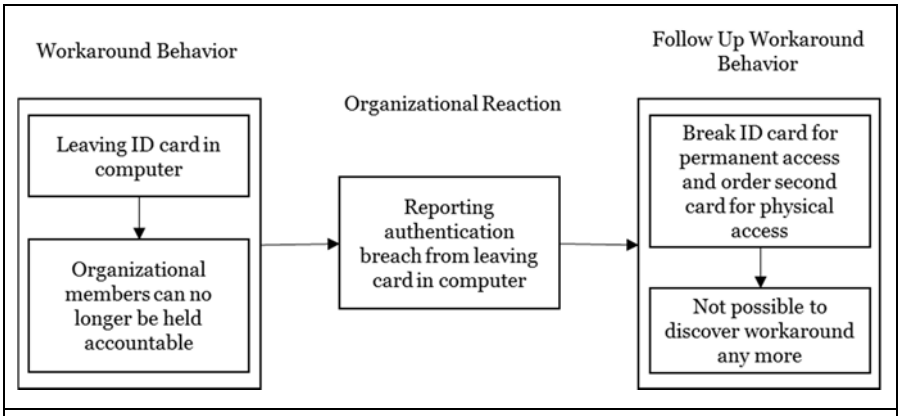

Figure 24: Evolution of ID Card Workaround
(Source: Own illustration)

4.3 Cross Case Analysis

We conducted a cross-case analysis in order to identify common themes and patterns of behavior (Yin 2009). Abstracting from the individual cases we focused on the characteristics of affordances to understand the institutionalization of workaround behavior. In line with Strong et al. (2014) we formulate each affordance as a gerund associated with the actions that would be taken to actualize that affordance. We formulated the workaround in the same style to show the reinterpretation of the affordance. Table 37 illustrates our findings with regard to each workaround.

Table 37: Comparison of Workarounds and Observed Affordances
(Source: Own illustration)

Domain	*Workaround*	*Description*	*Affordance*	*Workaround Emergence*	*Organizational Reaction*	*Workaround Institutionalization*
Health Care	Workaholics	Physicians download patient data	Creating and managing patient data	Downloading patient data on USB drive	Implementing VIP flag	Not downloading patient data when VIP flag is activated
Inno-vation	Broken ID Card	Organizational members do not log off the system	Verifying identity with ID card	Leaving ID card in computer	Reporting authentication breach	Breaking ID card for permanent access

Within the Workaholics Workaround physicians use the feature of the system and the hardware of the computer to download patient data. In this sense the organization counteracts the workaround and provides a clear cue of how to actualize the system. This reaction has an effect on the behavior and the evolution of the workaround. The workaround is institutionalized in a way that physicians and the hospital are both aware of the incongruent process behavior. Using the affordance lens advances the understanding of this evolution and enables the organization in gaining control over the workaround. The Broken ID Card Workaround shows that organizational members actualize the affordance in a way that was not intended. AUTO reports on the breaches and the workaround institutionalizes in favor of a different incongruent behavior. Due to the organizational reaction the workaround drives another workaround. Thus, enforcing the actualization of the affordance by punishing misbehavior leads AUTO to a loss of control.

By analyzing both workaround descriptions from an affordance perspective, we are able to understand the effect that affordances have on workarounds (Figure 25). First, we find that *affordances* are multifaceted which in turn may lead to various outcomes when organizational members interact with the system. In the hospital physicians interpret the EHR as affording them to download patient data and work from home. At AUTO organizational members leave their ID cards in the computer as it affords them to do so. In both situations the actualization of the affordance results in workaround behavior. Second, we find that affordances evolve during their actualization. In the health cars case similar use of the system by physicians leads the organization to implement a VIP flag. By reflecting the emerging workaround behavior, the organization and the physicians have a relational view on the affordance. The affordance that is created from interacting with the VIP flag is institutionalized. In the case of AUTO organizational members actualize the affordance differently when the workaround institutionalizes. Instead of leaving them in the computer, ID cards are even broken as the organization enforces the affordance by escalating workarounds. In both cases, physicians and organizational members interact with the system and reinterpret the affordance to achieve a goal-oriented outcome. Third, affordances can be used to control processes. From our cases it shows that workarounds are the result of actualized and perceived affordances. Organizations perceive an immediate outcome when affordances are actualized. In the case of the hospital this is a gain of control on the institutionalization of the workaround. AUTO perceives a loss of control when the workaround institutionalizes.

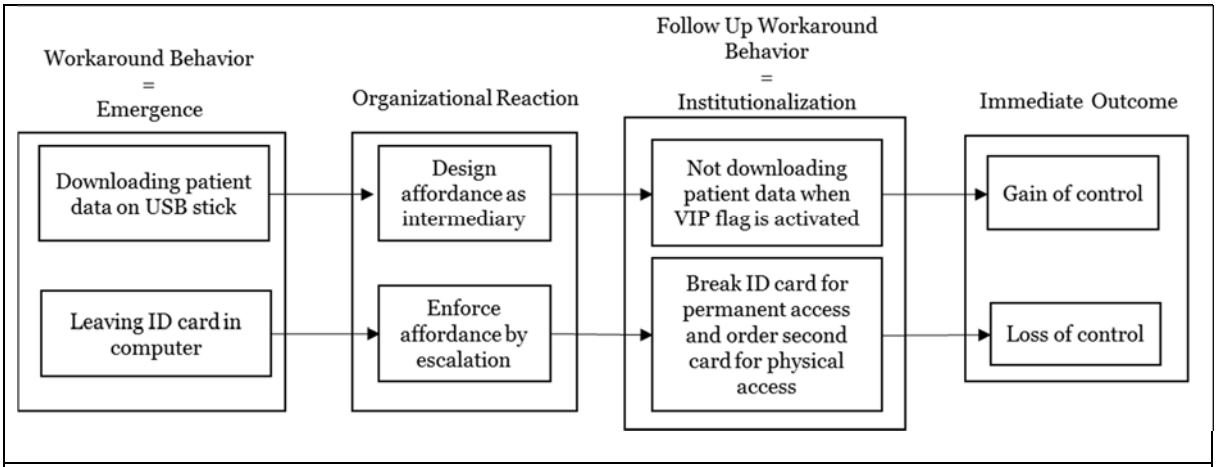

Figure 25: Evolution of Workaround Behavior from an Affordance Perspective
(Source: Own illustration)

5 Discussion

This paper was motivated by understanding how affordances can be used to understand the institutionalization of workarounds. We find that emerging workarounds become institutionalized differently depending on the actualization of the affordance. The immediate outcome that organizations perceive is a gain or loss of control on the institutionalization of workarounds.

Before we discuss the general findings, we have to keep some limitations in mind. First, this study is based on a case selection of highly uncertain processes. Both, in health care and in innovation processes it is difficult to determine a standard process ex ante. During data collection, we were confronted with the fact that physicians excuse workaround behavior by pointing out to save lives and innovators use organizational success for self-justification. Second, it is difficult to collect data on workarounds as it is a sensitive topic. We used different techniques such as ensuring anonymity and talking about workarounds by understanding obstacles in existing process. However, we might have missed central workarounds in our cases. Organizations are not aware of these rather hidden workarounds. Therefore, it would be fruitful to provide insights by using objective data that process relevant information (e.g event logs from process mining). Third, the study was conducted in two organizations. While we used existing knowledge to guide and structure our data collection, future research could examine different industries and could test the developed concepts in a larger sample.

In our research we were interested to shed light on how affordances can be used to understand workaround behavior. Our results both confirm and extend earlier findings. In the following we discuss our results in terms of (1) the contradicting affordance theories, (2) understanding institutionalized workarounds, and (3) desire paths.

Other than existing research we argue that the theories of affordance provided by Gibson and Norman are not contradictory, but are related to each other. Consider the following example.

A single user breaks his ID card by accident while storing the computer in his bag. He *perceives* personal benefits from this accident as he is now able to leave the card in the slot and orders a new one (Norman perspective). His colleagues adopt the behavior on purpose. As a result, the workaround hast turned into an *invariant* affordance (Gibson perspective). As the reflection of a certain routine becomes proceduralized users no longer actively question why certain routines or technologies exist or what they are good for (Leonardi 2011).

Workarounds evolve over time until they become institutionalized. As Azad and King (2012) observe, balance between top-down and bottom-up pressure causes the institutionalization of workarounds. In their research they treat the development of the equilibrium as black-box and focus on it as a static outcome with a steady state. However, we confirm the existence of this equilibrium but with our results we are able to explain how this situation develops. The actualization of affordances is dynamic which influences the dynamics of workarounds. Workarounds emerge and become institutionalized when organizational members interact with and reinterpret affordances. They develop a behavior that allows them to align the characteristics of business processes and IS while accomplishing their objectives.

Using the concept of desire paths in IS design, organizations are able to provide systems that reflect the needs of their organizational members. Adapted from architecture we refer to desire paths as a form of traces of collective and repeated crossing that wear down unpaved paths over time (Zhou et al. 2011). Analyzing the reason why people deviate from prescribed processes helps to understand organizational processes. Desire paths objectify the constraints that the organizational members face during their work. When considering workarounds in designing IS, new potential trajectories appear as they uncover organizational members' purpose more directly (Myhill 2004).

Our study contributes to theory in several ways. First, we take a step towards structuring the ongoing discussion between affordance theory by Gibson and Norman. We find that they are not controversial but rather related to each other. We show that the controversial explanation stems from observing two different points in time – when affordances are perceived and when they become invariant. Thus, our findings help researchers to design studies that will lead to more comprehensive theories about actual working practices and formal structures when using affordances. Second, organizations that seek to prevent users from engaging in workaround behavior with enforcement facilitate other workarounds. This arms race effect needs to be considered when designing IS or changing them in favor to standardization. Third, referring to the design of affordances, literature needs to investigate how IS needed to be designed in order to provide the user with readily perceivable affordances. Affordances that are not designed to be perceive directly and correct, may lead to negative outcomes. Fourth, past research often assumes that workarounds are the result of resistance towards a system. In our research we show that workarounds are the result of reflective behavior. Users engage in workaround behavior to achieve their goals that may sometimes be aligned with organizational goals or sometimes are non-compliant. Researchers need to consider, that organizational members may engage in workarounds due to their knowledge about how business process are more effective.

This study has several practical implications for organizations. First, we provide a step towards designing affordances into IS to encourage certain patterns of use and behavior. The possibility to design IS in a way that users actualize designer's intentions supports managers in gaining control on the workaround behavior. We refer to the method of desire paths as an emergent behavior-related concept arising from architecture. Observing the behavior that organizational members exhibit when interacting with IS, help to design workaround aware systems. Second, organizations are able to decrease workaround behavior that is associated with a higher risk. This relies on the assumption, that users are able to self-control their behavior by using affordances. Thus, affordances can only result in intended behavior when the user perceives them.

6 Conclusion

Following our analysis we are able to understand the effect that affordances have on the institutionalization of workarounds. Affordances may be the reason for organizational members working around IS but at the same time they may be the solution on how to gain control as well. Thus, from a relational perspective organizations are able to use affordances to drive the institutionalization of workarounds as technologies have the power to change people's way of doing things (van Osch/Mendelson 2011; Leonardi 2011). With our research we show that (1) affordances are multifaceted. In line with research we find that IS offer multiple affordances, and the actor can actualize them dynamically depending on circumstances and her or his shifting goals (Jung/Lyytinen 2014). (2) Affordances evolve during their actualization. We advance the understanding of the current discussion about the contradicting theories and show that this is unfounded. Rather than being inconsistent with one another, they depend on each other. Organizational members create affordances by reinterpreting their actualization. (3) Affordances can be used to control processes. As our cases show the actualization of affordances can be influenced. Therefore organizations can guide actualization by developing the capabilities to enable the competencies of their organizational members (Strong et al. 2014).

Publication 8

Designing Affordances to Control Workarounds: How Desire Paths may be used in Information Systems Research

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Abstract

To date, most research interprets workarounds from a predominantly adverse perspective where threats and rule breaking are the focus of investigation. Workarounds are frequently reported to be detrimental to performance and organizations are encouraged to invest efforts to hinder users from deviating from formal process descriptions. However, insights on how to prevent users from working around information systems (IS) only propose a partial explanation of the phenomenon. In this research we call for a change in perspectives and assume that workarounds can also be interpreted as a source of improvement and adaption to inefficiencies. When through the use of workarounds users find ways to achieve organizational goals more efficiently or identify potential innovations, these workarounds can be understood as an opportunity to change processes and procedures. This paper provides a first attempt to absorb action potential exhibited by workarounds. We investigate workaround behavior as information system-mediated interaction between users and organizations and find that the action potential of workarounds can be absorbed with desire paths in order to design necessary affordances for IS.

Keywords: Workarounds, evolution, desire paths, affordance theory.

Individual Contribution of Doctoral Candidate: The contribution of the doctoral candidate includes autonomously work within the introduction, theoretical background, the method, the results and the discussion as well as the conclusion. As interviewer she conducted the interviews and analyzed them in order to provide profound research results. She included the thoughts and ideas from the co-authors.

1 Introduction

Workarounds as a solution to process obstacles or cumbersome processes are frequently reported on in information systems (IS) research (Alter 2014). Rather than using this phenomena as a starting point, existing research ends the investigation with workarounds as an unexpected finding (Faraj/Azad 2012) and shows that organizations experience a loss of control (Ignatiadis/Nandhakumar 2009). The dominant view in literature interprets workarounds as a negative behavior resulting in non-compliance and inefficiencies that need to be prevented (Robinson/Bennett 1995). In our research, we propose that workarounds may be interpreted as a source of improvement (Patterson et al. 2002), creative flexibility (Miller/Wedell-Wedellsborg 2013), and adaption to inefficiencies (Debono et al. 2013). In order to understand their evolution, workarounds need to be further investigated. Our research can be seen as a starting point for turning value from understanding the evolution of workarounds. Building on existing insights, we are interested in providing organizations with recommendations related to obtaining value from understanding the evolution of IS-related workarounds.

Organizations implement control mechanisms to ensure that users follow formal process descriptions and that their behavior is compliant (Lowry/Moody 2015). To ensure compliance, organizations can follow a direct interaction strategy and introduce formal rules or they can use an information system mediated interaction strategy (Figure 26). This strategy is common practice as IS provide possibilities to implement standardized processes without risk of deviation (Wijen 2014). Thus, IS provide an instrument for organizations which allows them to control the behavior of users (Ahrens/Chapman 2004). As with most theoretical assumptions, however, practice reveals a different course of action. Literature reports that users frequently face challenges when it comes to working with IS as daily work procedures are prone to variability (Alter 2014). From an adoption perspective, each individual seeks to adapt existing functionalities to their own needs in order to enable effective and efficient daily working procedures (Ortiz de Guinea/Webster 2013).

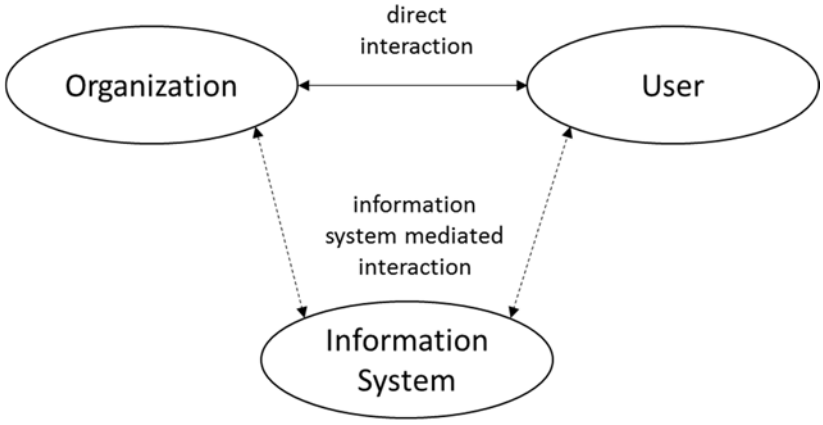


Figure 26: Information system mediated interaction
(Source: Own illustration)

Still, in research little attention has been given to how information system-mediated interactions between organizations and users are prone to workarounds (for an exception see Alter 2015b). Because users engage with IS differently, it is almost impossible to consider all workaround behavior and prevention approaches on an individual user level (Azad/King 2012). Instead, organizations need to understand how the evolution of workarounds takes place. The provision of an approach to recognize and utilize the action potential from workaround behavior can enable organizations to rethink the design of their existing IS. We turn on the phenomenon of desire paths that is routed in architecture and refers to tracks that are tramped across grassy spaces regardless of formal pathways (Myhill 2004). We use desire paths as a metaphor to show how organizational members develop their own methods of maneuvering through organizational processes when using IS. Following this approach, we seek to understand how organizations can create value from understanding the evolution of workarounds. We provide an approach to learn from IS-mediated interaction and thus, how to absorb action potential that may be used to design IS for representing daily working tasks rather than standardized processes.

A lens is required to better understand how and why users work around IS. The affordance lens disregards the generic user perspective as affordances are relational and depend on the user's knowledge and experience (Faraj/Azad 2012). Affordances arise when a person interprets a technology through his or her goals for action (Leonardi 2011). We draw on desire paths and adapt the concept to IS research to explain the information system-mediated interaction between users and organizations. We ask the following research question: *How can information system-mediated interaction between users and organizations help to implement necessary affordances for shaping organizational workaround behavior?*

The paper unfolds as follows. First, we describe the theoretical foundation of workarounds and affordances. We then present explain the method we used to conduct our research and present the empirical findings from our data. Next, we outline limitations of our research and discuss our findings with regard to existing literature. Finally, we draw a conclusion on how workarounds as desire paths help to identify necessary affordances for redesigning IS.

2 Theoretical Background

In literature, workarounds have been investigated with respect to resistance (Ferneley/Sobreperez 2006), workplace deviance (Robinson/Bennett 1995), or shadow IT (Silic/Back 2014). Reasons for workaround behavior include misfit between technology, process and culture (Ansari et al. 2010) as well as incongruent goals (Ignatiadis/Nandhakumar 2009). In addition to these factors, workarounds are fostered by organizational phenomena such as lack of accountability, drift, and change (Jenkins/Durcikova 2013; Azad/King 2012; Boudreau/Robey 2005). In this research we define workarounds as goal-driven changes to defined routines in business processes (Alter 2014) where anomalous IS use occurs when actual practices are not consistent with the intended use and official rules (Azad/King 2012).

Workarounds are predominantly seen as threats rather than opportunities whereby users defy behavioral prescriptions (Debono et al. 2013). In this research we interpret workarounds as a

source of improvement (Patterson et al. 2002), creative flexibility (Miller/Wedell-Wedellsborg 2013), and adaption to inefficiencies (Debono et al. 2013) thus casting a positive light on this phenomenon. In a positive sense, workarounds may occur when users engage thoughtfully with IS in a way that makes the underlying business process more effective (Alter 2014). Users engage in a recurrent risk-benefit analysis during which they decide whether to work around or stick to the standard process (Röder et al. 2014a). This leads to the assumption that it is not always valuable to prevent workaround behavior and encourage desired organizational behavior. Still, users that engage with IS in an unintended way present a challenge to system designers because they interact with the system in a way that was not planned (Faraj/Azad 2012). As a starting point desire paths (also referred to as desire lines) provide the possibility to visualize process instantiations (van der Aalst 2013) meaning that organizations can use the information that drives the workaround and learn from emergent change (Alter 2014). Providing an approach to absorb action potential from workaround behavior enables organizations to provide more efficient processes that are aligned with the daily working tasks of users. The desire of users to achieve organizational goals may be addressed by looking for possibilities within existing shortcomings (Nichols 2014). We argue that desire paths provide the possibility for organizations to identify and understand how and why workarounds occur.

Viewed in this way, IS play different roles in workaround situations as they bear severe risks but also promising potential (György et al. 2012). Analyzing literature, we find three different forms in which IS may influence workaround behavior: during their emergence, preventing their occurrence and during their institutionalization. In this research we refer to these three steps as the evolution of workarounds. First, IS may contribute to the emergence of the workaround. Yang et al (2012) found that a newly implemented electronic medication system does not provide relevant information on previously taken medications and differences in the routes of administration of different medications. Similarly, in the printing industry, a new system for scheduling prints requires duplicate work in printing and sending the records on paper in addition to the system, therefore the employees surpass the system (Dourish 2001). This type of an inadequate IT functionality can have positive effects as well. For example, social workers provide additional information on the children they supervise in the formal client information system. The provision of more information than the amount intended by systems designers assists colleagues in their work with the children. Second, IS can also inhibit workarounds as non-compliant behavior can be detected or prohibited. IT-enabled management control systems support managers in collecting, measuring, and comparing performance information (Orlikowski 1991). In line with these arguments, Lapointe and Rivard (2005) study the implementation of a new medication system that empowers pharmacists to control surgeons' medication dispensing behavior. Similarly, in the print industry, unequal distribution of print jobs can easily be prohibited by a formal system (Button et al. 2003).Third, IS can also contribute to the institutionalization of workarounds. When implementing organization-wide enterprise resource planning (ERP) systems, organizations inevitably define and enforce uncompromising rules enforced by the system in real-time (Ignatiadis/Nandhakumar 2009). Thus, employees tend to work around such formal processes more often (Robey et al. 2002). Similarly, strict rules occur in health care

information systems requiring compliance in segregation of duties (Azad/King 2008). IS further foster workarounds as they allow employees to build ‘facades of compliance’, which means that employees use information systems in order to feign compliance (da Cunha/Carugati 2009).

In order to understand how and why goal-directed actors work around IS, a lens is needed to view the relationship between IS and users. We propose affordance theory for describing the interaction between a technical object and a specific user that identifies what the user may be able to do with the object, given the user’s capabilities and goals (Markus/Silver 2008). Affordances can be explained as actionable properties between an artifact and an actor (Zhang 2008). They may be defined as “the qualities or properties of an object that define its possible uses or make clear how it can or should be used” (Meriam Webster). Affordances provide key characteristics that make it more or less likely that a practice will be adapted (Ansari et al. 2010) and support and create a representation of people’s interaction (Norman 1999). Affordances do not cause behavior but make certain behavior possible (Withagen et al. 2012). Although affordances provide strong clues to the operations of artifacts as the user knows what to do just by looking (Norman 1988), their actualization is related to an individual level (Strong et al. 2014). Affordances of technology can be broadly defined as the ways in which technology offers or supports certain things (Leonardi 2011) and are relevant for people’s interactions (Gaver 1991). The concept of technology affordance refers to an action potential, that is, those activities or tasks an individual or organization can perform with *IS* (Majchrzak/Markus 2012).

Existing research does not agree upon a clear definition of affordances and currently is two-fold. One theory defines affordances as properties of an artifact that can be designed (Gibson 1979). A controversial perception describes affordances as emergent properties in a dynamic actor–environment system (Norman 1988). Based on the definition of Gibson (1979), affordances explain how animals perceive their environment where surfaces and objects offer certain possibilities for action. In contrast to this description, Norman (1999) adds a subjective perspective on affordances in which affordances support and create a representation of human interaction. The existence of different interpretations of affordances (action possibility vs. perceived suggestion) (McGrenere/Ho 2000) has challenged IS research and existing theories. We reviewed existing literature in order to understand how affordances are conceptualized.

In his research, Gaver (1991) found that affordances help to improve usability of design. In his paper, Gaver (1991) provides examples of interface techniques and explains the concept of affordances as being a tool for user-centered analysis of techniques. Norman (1999) covers five concepts of design: the conceptual model, real affordances, perceived affordances, constraints, and conventions. Affordances specify the range of possible activities which are only of use if they are visible to the user. In turn, designers can only invent real and perceived affordances whereas social conventions cannot be changed on purpose. Markus and Silver (2008) analyzed DeSanctis and Poole’s (1994) concepts of structural feature and spirit in the context of IS design. They redefine the concepts as technical objects, functional affordances, and symbolic expressions in order to address existing shortcomings. The research of van Osch

and Mendelson (2011) describes the sociomaterial interactions between developers, users and artifacts in the context of generativity support applications. In order to better predict how technology affects the way people perform tasks and the relationships between people, they define three types of affordances: designed, improvised and emergent. Kaptelinin and Nardi (2012) present an initial outline of affordances as offering possibilities for individual human action mediated by cultural means (a mediated action perspective). Junglas et al. (2013) propose that in addition to the information and system component, a social component influences IS usage. These authors demonstrate that sociability impacts enjoyment and propose the incorporation of this finding into technology acceptance and adoption models. As a result of their research, Savoli and Barki (2013) identify four affordance archetypes regarding IT: facilitator, imposer, guardian angel and inhibitor. Those archetypes explain why a user continues or stops using IT or why he uses the artifact in unintended ways. Seidel et al. (2013) found that the primary role of IS in sustainable information is to create affordances. Affordances lead to sense making and sustainable practice which in turn provides action possibilities for participation, reassessment, behavior conditioning, and work virtualization. In their paper, Jung et al. (2014) provide five relational patterns of interactions among specific choice factors to investigate media choices in real-life settings. Drawing upon the theory of affordances, the authors provide a way to explain the dynamics of media choice as a multidimensional process. Finally, Pozzi et al. (2014) analyze existing literature regarding affordances and introduce four research categories: affordance existence, affordance perception, affordance actualization, and affordance effect. In his research, Leonardi (2011) finds that when a user perceives that IS offers affordances, the user will attempt to change routines to take advantage of that affordance. As IS already come with built-in physical affordances, designers can primarily control only perceived affordances (Norman 1999). Affordances are always perceived by a user who interprets a system through personal goals of action. In line with Markus and Silver (2008, 626), we interpret affordances as “the possibility for goal-oriented action afforded by technical objects to a specific user group”.

3 Method

To gain an understanding of the role of affordances in workarounds, we conducted an exploratory case study to analyze the information system-mediated interaction between users and IS (Eisenhardt 1989). Although the objective of conducting the interviews was not necessarily the identification of workarounds, by chance we were able to gain insights from the collected data as to how users adapt IS. The main purpose of the interviews was to understand how users deal with standardized IS in highly uncertain processes. In this research, we draw on two cases from health care and the innovation domain (Table 38) and provide a detailed description of our research context.

Table 38: Case Overview
(Source: Own illustration)

	Case 1	*Case 2*
Description	Common security issues in the health care sector are privacy breaches, especially within IS.	The innovation management process within the automotive domain is supported by multiple IS, tools, and methods.
Domain	Health care industry	Automotive industry
Core Process	Patient record process	Innovation management process
IS	Hospital information system (HIS)	Innovation platform
Interviews	10	18
Sample	Junior (5) and senior (3) physicians, security officer (1), IT director (1)	Innovation management (5), process owner (8), sales and marketing (4), IT architect (1)

In health care, high levels of uncertainty exist and key decision makers within the hospital determine the daily working processes. The innovation domain requires extensive knowledge and is characterized by rapid changes. Workarounds in the innovation context occur in successively faster cycles and result in more effective outcomes. We were able to gain insights into the daily activities of the users of each domain by interviews, observational data (off-the-record talks, meetings, etc.) and secondary data collection (archival data, presentations, etc.). During our data collection we developed a case study protocol which allows us to strengthen the reliability of our findings (Yin 2009).

As one of the most studied examples within workaround research, we found health care (case 1) to be a particularly suitable domain to start our analysis. Physicians talk rather frankly about how they disregard organizational processes and then work around IS (Vogelsmeier et al. 2008; Safadi/Faraj 2010). These interviews have mainly contributed to our interest in workaround behavior. Therefore, we focused our investigation on behavior that was non-compliant with formal process descriptions.

In the second case, we examined the innovation management process in the automotive industry (case 2). We found this process particularly suitable for our research endeavor as innovations often do not follow the intended process. Organizations often approach the management of innovations in a formalized manner. The automotive domain provides an interesting area for research; the business model shifts from solely producing cars to a more holistic concept that offers services for supporting mobility.

With the interviews we were able to identify a list of 20 workarounds in two cases: health care and innovation (Table 39). As the data collection occurred iteratively, we were able to concentrate on the most promising workarounds for further investigation. In order to gain more insights, we conducted further on-site observations of the organizations and included secondary data (Yin 2009).

Table 39: List of identified Workarounds
(Source: Own illustration)

Workaround	*Description*	*Intended Process*	*Effect/Consequence*
Health Care Case			
workaholic	physicians copy patient data from the secure information system	work on patient data from hospital computer	no guarantee of security of patient data
sharing passwords	sharing passwords with colleagues or pinning them to the monitor	keep password in private	passwords hinder work and are seen as time-consuming
log out	physicians do not log out of the system	log out when leaving computer	not logging out or in is time saving and convenient
taking patient records home	physicians take patient records home	work on patient records only in the hospital	maintain work-life balance
copying patients records	physicians copy patient records and edit as necessary	write new/individual records	mistakes appear when missing necessary parts
patient records trolley	leaving the trolley with patient records standing unattended in the corridor	keep records in a safe place	belief that others have no interest in reading records
data access reason	physicians do not provide reason for accessing patient data	insert information for access reason	access transparency is not guaranteed
standard password	all employees in a particular ward use the emergency standard password	use personal password	privacy and security regulations are not respected
Innovation Case			
broken ID card	users break the ID card for permanent access	remove card when leaving desk	unauthenticated persons may use the computer
favoritism	compromise with other business units to ensure that in later projects own requirements will be implemented	discuss the necessity of suggestion	unnecessary or wrong requirements could be implemented
innovation camouflage	innovations are treated as change requests; confront with a prototype (fait accompli) to overcome obstacles	approval from steering board, discuss the necessity of specification	no transparent allocation of resources which has an influence on organizational culture
functionality integration	bypass requirements by creating new functions during project specification	avoid the interrelation of functions	overkill of functions
relocate capacity	use resources from other projects and record them	invest capacity in specific project	“no time to fail” mentality

standard application	IT department pretends to implement standard application	dynamic certification should be implemented	reduce workload and extra effort, build on existing implementation
manipulation of decision-maker	pushing people with strong ties to the steering board to pave the way for their project	follow the standard process through steering board decision	unnecessary requirements may be implemented
build up pressure	reoccurring problems remain unsolved until they escalate	solve the problem	no time to solve problem
reap resources	pro forma gathering of resources during planning phase	record correct requirements	lack of trust
task redirection on platform	redirecting assigned tasks on the platform abandons more work	reviewing task	anticipate effort
ignoring basic conditions	avoid more work by not integrating new ideas in projects	discuss the necessity of suggestion	if important, suggestion/new ideas will re-emerge
seizing the window of opportunity	ignoring time specifications in order to complete project implementation	some innovations have to be launched faster due to rapid technology changes	strategy is not followed and does not meet milestones

Table 40 provides an overview of the procedure of the data collection and analysis in order to become intimately familiar with each case as a stand-alone entity (Eisenhardt 1989). In the first phase, we conducted 6 interviews in the health care environment and 11 in the innovation case. We analyzed the interviews and found the phenomena of workarounds after studying the cases. In order to gain more insights, we conducted another iteration of interviews which included an additional 4 interviews for case 1 and 7 interviews for case 2. Through conducting these insights we were interested in obtaining more background information on workarounds in each case. We conducted on-site observations in order to understand how and why the concrete workaround occurs. In sum, we conducted 10 interviews identifying 8 workarounds in the health care case and 18 interviews identifying 12 workarounds in the innovation case.

Table 40: Data Collection and Analysis Procedure
(Source: Own illustration)

Phase 1: Data Gathering	**Health Care**	**Innovation**
Number of Interviews	6	11
Number of Workarounds	5	7
Phase 2: Data Allocation	**Health Care**	**Innovation**
Number of Interviews	4	7
Number of Workarounds	3	5
Phase 3: Data Reduction	**Health Care**	**Innovation**
Number of Interviews	On-Site Observation	On-Site Observation
Number of Workarounds	1	1
Final	**Health Care**	**Innovation**
Number of Interviews	10	18
Number of Workarounds	8	12

A student assistant transcribed all 28 interviews. To ensure quality assurance, we cross checked the transcribed records with the interviewees and verified the records with our observations and secondary data. In order to analyze the transcripts, we used an initial coding technique to identify causes, context, contingencies, consequences, conditions, and covariance for each workaround (Glaser 1978). With this coding scheme we were able to concentrate on the evolution of workarounds and the role of IS. The coding process was iterative and included both the initial coding scheme and an open coding. One of the authors and a student assistant independently coded the transcripts and provided a coding report. The report consisted of a list of codes, the related quotes, emerging concepts and the further aggregated categories. We resolved disagreements with a consensus approach and validated the new codes. We selected categories and dimensions in order to look for within-group similarities coupled with intergroup differences (Eisenhardt 1989). Our final coding comprises 254 codes in total with an average of 7.5 per workaround in case 1 and 8.25 codes per workaround in case 2. We concentrate on one workaround for each case and chose the most informative ones providing rich insights into the process of the workaround evolution.

Case study 1 took place in a German hospital where occupation groups from different backgrounds work together. In our study, both physicians and IT personnel were interviewed to gain a comprehensive perspective on the implementation of IS. We were able to gain insights into the daily working procedures of both groups and how they both interact with the hospital information system (HIS). HIS systems can be described as applications of IS in the context of health care that relate a wide range of disciplines including medicine, computer science, management science, statistics, and biomedical engineering (Anderson 1997). In total, we interviewed 10 users in the hospital: five junior and three senior physicians, one security officer and one IT director. The hospital has a close relation to research where the

majority of the projects that have been developed evolve from the pilot and funding phase into efficient and health economic sensible structures and processes. Due to collaborations with external funding sources including the pharmaceutical industry and the federal German health system, the hospital is vulnerable to threats as the challenge for the hospital lies in balancing complex security requirements with the integration of advances in medical technology. Potential threats may include the violation of medical and scientific rules, data manipulation, corruption in the procurement process for following funding, sloppiness during audit inspections, and fraudulent accounting. The users involved in the processes we were interested in investigating are physicians (senior, junior and intern physicians), nurses and IT personnel. We were interested in evaluating the HIS as it is a comprehensive, integrated information system designed to manage all aspects of hospital operations such as medical, administrative, financial and legal issues and the corresponding processing of services. Besides the focus on administration needs, HIS provides a common source of information about a patient's health history. HIS enables physicians and nurses to electronically store patient data. In order to edit the data, personnel need to login with a username and password; they must be the designated provider of care in order to access the particular patient's data.

Case study 2 was conducted within the innovation management department of a large German automotive manufacturer (designated as AUTO for purposes of our research). We interviewed different users who generate radically new ideas and use existing approaches for incremental ideas. In order to gather all ideas, the organization implemented an innovation platform for creating the "next big idea". We were interested in how users from different business units use the platform for supporting their ideas. In total, we interviewed 18 users from different business units regarding their innovation generation: five innovation managers, eight process owners, four sales and marketing employees and one IT architect. The shift from solely operating as an automobile manufacturer towards providing mobility services challenges this organization. Especially the high competition among manufacturers has driven the organization to achieve ambidexterity – achieving a balance between exploratory and exploitative innovations. Research regarding ambidexterity proposes to achieve a trade-off between creating new knowledge and using existing knowledge. The users are urged to propose innovative ideas that enable technological progress and incremental change. From an organizational perspective, several roles are organized in a hierarchical manner: business unit manager, department manager, team leader, and employee. While each business unit has a clear focus on its contribution to the core business, it also needs to generate innovations. The IS we were interested in is an innovation platform used to generate, discuss and "like" ideas. The organization seeks to change the innovation culture within the hierarchical structure by providing a platform for ideas. Users can post innovative ideas on the platform and add keywords, additional data (pictures, files, and links) and a short description of the idea. In turn, colleagues comment on the idea, pose questions and "like" the idea. Ideas receiving high rankings are chosen to be introduced in the next steering committee meeting for which the submitter of the idea needs to prepare a business case.

4 Results

4.1 Workaholic Workaround

Analyzing data from case 1, we found incongruence in the formal process description and actual working practice which we call *Workaholic Workaround* (Table 41). Physicians use HIS to write their electronic health records (EHR) on the medical status of patients. They need to login to the HIS and use the patient data from the EHR to update records. Those records are stored in a physical file in the EHR. In the following we describe the information-system mediated interaction between physicians and the EHR.

Table 41: Description of Workaholic Workaround
(Source: Own illustration)

Characteristic	*Workaround*
Task	Writing record on medical status of patient
User and Organizational Perspective	IT Security Officer and Physicians
Formal Process Description	Login HIS and use the patient data for updating records Record is stored in a physical file in EHR
Workaround Behavior	Instead of writing the record at the computer station at work, physicians download patient data on a private USB drive and write the record at home

Physicians do not follow the indented process. They login to the system and download all relevant data for writing records on private USB drives. Physicians take the USB drive home and write the record on their personal computer. On the next day the record is copied back to the HIS. When asked about their motives, they said their workaround allows them to see their families and facilitates their work-life-balance. As a consequence, the hospital is not able to guarantee the security of the patient information. Further, USB drives may be lost and security standards are not as high on private computers as on those in the hospital.

In order to illustrate the workaround behavior we use the Workaround Process Modeling Notation (WPMN). WPMN is an extension of the Business Process Modeling Notation (BPMN) which incorporates workarounds and related concepts in a formal business process model (Röder et al. 2015). Using WPMN, we are able to visualize the desire paths in the workaholic workaround and highlight the information system-mediated interaction between physicians and the EHR (Figure 27).

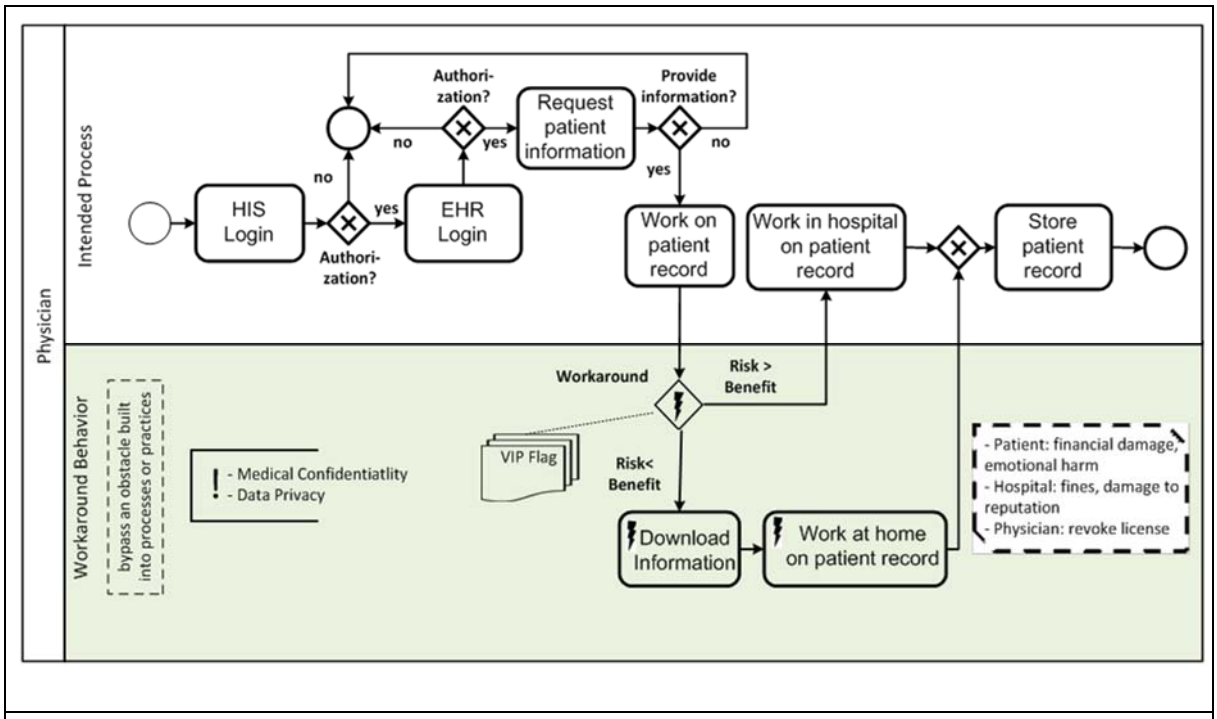


Figure 27: Desire Paths in the Workaholic Workaround
(Source: Own illustration)

In order to gain control of the patient information, the IT architect implemented a feature in the HIS to identify critical patient information. He implemented a VIP flag to identify particularly sensitive patient information. In this way, the hospital guarantees that critical information is not exposed to privacy breaches as physicians know which patient information is sensitive. The evolution of this workaround may be related to the phases we identified in the literature: (1) emergence, (2) inhibition, and (3) institutionalization. Table 42 presents the different stages which the workaround traverses.

Table 42: Evolution of Workaholic Workaround
(Source: Own illustration)

Evolution	*Workaround Description*
Emergence	Physicians download patient data on USB stick
Inhibition	Security officer implements VIP flag
Institutionalization	Physicians do not download patient data when VIP flag is activated

To understand the evolution of the workaround we visualize the process of how the new affordance is implemented in IS (Figure 28). In the first step, the workaround evolves where the IS enables certain behavior; in this case, the activated USB drive. For the second step, the hospital uses the underlying information of the workaround in order to implement the necessary affordance. Following the desire paths, physicians need a process which allows them to download data to work on at home. Thus, the necessary affordance needs to provide the possible use of certain patient data. The VIP flag informs physicians when they are allowed to download the data and when they are not. The third step shows that this affordance

meets the conditions of the working environment and the hospital. The bottom-up requirements and the top-down conditions are combined in this affordance.

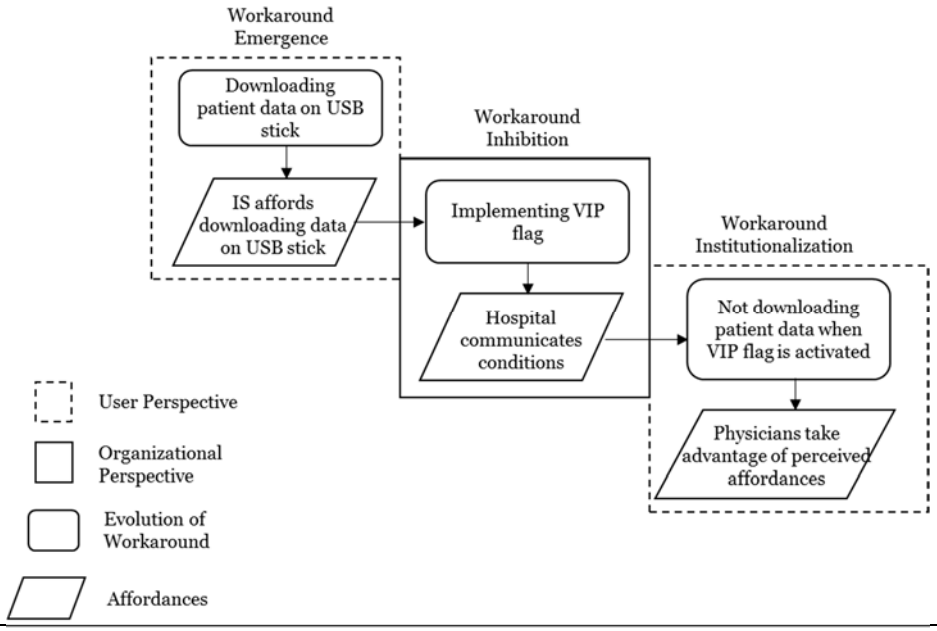


Figure 28: Affordances in the Workaholic Workaround
(Source: Own illustration)

4.2 Broken ID Card Workaround

The insights we could gain in case 2 resulted in detecting the *Broken ID Card Workaround* (Table 43). AUTO developed formal processes for IS access verification. The workplaces are located in open plan offices making it exceedingly important that users authenticate themselves to the system. Users need to insert a personalized ID card into the computer and provide a password to verify their access. The policies of the organization stipulate that users logoff when leaving their desk in order to ensure that no other person uses their account while not being at the desk. This is crucial as AUTO owns sensitive data that is not meant to be accessed by unauthorized people. In the following we describe the information system-mediated interaction between users and IS.

Table 43: Description of Broken ID Card Workaround
(Source: Own illustration)

Characteristic	*Workaround*
Task	User verification and computer logoff
User and Organizational Perspective	IT Security Officer and users
Formal Process Description	• Organizational members need to insert ID card in the computer to verify account • Organizational members need to pull ID card out of the computer to logoff
Workaround Behavior	Organizational members leave their ID card in the computer when leaving the workplace

Users work around this intended process. They leave their desk and do not logoff the computer to attend a meeting. As the ID card is not only used to authenticate to the system but also for physical access, employees request a second card: they leave one card in the computer and take the other card with them when they leave their work area. When asked why users work around the designated process, they replied it is too time consuming. The risk for the organization is that unauthenticated people may use the computer while the users are not at their desk. The organization can no longer make an individual accountable for behavior that is not aligned with organizational goals. Figure 29 shows the desire paths in the case of the broken ID card workaround using WPMN highlighting the information system-mediated interaction between the user and IS (Röder et al. 2015).

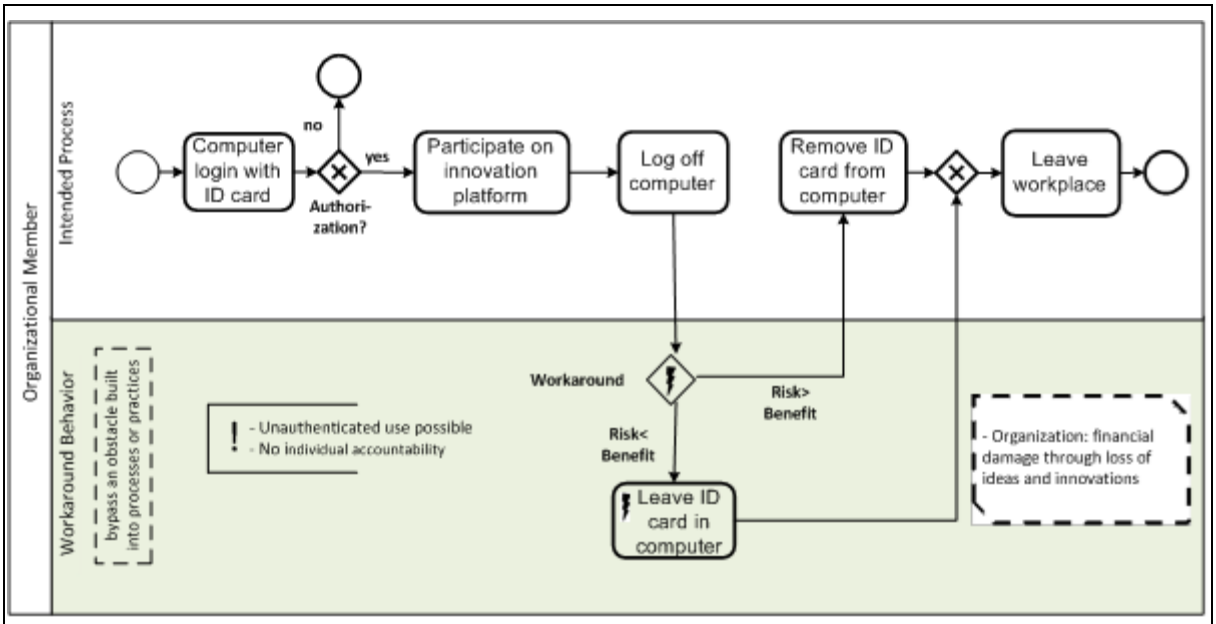


Figure 29: Desire Paths in Broken ID Card Workaround
(Source: Own illustration)

In order to gain control of the authentication, the IT Security Officer collected ID cards left at computers when the user was not present. The IT Security Officer enforces the intended process by reporting and escalating the workaround to management. As a reaction, the users manipulated the process by inserting the card in the slot and breaking off the part sticking out. Therefore, the inserted card was no longer visible but the user was permanently logged into the system. The employees report a lost card to the IT department and request a new one whereby both cards remain valid. Table 44 shows how the workaround traverses the three stages: (1) emergence, (2) inhibition, and (3) institutionalization.

Table 44: Evolution of Broken ID Card Workaround
(Source: Own illustration)

Evolution	*Workaround Description*
Emergence	Users leave their ID cards in the computer when leaving their desk
Inhibition	Security officer reports authentication breach because of users leaving their card in the computer
Institutionalization	Users break their ID cards for permanent access and order a second card for physical access

When relating the evolution of workarounds to affordance theory, we are able to explain how the workaround becomes institutionalizes and show the information system-mediated interaction between the user and IS (Figure 30). In the first step, the workaround emerges as users see a restriction in their daily work task by pulling the ID card out of the slot when leaving the desk. As the computer affords leaving the card in the slot, users take advantage of

this possibility. Instead of understanding the workaround as a desire path, the organization enforces compliance in the second step. As a result, the users reinterpret the affordance and find a new solution to work around the rule. The resulting institutionalization of the workaround combines the bottom-up requirements with the top-down conditions in an unintended way.

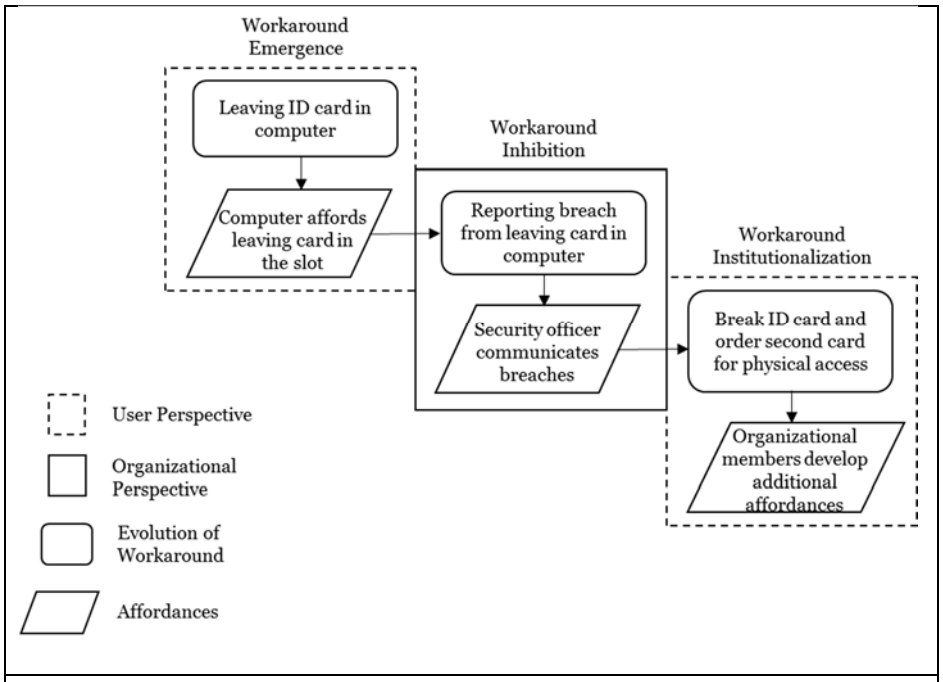


Figure 30: Affordances in the Broken ID Card Workaround
(Source: Own illustration)

4.3 Cross Case Analysis

We conducted a cross-case analysis in order to identify common themes and patterns of behavior (Yin 2009). Abstracting from the individual cases we focused on the characteristics of affordances to understand the evolution of workaround behavior. Figure 5 provides an overview of the relation between affordances and workarounds from an abstract level of investigation. In the following section we explain each stage of evolution of workarounds in relation to the affordances.

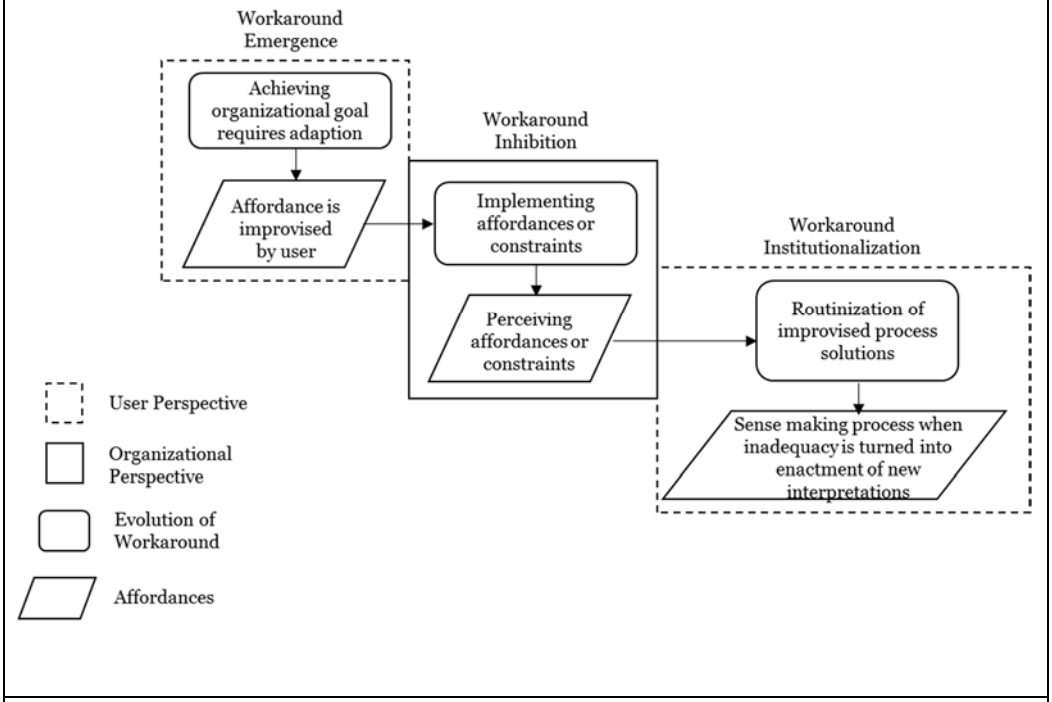


Figure 31: Workaround evolution from an affordance perspective
(Source: Own illustration)

We find that during the emergence of the workarounds users interpret the affordance of the system not in the way it was planned. Thus, the information system-mediated interaction between the user and the organization is based on improvised actions. From a workaround perspective this concept is related to the process of an emerging behavior. Thus, users perceive IS in a way that helps them to align their own goals to organizational goals. In this case, users perceive affordances as a possibility to develop an artifact to help them achieve a particular outcome (van Osch/Mendelson 2011). Improvised affordances may be recognized and perceived by a certain user, meaning that the designer was not aware of these affordances during the design phase (van Osch/Mendelson 2011). As stated by Gaver (1991): “People will usually not think of a given action when there is no affordance for it nor any perceptual information suggesting it”.

In turn, when organizations seek to prohibit certain user behavior, they implement constraints or affordances. The information system-mediated interaction is affected by the organization: the reaction of the organization influences the workaround behavior. We find that in this phase, organizations seek to inhibit the workaround in order to prevent unintended outcomes (Alter 2015b). Organizations that aim to prevent users from engaging in workaround behavior built on the relational component and facilitate or constraint user behavior (Savoli/Barki 2013). Users either change their routines or change the system when they perceive a changing organizational environment in the form of constraints or affordances (Leonardi 2011). Constraints limit the possible behavior of a user whereas affordances enable a certain behavior. Therefore, it may be prudent for organizations to rethink the inhibition of

workarounds by implementing new constraints: affordances may provide a more effective reaction to control workarounds.

We find that when workarounds are interpreted as desire paths, necessary affordances aligned with top-down constraints and bottom-up requirements become institutionalized. In this case the improvised processes evolve over time and eventually become organizational routines. The evolution of information system-mediated interactions is becoming part of organizational processes. Users develop a behavior that allows them to align the characteristics of business processes and IS while accomplishing their objectives. Organizations are able to react to changing tensions and specify the range of possible activities within IS using affordances. Affordances focus on the translation and transformation into action (Pozzi et al. 2014). Thus, affordances may be implemented in an iterative process and are dependent on IS features, the capabilities and goals of the user, and external information (Pozzi et al. 2014). In the case of the workaholic workaround, the hospital uses the information grounded in the workaround and implements a necessary affordance: the VIP flag. In our innovation case, the organization seeks to inhibit the workaround by providing constraints. An example of a necessary affordance in this situation would be to allow users a quick restart of their computer after returning to their desk after a designated period of time. As shown in case 2, by instituting constraints, other (sometimes more severe) workarounds occur.

5 Discussion

This research was motivated by our interest in understanding the information system-mediated interaction between users and organizations in workaround behavior. While literature provides a predominant adverse perspective, we assume that workarounds can also be interpreted as a source of improving inefficiencies. Through the use of WPMN, we are able to visualize workaround behavior within formal business processes and show how users deviate from prescribed processes. We are interested in understanding workarounds using the concept of desire paths from architecture. In line with architecture, we argue that desire paths may help organizations in identifying and understanding actions as expressions of desires in response to restrictive formal structures (Nichols 2014). In order to turn workaround behavior into real value, we draw on the concept of affordances. Affordances are “qualities or properties of an object that define its possible uses or make clear how it can or should be used” (Meriam Webster). Using our study results, we are able to (1) illustrate workaround behavior using WPMN, (2) absorb action potential of workarounds using desire paths in order to (3) generate recommendations for implementing affordances in IS. Our results both confirm and extend earlier findings. In the following we discuss our results in terms of how to adapt desire paths in IS and how workarounds evolve.

Before we discuss the general findings, several study limitations should be addressed. First, our sample comprised two research sites limiting the generalizability of results. Nevertheless, we are confident that our insights are applicable to other domains and organizations as workarounds are inevitably to be found in other industries. Second, workarounds represent a sensitive topic requiring special forms of data collection. We collected initial data through interviews and were able to enhance our data with information gained through onsite

investigations at the two organizations. We did not start our interviews with the intention to talk about workarounds but rather the users came up with the phenomenon. This shows the importance of research on workarounds and the willingness of users to report on their behavior.

Workarounds are the result of users interacting with IS in a way not intended by the designer. From a user perspective, the incongruence between formal process descriptions and actual working practices highlights a shortcoming that the processes exhibit. Workarounds are dynamic and provide rich insights about the user's desire to achieve organizational goals. Desire paths provide the possibility to visualize the information system- mediated interaction between users and organizations. Interpreting workarounds as desire paths enables organizations to uncover recurring shortcomings (Cabitza and Simone 2013). We adapt the idea of desire paths from architecture and argue that retracing users' steps through organizational processes provides an approach to absorb action potential. We use the term as a metaphor to show how organizational members build their own ways through organizational processes when using IS. We argue that fighting workarounds through the use of control and punishment does not always result in the intended outcome. Rather, organizations need to learn how to embrace them and absorb action potential from workaround behavior. Desire paths provide strong clues about how users deviate from formal process descriptions. Understanding why and how users work around existing IS is only the first step. Organizations need to use this information and turn the process incongruences into real value. By using desire paths organizations are able to uncover, explicate, and evaluate workarounds in terms of enhancing their existing IS.

With our findings we are able to explain the underlying dynamics of workarounds and how they evolve over time. In their study, Azad and King (2012) observe that a balance between top-down and bottom-up pressure leads to an equilibrium which causes the institutionalization of workarounds. They treat the development of the equilibrium as black-box and focus on it as a static outcome with a steady state. We confirm the existence of this equilibrium and our results provide insight as to how this situation develops. We show that workarounds evolve due to the interaction between users and IS. This interaction builds upon a sequence of affordances that are the result of this relational perspective. Users develop a behavior that allows them to reinterpret the characteristics of IS while accomplishing their objectives. They perceive affordances when working on their daily tasks and use them to align their goals. When organizations establish new affordances, users interpret them and find other ways to actualize those affordances (Strong et al. 2014). Therefore, the action and reaction process of organizations and their users makes the equilibrium dynamic (Smith/Lewis 2011). Instead of perceiving workarounds as acts of resistance organizations can absorb the action potential and use the phenomena to design necessary affordances. Organizations that are able to react to changing tensions and specify the range of possible activities within their goals can shape organizational workaround behavior.

Implementing affordances in existing IS allows organizations to create a space of opportunity in which users may act upon their goals (Leonardi 2011). In line with Leonardi (2011), we propose affordance theory as a viable lens to investigate how workarounds evolve. With our

findings we are able to show that affordances are dynamic. Organizations that seek to implement affordances need to consider that their design is a sequence of action and reaction where users will find ways to adapt IS if expectations are not met (Leonardi 2011). We find that desire paths provide an instrument to interpret workarounds and offer the possibility to add value when using affordances in IS.

With our findings we make several contributions to design research. First, numerous IS have not been designed to achieve their intended use. As one prominent example we refer to spread sheets that are used instead of IS that are perceived as inefficient. With our research we propose that addressing this shortcoming by absorbing action potential, daily working tasks may be enhanced. Our findings show how those shortcomings may be identified when visualizing workarounds with WPMN and interpreting them as desire paths. Second, continual redesign of IS is needed due to continually changing dynamics. Instead of following the "design-build-implement" approach we show how information behind workarounds can be used to redesign existing systems. In turn, potential workarounds that may occur should be considered during the design phase. Learning from emergent change enables designers to provide more realistic systems that are aligned with organizational characteristics. Thus, following our findings that workarounds are dynamic and evolve, designers need to redesign existing IS with regard to the changing environment in organizational working environments.

This study has several practical implications. First, from an organizational perspective, we assume that eliminating or prohibiting existing workarounds may bring unintended results, e.g. severe or various other workarounds (Azad/King 2012). Therefore, organizations need to understand why their users do not follow intended processes and how the information system-mediated interaction influences user behavior. Identifying the trigger of the workaround enables organizations to think about how necessary affordances need to be designed. Integrating information on how the workaround traverses organizational process in the redesign of IS leads to more realistic systems and thus to performance improvements in the organization. Second, when IS is designed in a way that it conflicts with the daily working tasks of users, managers may not enforce its use because it is not in their best interests (Markus/Keil 1994). Instead of creating a working environment under a façade of compliance, we show how workarounds may be used to redesign IS in a way that aligns it with organizational goals and the demands of the users at the same time. Thus, we show that desire paths help to extend the set of strategies for managerial intervention using affordances.

6 Conclusion

The aim of this research was to understand the evolution of workarounds as a result of information system-mediated interaction between users and organizations. We use an exploratory case study and introduce two research sites: health care and innovation domain. The Workaholic Workaround from health care describes how physicians download patient data on a private USB drive and write the patient record at home instead of writing the record at the computer station at work. The Broken ID Card Workaround from the innovation case deals with users leaving their ID card in the computer when leaving their workplace instead of taking the card with them. In order to visualize the formal process and the workaround

behavior, we use the Workaround Process Modeling Notation (WPMN). Using this visualization as a starting point, we turn on the concept of desire paths from architectural theory to understand workarounds as expressions of desires in response to restrictive formal structures. With our findings, we shed light on the evolution of workarounds by differentiating three phases: workaround emergence, the inhibition of workarounds and their institutionalization. Interpreting workarounds as desire paths helps in understanding the shortcomings of existing formal process descriptions and thus, absorbs action potential. By using the concept of desire paths as ex-post interpretation of workarounds, we explain how they evolve and become a consistent part of organizational routines. In order to learn from evolutions of workarounds, we propose to design IS with regard to the information that the workarounds exhibit in the form of action potential. In order to turn workaround behavior into real value, we draw on the concept of affordances from architectural theory where they are defined as the "qualities or properties of an object that define its possible uses or make clear how it can or should be used" (Meriam Webster 2016). Thus, affordances can be used to enable certain behavior to provide hints on how the information system-mediated interaction between users and organizations should take place. In this research, we propose that the action potential of workarounds can be absorbed with desire paths in order to design necessary affordances for IS.

PART C

4 Summary of Findings

This thesis focuses on how organizations are challenged when realizing a trade-off between exploratory and exploitative innovations. Organizations are forced to provide exploratory innovations in order to open new markets. While on the other side they need to serve existing customers with exploitative innovations in order to satisfy their urge for product improvement. By introducing ambidextrous concepts organizations aim to balance this trade-off. Therefore, we were interested in investigating how organizations seek to achieve this balance by providing clear descriptions on how organizational members need to achieve those goals. When organizational members accept those goals but lack access to legitimate means to achieve it, they find their own ways. We find workarounds as an anchor to be able to achieve ambidexterity without losing structure. Workarounds are predominantly used when rigorous processes hinder employees from delivering exploratory innovations. Understanding this mechanism is crucial when organizations seek to work in an ambidextrous environment. From a scientific perspective we used existing concepts that are already approaching the phenomenon of workarounds. We extended the concepts by adding the organizational perspective of tolerating or prohibiting workarounds. By understanding which factors influence decisions on tolerating or prohibiting workarounds we shed a more constructive perspective on how to integrate workarounds. Introducing the possibility to visualize workarounds enables organizations to influence their institutionalization. We argue that desire paths may help organizations in identifying and understanding workarounds as expressions of desires in response to restrictive formal structures. Organizations implement affordances to create spaces of opportunities in which organizational members may act upon their goals. Thus, implementing affordances enables organizations to arouse a certain behavior and may enable them to control the institutionalization of workarounds.

Throughout the publication cycle we addressed the challenges we illustrated in the introduction. First, we were able to gain insights into the (C1) generalization of workarounds in literature. Second, we investigated the (C2) missing explanation on how to achieve organizational ambidexterity. Third, we were interested in the (C3) effect of drifting IS on the standardization of business processes. Fourth, we shed light on the (C4) design of IS to control workarounds using affordances. The research questions that guide our publications have been answered with the following findings.

RQ1: How can ambidexterity be organized through IT enabled agility?

P1: This publication provides three major findings for explaining how to achieve ambidexterity through IT enabled agility. First, we find that entrepreneurial agility impedes exploitative concepts in ambidextrous organizations. Second, we show that adaptive agility impedes exploratory concepts in ambidextrous organizations. Third, we provide empirical evidence that ambidextrous organizations exhibit structures that allow them to transfer results from exploratory to exploitative activities through IT enabled agility. The results we provide differentiate between four effects dominating the organizational ambidexterity and IT enabled agility concepts. An exploitative focus can trigger a (1) ‘success trap’ in which exploitation drives out exploration, while focusing solely on exploration results in a (2) ‘failure trap’. We

find evidence for incompatible structures when organizations with entrepreneurial agility seek to execute exploitative concepts and organizations with adaptive agility try to operate exploratory concepts. We refer to these antagonistic structures as (3) 'improvement trap' and (4) 'disruption trap'. Furthermore, we find that unintended side effects occur when organizational members transfer their knowledge between exploratory and exploitative business units. The structures that enable a knowledge transfer become part of organizational routines and thus, institutionalized. The transfer occurs frequently, but is yet not fully integrated from an organizational perspective as tensions between organizational goals make the transfer dynamic. Deriving the findings from this study, we suggest that exploitative concepts require IT enabled agility mechanisms that are incompatible with those for exploratory concepts, and oppositely. We highlight the need for ambidextrous organizations to facilitate permeable boundaries with IT enabled agility by offering a transfer. With our research we support literature which treats IT enabled agility as an indispensable ingredient in organizational ambidexterity to achieve competitive advantage.

RQ2: a) What types of workarounds are discussed in literature and how can they be classified?

b) Which concepts are relevant when investigating workarounds and how are these concepts related?

P2: Scanning literature, we discover three gaps in workaround research: (1) lack of conceptual consensus, (2) fragmentation and (3) a static perspective on the phenomena. To close this gap and in order to advance theory, we provide an overview of different types of workarounds that are frequently used in literature. Using a literature review we collect types that describe the phenomena and provide a working definition of each term. The resulting overview is based on a concept-centric summary where each paper from the literature analysis is related to the type of study (empirical or conceptual), type of workaround, level of workaround (individual, team, organization), industry, country, IS, orientation (technology or process), and intention (negative or positive). We find that literature distinguishes workarounds with regard to the underlying intention and the orientation. The intention behind workaround behavior can either be positive (to enable certain processes) or negative (to hinder certain processes). The orientation can be separated into a process oriented perspective and a technical perspective. Taken from literature, we find recurrent concepts that describe how workarounds emerge and institutionalize in organizations. As a result, we offer an ontology that combines all concepts to the phenomena of workarounds. We extend existing research by proposing that the institutionalization of workarounds is dynamic. Therefore, workarounds need to be investigated with regard to their evolution in order to understand and learn from emergent change.

RQ3: How does Alter (2014) help in understanding how and why employees enact workarounds in formalized IT-enabled business processes?

P3: The results of this publication address the differences between process-instance-level and process-level workarounds. We find that process-instance-level workarounds are treated as options where organizational members engage in when the situation permits this behavior.

This is the case when associated risks of a workaround are lower than the resulting benefits. On the other hand process-level workarounds manifest as unofficial routines. Those workarounds are enacted once and evolve quickly as part of organizational business processes. With our findings we show that both forms of workarounds are the result of a risk-benefit analysis which in turn provides important feedback mechanisms for organizational improvement. When the risks outweigh the benefits organizational members tend to follow the defined process. When the benefits outweigh the risks they either will conduct the workaround. During this risk-benefit evaluation organizational members look for indicators that help them to identify the related consequences. We assume that an effective outcome of this evaluation provides a first step towards the institutionalization of workarounds. Organizational members provide solutions to a more efficient process execution and thus, tend to engage in workaround behavior.

RQ4: Which factors influence manager's decision on tolerating or prohibiting workarounds?

P4: This study provides insights into situations in which managers decide whether to tolerate or to prohibit workarounds. Structuring workarounds with a theoretical framework we show the usefulness of Alter's theory of workarounds (2014). We show the ambivalent character of workarounds and propose that management is challenged when deciding whether to tolerate or prohibit the workaround. We find factors that influence the willingness of management to tolerate workarounds: expected efficiency gains, exposure to compliance risk and perceived process weakness. Expected efficiency gains increase management's willingness to tolerate workarounds while exposures to compliance risks reduce management's willingness to tolerate workarounds. More importantly, we show that perceived process weaknesses that are caused by IS, facilitate workarounds. Those process weaknesses add the factor of deniability and enable managers to place emphasis on the expected efficiency gains. More than often managers use IS as a 'scapegoat' to make their decision deniable. As a result we provide a model of managerial willingness to tolerate workarounds in order to illustrate the important aspects of decision situations. We extend Alter's theory of workarounds (2014) by highlighting the role of IS in the emergence of workarounds in organizations.

RQ5: How can business process management be improved by including capabilities for modeling workarounds?

P5: In order to improve business process management we provide an extension to the Business Process Modeling Notation (BPMN), which includes workarounds. The result of our meta-model transformation is the Workaround Process Modeling Notation (WPMN). As literature proposes that workarounds encode rich knowledge about the needs of the users and the required customizations of the IS, we integrate this knowledge into an efficient business process management. We identified requirements to understand and represent workarounds graphically and tested our proposed modeling technique with an example from health care. Providing this modeling approach for visualizing workaround leads organizations in designing workaround aware systems. Furthermore, it supports managers in deciding how to deal with workarounds. Additionally, WPMN provides auditors with visualizations of non-

compliance. We exemplify how this technique can be used to model a workaround in the process of accessing patient-identifying data in a hospital. We evaluated the model and find it particular suitable as an empirically grounded BPMN extension.

P6: The results of this research build upon the Workaround Process Modeling Notation, which we derived based on a meta-model extension. We suggest a tentative design called WPMN and report initial qualitative evidence on the usefulness and usability. The evaluation shows that modeling workarounds leads to a 'workaround aware' understanding of business processes where organizations are aware of process deviations from formal descriptions. WPMN is helpful in several ways as it enables business process managers to explicate and evaluate incongruent practices in the context of formal business process models. This leads to the possibility of discussing the consequences of workarounds with stakeholders and to identify business process variations that are less prone to workarounds. The following steps lead to the outcome of this research. (1) We derive ontological constructs of workarounds from literature and (2) integrate them into the BPMN 2.0 meta-model. (3) We evaluate the task of model construction and model interpretation of WPMN with a model assignment and two focus groups.

RQ6: How can affordances advance our understanding of the institutionalization of workarounds?

P7: The findings of this research show that understanding workarounds in organizational processes is critical for adoption and diffusion research. While existing literature treats workarounds as an outcome we advance this understanding by interpreting workarounds as a starting point of our research. The challenge in workaround research is that incongruence between formal processes and actual working processes produces various outcomes, which are not controllable using a standard approach. Using a multiple case study we apply an affordance lens to understand workarounds in organizational business processes. We find that affordances are multifaceted, evolve during their actualization and that they can be used to control organizational processes. This relational view shows that the actualization of affordances leads emergent workarounds to their institutionalization.

P8: Still, most research interprets workarounds from a predominantly adverse perspective where threats and rule breaking are in the focus of investigation. With our research, we propose that workarounds can be also interpreted as source of improvement and adaption to inefficiencies. Our findings enable organizations to absorb action potential from workarounds. We use the Workaround Process Modeling Notation (WPMN) in order to visualize the formal process and the workaround behavior within organizations. Based on this visualization, we turn on the concept of desire paths from architectural theory to understand workarounds as expressions of desires in response to restrictive formal structures. We differentiate workarounds in three phases: workaround emergence, the inhibition of workarounds and their institutionalization. Following, we are able to show how workarounds evolve and understand the shortcomings of existing formal process descriptions. In order to learn from the evolution of workarounds, we propose to turn the action potential of workarounds in real value. Therefore, we draw on the concept of affordances from architectural theory where they are

defined as the “qualities or properties of an object that define its possible uses or make clear how it can or should be used” (Meriam Webster 2016). Thus, affordances can be used to enable certain behavior to provide hints on how the information system mediated interaction between users and organizations should take place.

5 Discussion

This thesis was motivated by the need to shed light on the controversial discussion about how to achieve a balance between exploratory and exploitative innovations. Organizations struggle when it comes to decisions whether either exploration or exploitation need to be highly prioritized. Achieving a balance creates new opportunities and customer segments while at the same time improving existing products ensures a reliable customer base. Originated form this practice-oriented we were interested in how organizations struggle when it comes to successfully delivering exploratory innovations. We find that workarounds as a deviation from formal process descriptions provide the possibility to deliver exploratory innovations in exploitative organizations. With this finding we are able to advance the understanding of how organizations achieve ambidexterity by considering workarounds in their business process management. Being able to control workarounds enables organizations to resolve the paradoxon between exploratory and exploitative innovations. During our research we quickly realized that controlling workarounds is a misconception in itself. Workarounds are successful when they are developed behind the curtains and under the radar. Therefore, we focused on understanding how to create an environment where workarounds are used as a source of improvement. We differentiated between different forms of workarounds and provide insights on how organizations are able to take advantage of them. With respect to the challenges we were confronted during this research our publications are discussed in terms of pervading concepts that guided this thesis.

Our results confirm, challenge and extend earlier research outcomes. We seek to provide thoughts about our findings that deepen the understanding of workarounds in ambidextrous organizations. In the following we discuss our results in terms of (1) institutionalized workarounds as a form of balancing exploration and exploitation, (2) the design of workaround aware systems, (3) the use of desire paths for designing IS, (4) and living models for integrating workarounds in business process management.

5.1 Institutionalization of Workarounds in Ambidextrous Organizations

The need to deliver exploratory and exploitative innovations in organizations may result in an institutionalization of workarounds. Organizational members develop a behavior that allows them to align the characteristics of two opposing concepts that need contrary process structures. With workarounds organizational members decouple actual working practices from formal process descriptions. In line with Azad and King (2012) we observe that the balance between top-down and bottom-up pressure causes the institutionalization of workarounds. We uncover their black box of institutionalization and extend their findings by proposing that this balance moves due a constant motion in business processes (Smith/Lewis 2011). Rather than assuming that the institutionalization of workarounds is a static outcome with a steady state we are able to explain how this situation develops and how the balance dynamically becomes a part of the business processes. Workarounds emerge when organizational members may not achieve certain goals as obstacles, misfits or hindrances limit their working practices. These restrictions lead them to search for alternate paths to achieve organizational goals, deviating from formal process descriptions.

In ambidextrous organizations the need to constantly deliver exploratory and exploitative innovations affects the organizational environment. Literature finds that cultural pressure builds organizational boundaries that challenge innovations when seeking to become ambidextrous. This may for example be due to the not-invented-here syndrome where working teams develop own routines, beliefs, artifacts, and habits that inhibit external knowledge (Hussinger/Wastyn 2012). Another challenge lies in the success and failure trap which is related to the need of serving two contradictory concepts at the same time (Gupta et al. 2006). In both cases organizations find themselves trapped in suboptimal stable equilibria either being able to only deliver explorative or exploratory innovations (March 1991). With our research we show that organizational members that are restricted in their possibilities to deliver certain organizational goals and are trapped, start to exhibit workaround behavior. When organizational business process structures are perceived as stiff and restrictive other ways are developed to overcome obstacles. Thus, organizations that are trapped in an exploitation cycle are only able to escape the iteratively self- reinforcing process by following new ideas and processes. The assumption that we make is that workarounds enable this behavior by proposing new ways of thinking and reflecting existing business processes.

When workarounds become institutionalized it is in the interest of the organization that only behavior becomes part of their processes that improves the overall performance. By assuming that organizational members purposefully interact with IS, they may use their existing knowledge and adapt technologies to overcome obstacles. On the opposite, when organizational members actively damage business processes or IS, their intention is not aligned with organizational goals. In this case decision makers need to prevent negative workarounds. However, hindering organizational members to engage in negative workarounds with control may even result in more or worse workarounds (Azad/King 2012). In our research we were able to show this behavior with the example of organizational members breaking their ID cards after the organization implemented a login system. As soon as this workaround behavior has institutionalized it is more than difficult to develop alternative standards (Graham et al. 2003). Therefore we provide an alternate approach to control workaround behavior with affordances. With the ontology of workarounds, we provide a first step towards understanding the organizational environment and collect existing findings on their emergence. Based on the ontology, the associated risks and benefits give an indication whether the workaround enhances business performance or hinders it. Building on this, the visualization of incongruence shows how workarounds are embedded in existing business processes. Their analysis reflects the potential of becoming an official part of the organizational process or if they need to be controlled.

Overall, understanding workaround behavior is not about IS itself nor about the process in general. Only the consideration of the relations between an actor, the process and the system in a hole can reflect a realistic understanding of the behavior. Thus, affordance theory enables researchers to develop a sociomaterial explanation without seeing the user as generic actor nor IS as a static representation of stiff processes (Faraj/Azad 2012). The actualization of affordances determines how the operations of the artifact are used in an organizational environment. Researchers are able to interpret the needs of organizational members by

reflecting the behavior and the goals they are currently not able to satisfy. This reinterpretation of affordances leads organizations to control the workaround where the emerging state results in the institutionalization of positive behavior.

While research assumes that standardization is a process of institutionalization (Graham et al. 2003) we argue that working around standardization may become a process of institutionalization as well. Emerging institutional structures challenge organizations when they are not in line with formal business process descriptions (Joshi 1991). As soon as the workaround is more efficient than formal descriptions this behavior becomes routinized. In turn it is difficult to prevent organizational members from engaging in workaround behavior (Graham et al. 2003). IS that provide clues on how organizational members should interact with the system provide affordances that are readily perceivable and may become institutionalized over time (Majchrzak/Markus 2012). Therefore, this thesis shows how organizations may gain control on the institutionalization of workarounds by using affordances.

5.2 Designing Workaround Aware Systems

The design of workaround aware systems (WAS) is contingent upon the process of workarounds that emerge and become institutionalized. Emergence and institutionalization incorporate the notion of workarounds and provide properties that need to be considered for designing IS. We draw on affordance theory that refers to action potential, that is, to what an individual or organization with a particular purpose can do with a technology or IS. The value of having relational concepts of affordances is that it helps to explain why users do not always realize the apparent potential of a technology when they use it and why they sometimes use technology in ways that designers never intended (Majchrzak/Markus 2012). We propose that organizations are able to react to changing tensions and specify the range of possible activities when using affordances. Understanding the intention behind workaround behavior provides the possibility for organizations to design affordances in IS that enable organizational members to achieve their goals. Opposite to that, the notion of constraints limits the possible behavior of a user. Constraints can be seen as “control that limits or restricts someone's actions or behavior” (Norman 1988). Literature finds that when users perceive IS as a constraint the user will look to change the functionality of the system (Leonardi 2011). When constraints are implemented, users may either utilize alternative IS use or manipulate the current system to achieve their desired outcome outside the organizational scope (Thatte et al. 2012). As a reaction, shadow systems are used when current systems lead users to the experience of frustration due to constraints (Haag/Eckhardt 2014). Literature often assumes that affordances and constraints only exist in conjunction. Stoffregen (2003) argues that affordances should include both enablers of and constraints on behavior.

Perceiving the use of IS as an individual journey of organizational member’s interaction, an appropriate system has to reflect different needs and knowledge. As organizations are not able to provide personalized IS for each of their organizational members, rather the behavior and culture of a group has to be considered. The relationship between organizational members, the organization itself and the IS provides rich insights on how to design technical artifacts in the

form of affordances (Savoli/Barki 2013). Thus, by structuring workarounds and being able to classify them with regard to the intention and orientation, organizations take a step further when understanding behavior of their organizational members. This leads organization in designing IS that may react and integrate various ways of achieving same organizational goals. For implementing WAS, Alter (2015b) proposes assumptions for typical analysis and design methods. In line, we argue that systems that only reflect best case assumptions are most likely to increase the probability of surprising responses (Alter 2015b; Faraj/Azad 2012). Therefore, organizations enhance their IS by reflecting the incongruence of actual working practices with formal process descriptions.

Assuming that organizations are able to implement WAS, the balance of exploration and exploitation is no longer a black box without design suggestions. When organizations are able to provide adaptive and flexible systems for delivering both kinds of innovation modes, the transfer will support radically new and incremental business products and services. As literature proposes that workarounds encode rich knowledge about the needs of the users and the required customizations of the IS, we extend existing research on the design of efficient systems. Using affordances enables the person-as-designer to tinker and reconfigure the IS which in turn can be considered during the design of system right from the beginning (Germonprez et al. 2009).

5.3 Adopting the Idea of Desire Paths

When you can see actual working practices that organizational members perform, you can see the patterns they leave over time (Opp 2010). In line with this assumption, we argue that the visualization of workarounds enables organizations to make *desire paths* visible. Figure 32 shows how desire paths (also known as desire lines) are constituted in real world settings.

Figure 32: Desire Paths in Real World Settings
(Source: van der Aalst 2004)

Workarounds as desire paths are therefore understood as a form of regularly recurring execution processes. Desire path originally come from architecture where they refer to worn path showing where people naturally walk (Myhill 2004). In the context of understanding workarounds in IT-enabled business process, we adapt this concept and suggest that organizations are able to use desire paths to design their IS. Organizations are not only able to visualize workarounds but they may understand how the desire paths change over time. The identification and understanding of these paths can lead organizations to redesign their IS which has a direct implication for their performance (Nichols 2014). Knowing about desire paths provides an exhilarant approach on considering workarounds in IT-enabled business process. A promising approach in order to use workarounds as desire path is provided by process mining which aims to exploit working practices in event logs (van der Aalst 2011). Process mining can be used in several ways, e.g. (1) to redesign procedures and systems which can be seen as reconstructing the formal pathways, (2) to recommend people taking the right path which requires adding signs at certain situations, (3) or to build in safeguards where kind of fences are built in order to avoid dangerous situations (van der Aalst 2013). We extend the concept of process mining by introducing workarounds as a form of positive deviance and deviance mining (Recker 2014a).

Providing an approach for tracing workarounds offers new avenues of exploring business process management. Existing BPM research mainly concentrates on process standardization (Davenport 2005), process modeling (Recker et al. 2009), and implementation (Mykkänen et al. 2007). Instead, this thesis focuses on counterexamples and highlights the need for investigating the boundaries where process standardization may even go “too far” (Recker 2014a). Literature finds that situations in which recommendations explain people on how to take the right path are more effective than restricting behavior by rules and prohibitions (van der Aalst 2013). The trend of *defensive architecture* in controversial urban design is constructed to discourage people from using them in a way not intended by the owner. As an example we refer to slanting windowsills to stop people sitting on them. There is no sign telling passersby not to sit there, instead the shape of the object hinders people from doing certain things. Following our research, the underlying idea can be matched in order to design IS in practice. Using the concept of defensive architecture in IS may enable organizations in rethinking their systems. When users are not directly confronted with prohibition they will rather perceive affordances than control (Leonardi 2011). Systems may be designed in a way that certain behavior is actively controlled without users perceiving this intervention.

5.4 Business Processes as Living Models

Other than Argote and Ingramm (2000) we argue that incongruence between formal process description and actual working practices does not inhibit but rather fosters the transfer of knowledge. Incongruence provides an indication that business processes and IS emerge and need to be reinterpreted continuously. We propose the concept of living models as an explanation for those emerging tensions. Living models are a novel paradigm of model–based development, management and operation of evolving systems (Breu 2010). Living models have been built upon the idea of model based software development where processes may be recorded, can be analyzed and provide the possibility to interconnect (Breu 2010).

Reshaping the existing view on BPM by integrating workarounds as critical and continuous feedback loops sheds light on the current discussion about drifting business processes (Beverungen 2014; Recker 2014b). This thesis proposes that workarounds consist of an emerging and an institutionalization stage. We show that dynamic structures have an effect on organizational processes and the behavior of the organizational members. In a constant motion organizations and the used technologies change and evolve. This has an effect on organizational members and how they traverse business process although they may come to the same outcome. However, we argue that organizational members enact a multiplicity of IS in re-current practices which increases the likelihood that they will enact altered paths or alternative ways of using them (Orlikowski 2000). Assuming that those organizational members are purposive, knowledgeable, adaptive, and inventive agents, workarounds offer new ways of designing business processes.

Our research shows that the evolving nature of workarounds is proven to be difficult to be integrated in BPM. Therefore, existing approaches need to understand business process as living models in order to be able to understand the effects of workarounds. In this thesis we theorize about the workings behind the drift of IS. Workarounds are understood as a form of reaction to a flexible environment in which organizations and their surrounding context changes over time (Alter 2015b). The starting point of this research discusses how organizations overcome inertia while reacting to change in an innovative environment. Research states that organizations constantly grow and develop structures and IS to handle the increased complexity of their work (Tushman/O'Reilly 1997). The interrelation of structures, human and materiality challenge proposed changes in response to one another (Leonardi 2011). As indispensable result organizations are stuck in structural inertia where the resistance to change is rooted in the size, complexity, and interdependence of structures, systems, procedures, and processes (Tushman/O'Reilly 1997). This inertia is overcome by a non-canonical use of IS which enables the organization to achieve outcomes in support of their changing goals (Faraj/Azad 2012). Therefore, organizations need to approach the design of their IS thoughtfully and with curiosity to understand their business process as living models and workarounds as compensation for obstacles.

6 Limitations

As with all theoretical research outcomes, some limitations should be kept in mind.

First, as we followed a qualitative research approach this thesis is limited in its generalizability. Although we conducted a multiple case study we are not able to generalize our findings. Nevertheless, we are confident that our findings may be replicated and that further cases show the same characteristics when studying workarounds in ambidextrous organizations. We were able to investigate people's individual experiences and draw on a cross-case comparison for the phenomena we discovered. Investigating workarounds in other domains that are prone to workarounds or indeed do not exhibit deviance allow researchers to provide further insights into the phenomenon.

Second, with our interviews we are only able to provide a short-term data set collected over three years. Fortunately, we were able to collect observational data during an on-site phase at the automotive domain. The data we observed is the result of a three-year practical phase with several pauses. The data we observed from the health care case was likewise the outcome of an on-site observation where one of the authors could gain insights in the daily working procedures of a hospital. With the support of further researchers we were able to receive data from the accounting area where information was collected from in-depth work. With our data we are therefore able to gain insights not only through the interviews, but also by using the observational data. As the phenomenon of workarounds evolves over time, we integrated those observations and archival data in order to provide a longitudinal perspective.

Third, workarounds are a rather sensitive topic and need to be treated with caution. As people tend to overact or understate in sensitive situations, we are limited in the tendency towards self-representation, which could have caused inaccuracies. Nevertheless, using a snowball sampling we were able to identify organizational members that are open to talk about deviations from formal business process descriptions. Collecting information about a concrete workaround enabled us to start the interviews with well-grounded background information. This motivated the case study participants to frankly talk about different workaround behavior as we already knew about their existence. The visualization of workarounds encourages them to externalize their knowledge and to gain insights into actual working practices

Fourth, the findings are limited to special industries in which we collected our data. Although the health care domain promises rich insights into workaround behavior, this may also be a weakness of our findings. Additionally in the innovation context workaround behavior is commonly reported on. In order to address this issue, we collected data in the accounting domain where the emphasis is on congruence between formal process descriptions and actual working practices. With our cross-case analysis we were able to show that workarounds are independent from the related industry but rather are bound to the processes in which they occur.

Fifth, during our observation we found that individuals belonging to the same group do not always respond uniformly to the use of IS. We found that different behavior among groups influence the overall routines but not necessarily for all members. This may stem from

different educational or personal background where organizational members rely on their experience. Overall, this is not contradicting our findings but rather enhances the need for understanding workarounds on an individual level to provide assumptions on how organizations can provide IS on a holistic level.

7 Contribution

The results of this thesis contribute to theory and practice in several ways.

7.1 Theoretical Contribution

Organizational Theory: We advance organizational theory in understanding the concept of ambidexterity. With our research we show that the interplay of exploration and exploitation is based on the ability of organizational members to work around formal process descriptions. This is especially helpful when perceived obstacles prevent the achievement of organizational goals in an exploratory innovation mode. Literature agrees upon the assumption that ambidextrous organizations need different organizationally distinct units for exploratory and exploitative innovations (O'Reilly/Tushman 2007). Understanding workarounds as the possibility to provide a structural bridge between different units, we extend prior research and show that organizations are able to balance the ambidextrous paradoxon. Workarounds serve as anchor when organizational members accept a certain goal (e.g., delivering exploratory innovations) but lack access to legitimate means to achieve it.

Workaround Theory: Studying workarounds in different industries and organizational processes, we advance the theory proposed by Alter (2014). Introducing the five voices of workarounds and a wok systems perspective, we extend the findings by suggesting a modeling technique in order to visualize workarounds. We use the existing theory to uncover the ongoing discussion about positive and negative workarounds and how they become institutionalized in organizational processes. This thesis advances the understanding of incongruent business practices where prescribed processes are not followed in order to achieve organizational goals. We introduce the evolution of workarounds and show how they evolve and become a consistent part of organizational routine. In order to advance workaround research, we propose affordance theory as a viable lens. Affordances help to understand workarounds as the result of interaction between organizational members and IS.

Adoption and Diffusion Theory: Adoption and diffusion theory treats workarounds as an outcome rather than starting point. Contrary to existing studies we impose a relational view on business process variations. By doing so, researchers can understand how different workarounds become institutionalized. Instead of treating workarounds as surprisingly our findings advance the understanding of non-compliant behavior of organizational members. We combine the perspective of this behavior, the use of the IS and the actual working practices. We uncover the black box of how workarounds become institutionalized and show that adoption and diffusion theory needs to consider the relational perspective including the social and the material (Faraj/Azad 2012). The process of adoption and diffusion is critical when deriving the benefits of IS (Karahanna et al. 1999) and provides beneficial insights into how users interact with systems. We suggest to create experience and concrete knowledge about how organizational members interact with IS. Our findings contribute to theory by introducing the dynamic structure of workarounds in adoption and diffusion theory.

Affordance Theory: We uncover the ongoing discussion regarding the theory of affordances provided by Gibson (1979) and Norman (1988). We find that they are not controversial but

rather built on each other. Instead of being inconsistent with one another, both theories have perspectives that represent different points of time in system design. The perspective that Norman shares is the focus on perception and how the user individually interacts with the IS. Gibson instead interprets the IS as invariant and not depending on prior knowledge of the user. Thus, our findings help researchers to design studies that will lead to more comprehensive theories about actual working practices and formal structures when using affordances. Introducing workarounds in affordance theory provides alternate explanations on how features related to the goals and properties of organizational members may deviate from intended IS use (Markus/Silver 2008).

7.2 Practical Contribution

Creating Exploratory Innovations: This thesis advances the understanding on how organizations can become ambidextrous. We argue that exploitation is an act of reconfiguring existing knowledge, which is an ability that organizations are extensively competent in. On the other hand, exploratory innovations require small and decentralized units with a loose culture and loosely coupled processes. Organizations are challenged by this composition as they are not designed to deliver radically new innovations. Being successful in exploratory innovations requires non-routine problem solving and deviation from existing knowledge. We suggest that workarounds are a feasible approach to overcome inertia and can be used to burst out of rigid structures.

Workaround Aware Systems: We provide a step towards designing affordances into a system to encourage certain patterns of use and behavior. The possibility to design IS in a way that users actualize designer's intentions supports managers in gaining control on the workaround behavior. From a design perspective, we provide an informative basis on how to implement IS in way that organizational goals and users intentions are aligned. As organizations are able to prepare information on workarounds in a comprehensible way (using WPMN) the analysis of resulting consequences is possible. With affordance theory, organizations are able to successfully implement IS that provide higher levels of expected use and fewer unintended negative consequences (Majchrzak/Markus 2012).

Controlling Workarounds: Several researchers assume that workarounds can be best controlled by punishment and sanctions (Straub/Nance 1990; D'Arcy et al. 2009). Instead, we propose that organizations that reflect workaround behavior of their organizational members can actively influence the use of IS in line with their intention. Reacting to workaround behavior with punishment, we show that even worse behavior may develop. With our results we show how organizations can achieve a gain in control when workarounds institutionalize instead of perceiving a loss of control. Providing affordances instead of punishment drives emerging workarounds to commonly accepted workarounds that may institutionalize. In practice, the reflection of emerging workaround behavior provides an insight into how IS need to be designed in order to drive the institutionalization into a desirable outcome. Thus, the control of workarounds does not necessarily mean that decision makers enforce rules while organizational members wish to avoid following them (Martin et al. 2013). We argue that controlling workarounds in organizations is a process of understanding and reflecting the

needs of the user while designing IS in a way that both parties (decision makers and organizational members) may achieve their goals.

Best Practice Solutions: With our research we enable organizations to rethink best practice solutions for efficient business processes. We raise the awareness for workarounds as an omnipresent part of organizational processes. With WPMN workarounds may be visualized and used as a basis for discussing different variations on how to achieve a certain organizational goal. In addition, the ontology we provide enables organizational members to understand the environment in which the workaround emerges. Thus, organizations are able to actively intervene in order to control the institutionalization of workarounds by using affordances. Organizations are able to design IS that reflect various outcomes of use. In line with the idea of desire paths, organizations can receive feedback on formal process descriptions by absorbing potential best practice solutions from workaround behavior.

Desire Paths in Information Systems: We adapt the concept of desire paths in information systems research and are able to provide insights into how to redesign affordances. The desire of organizational members to achieve organizational goals differently than prescribed may be addressed by looking for possibilities within existing shortcomings (Nichols 2014). Organizations need to identify and understand workaround behavior in order to provide information systems that may be used to achieve organizational goals. We argue that desire paths, in the form of regularly recurring execution processes provide the possibility for designing necessary affordances. When necessary affordances, aligned with top-down requirements and bottom-up constraints become institutionalized, organizations may benefit from this process redesign. This reflexive adaption includes the interpretation of why and how organizational members use IS at hand where needs are tangible.

8 Future Research

With regard to our results and the limitations, this thesis opens up various avenues for future research.

(1) Theory on ambidexterity has to encounter that processes for exploratory and exploitative innovation modes are **dynamic processes**. Instead of understanding both concepts as static condition we propose to interpret them as evolving and changing mechanisms in order to achieve ambidexterity. Therefore, we encourage researchers to engage in a longitudinal perspective in order to better understand the process of achieving a balance between the incompatibilities of two opposing processes. Current research provides only limited approaches to achieve ambidexterity. For example the punctuated equilibrium is described as a solution when it comes to balance contradictory tensions. Still, there is no explanation on how to alternate exploration and exploitation from an organizational perspective. We propose that research on the use of IS in ambidextrous organizations provides attempts on how systems need to be designed. As exploratory and exploitative innovation modes require different environmental conditions, the underlying IS may as well.

(2) Affordance theory is challenged by the ongoing discussion about how the **contradictory perspectives of Norman and Gibson** may be interpreted. Till now, the perspectives that both researchers provide are interpreted as opposing and conflicting. With our research we show that they rather built upon each other than disprove each other. The investigation of workarounds from an affordance perspective provides rich insights into how both perspectives are related. Depending on the perspective, affordance theory can be explained using Gibson (1979) or Norman (1988). Research that grounds on Gibson interprets affordances as stable and invariant, whereas Norman's perspective explains hem as relational and perceivable. In line with our research, we encourage researchers to investigate the role of affordances in IS research. From our findings we are able to derive first insights into how workaround aware systems may be designed. The implementation, observation and evaluation of affordances provide insights on how other phenomena in IS influence the design of organizational technology. Further examples may enhance the understanding of how features of technology shape the behavior of organizational members. A potential entry for a comprehensive understanding is the use of design science research in order to implement, observe and evaluate the reaction of users towards different forms of affordances.

(3) A **quantitative or mixed method approach** promises fruitful insights for understanding the emergence of workarounds. Our study focuses on qualitative research where we were able to provide first insights into a new phenomenon in IS research. Further investigation can extend our findings by using quantitative data or mixed method. For example experimental design promises to enhance our understanding of actual working practices. Providing insights with the use of an

experiment may extend the findings we gained in our research by creating environmental working conditions with reasonable working tasks. The propositions we provide in this thesis can be tested and extended. Furthermore, researchers can use our preliminary findings to design surveys that are aimed to show how workarounds emerge. Building on technology acceptance research, we propose to rethink how knowledge about workarounds influences the use of IS.

(4) The **evaluation of risks and benefits** related to workarounds is yet not well understood. Attempts to measure the consequences of workarounds seek to shed light on the ongoing debate about the effect of business process standardization. As this thesis shows, risks and benefits are related to workarounds and affect individual decisions of organizational member. In different situations the same workaround may result in a positive or negative outcome. The integration of available information about rules, the IS and the workplace environment is necessary to be able to evaluate workaround behavior. With our ontology we provide a first attempt on how to structure workarounds in IS research. Building on these findings, future research can for example investigate how to measure the associated risks and benefits in the form of costs and earnings. This leads to insights on how workarounds not only changes business process execution but in turn has an effect on the organizational performance.

9 Conclusion

This thesis was guided by the question on how workarounds become institutionalized in order to achieve a trade-off between exploitative and exploratory innovations. We started this research by understanding how organizations are able to overcome inertia while reacting to change in an innovative environment (Robey et al. 2002). We find that organizations are challenged when delivering exploratory innovations, as they require small and decentralized units with a loose culture and loosely coupled processes. Organizations are challenged by this composition, as they are not designed to deliver radically new innovations. In order to overcome this challenge, organizational members modify and adapt processes and technologies in the form of workarounds to achieve exploratory goals. Thus, the incongruence between formal business process descriptions and actual working process execution balances the ambidextrous trade-off between exploration and exploitation. This balance can be achieved by organizational members when they execute workarounds in order to achieve organizational goals. We deepen our understanding of workarounds and show that their outcome is twofold: the consequences can be beneficial or harmful. We propose that organizations that are able to control the institutionalization of beneficial workarounds, exhibit structures that enhance exploratory innovation activities. Thus, achieving a balance between exploratory and exploitative innovations in organizations is largely a function of controlling workarounds. Based on our analysis we provide an ontology of workarounds to structure and organize the existing knowledge of the field. We show that on a process-instance level the execution of workarounds depend on situational factors whereas a process level workaround manifests as unofficial routine. The willingness of decision makers tolerating workarounds is influenced by expected efficiency gains, exposure to compliance risk and perceived process weakness. To support organizations in deciding how to deal with incongruence we propose a modeling language to visualize workarounds. We turn on the phenomenon of desire paths that is routed in architecture where they refer to tracks that are tramped across grassy spaces regardless of formal pathways. Building on this assumption, we offer insights into how workarounds evolve by proposing affordance theory as viable lens. Affordances describe the possible action between a technical object and a user. Following our findings, organizations are able to achieve ambidexterity by using the action potential of workarounds. We show how organizations can design their IS using affordances to institutionalize workarounds as an anchor for becoming ambidextrous.

References

Adler, P.S.; Borys, B. (1996): Two Types of Bureaucracy: Enabling and Coercive. In: Administrative Science Quarterly, Vol. 41 (1996), pp. 61-89.

Afflerbach, P.; Kastner, G.; Krause, F.; Roeglinger, M. (2013): An Optimization Model for Valuating Process Flexibility. Paper presented at the 34th International Conference on Information Systems, Milan, Italy.

Aguilar-Saven, R.S. (2004): Business Process Modelling: Review and Framework. In: International Journal of Production Economics, Vol. 90 (2004) No. 2, pp. 129-149.

Ahrens, T.; Chapman, C.S. (2004): Accounting for Flexibility and Efficiency: A Field Study of Management Control Systems in a Restaurant Chain. In: Contemporary Accounting Research, Vol. 21 (2004) No. 2, pp. 271-301.

Alter, S. (2012): Exploring the Temporal Nature of Sociomateriality from a Work System Perspective. Paper presented at the 18th Americas Conference on Information Systems, Seattle, Washington.

Alter, S. (2013): Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. In: Journal of the Association for Information Systems, Vol. 14 (2013) No. 2, pp. 72-121.

Alter, S. (2014): Theory of Workarounds. In: Communications of the Association for Information Systems, Vol. 34 (2014) No. 1, pp. 1041-1066.

Alter, S. (2015a): Beneficial Noncompliance and Detrimental Compliance: Expected Paths to Unintended Consequences. *Proceedings of the 21st Americas Conference on Information Systems*. Puerto Rico.

Alter, S. (2015b): A Workaround Design System for Anticipating, Designing, and/or Preventing Workarounds. In: Enterprise, Business-Process and Information Systems Modeling. Eds. Springer 2015b, pp. 489-498.

Alvarez, R. (2008): Examining Technology, Structure and Identity during an Enterprise System Implementation. In: Information Systems Journal, Vol. 18 (2008) No. 2, pp. 203-224.

Anderson, J.G. (1997): Clearing the Way for Physicians' Use of Clinical Information Systems. In: Communications of the ACM, Vol. 40 (1997) No. 8, pp. 83-90.

Andriopoulos, C.; Lewis, M.W. (2009): Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation. In: Organization Science, Vol. 20 (2009) No. 4, pp. 696-717.

Ansari, S.M.; Fiss, P.C.; Zajac, E.J. (2010): Made to Fit: How Practices Vary as they Diffuse. In: Academy of Management Review, Vol. 35 (2010) No. 1, pp. 67-92.

Argote, L.; Ingram, P. (2000): Knowledge Transfer: A Basis for Competitive Advantage in Firms. In: Organizational Behavior and Human Decision Processes, Vol. 82 (2000) No. 1, pp. 150-169.

Assink, M. (2006): Inhibitors of Disruptive Innovation Capability: A Conceptual Model. In: European Journal of Innovation Management, Vol. 9 (2006) No. 2, pp. 215-233.

Atuahene-Gima, K. (2005): Resolving the Capability - Rigidity Paradox in New Product Innovation. In: Journal of Marketing, Vol. 69 (2005) No. 4, pp. 61-83.

Auer, T. (1998): Quality of IS Use. In: European Journal of Information Systems, Vol. 7 (1998) No. 3, pp. 192-201.

Augsdorfer, P. (1994): The Manager as Pirate: An Inspection of the Gentle Art of Bootlegging. In: Creativity and Innovation Management, Vol. 3 (1994) No. 2, pp. 91-95.

Augsdorfer, P. (2005): Bootlegging and Path Dependency. In: Research Policy, Vol. 34 (2005) No. 1, pp. 1-11.

Azad, B.; King, N. (2008): Enacting Computer Workaround Practices within a Medication Dispensing System. In: European Journal of Information Systems, Vol. 17 (2008) No. 3, pp. 264-278.

Azad, B.; King, N. (2012): Institutionalized Computer Workaround Practices in a Mediterranean Country: An Examination of two Organizations. In: European Journal of Information Systems, Vol. 21 (2012) No. 4, pp. 358-372.

Bagayogo, F.; Beaudry, A.; Lapointe, L. (2013): Impacts of IT Acceptance and Resistance Behaviors: A Novel Framework. Paper presented at the 34th International Conference on Information Systems, Milan, Italy.

Baker, T.; Nelson, R.E. (2005): Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage. In: Administrative Science Quarterly, Vol. 50 (2005) No. 3, pp. 329-366.

Bala, H.; Venkatesh, V. (2007): Assimilation of Interorganizational Business Process Standards. In: Information Systems Research, Vol. 18 (2007) No. 3, pp. 340-362.

Bala, H.; Venkatesh, V. (2013): Changes in Employees' Job Characteristics during an Enterprise System Implementation: A Latent Growth Modeling Pperspective. In: MIS Quarterly, Vol. 37 (2013) No. 4, pp. 1113-1140.

Bandara, W.; Gable, G.G.; Rosemann, M. (2005): Factors and Measures of Business Process Modelling: Model Building through a Multiple Case Study. In: European Journal of Information Systems, Vol. 14 (2005) No. 4, pp. 347-360.

Bates, D.; Cohen, M.; Leape, L.; Overhage, J.M.; Shabot, M.M.; Sheridan, T. (2001): Reducing the Frequency of Errors in Medicine Using Information Technology. In: Journal of the American Medical Informatics Association, Vol. 8 (2001) No. 4, pp. 299-308.

Batra, D.; Davis, J.G. (1992): Conceptual Data Modelling in Database Design: Similarities and Differences between Expert and Novice Designers. In: International Journal of Man-Machine Studies, Vol. 37 (1992) No. 1, pp. 83-101.

Becker, J.; Breuker, D.; Weiß, B.; Winkelmann, A. (2010): Exploring the Status Quo of Business Process Modelling Languages in the Banking Sector – An Empirical Insight into the Usage of Methods in Banks. Paper presented at the 21st Australasian Conference on Information Systems, Brisbane, Australia.

Becker, J.; Karow, M.; Mueller-Wienbergen, F.; Seidel, S. (2009): Toward Process Modeling in Creative Domains. Paper presented at the 15th Americas Conference on Information Systems, San Francisco, California.

Becker, J.; Rosemann, M.; Von Uthmann, C. (2000): Guidelines of Business Process Modeling. In: Business Process Management, Models, Techniques and Empirical Studies (Vol. LNCS 1806). Eds.: van der Aalst, W.; Desel, J.; Oberweis, A. Springe-Verlag Berlin Heidelberg 2000, pp. 30-49.

Behrens, S. (2009): Shadow Systems: The Good, the Bad and the Ugly. In: Communications of the ACM, Vol. 52 (2009) No. 2, pp. 124-129.

Behrens, S.; Sedera, W. (2004): Why do Shadow Systems Exist After an ERP Implementation? Lessons from a Case Study. Paper presented at the 8th Pacific Asia Conference on Information Systems, Shanghai, China.

Beimborn, D.; Palitza, M. (2013): Enterprise App Stores for Mobile Applications-Development of a Benefits Framework. Paper presented at the 19th Americas Conference on Information Systems, Chicago, Illinois.

Belderbos, R.; Faems, D.; Leten, B.; Looy, B.V. (2010): Technological Activities and their Impact on the Financial Performance of the Firm: Exploitation and Exploration within and between Firms. In: Journal of Product Innovation Management, Vol. 27 (2010) No. 6, pp. 869-882.

Benner, M.J.; Tushman, M.L. (2003): Exploitation, Exploration, and the Productivity Management: Dilemma Revisited. In: Academy of Management Review, Vol. 28 (2003) No. 2, pp. 238-256.

Bennett, R.J.; Robinson, S.L. (2000): Development of a Measure of Workplace Deviance. In: Journal of Applied Psychology, Vol. 85 (2000) No. 3, pp. 349.

Berente, N.; Yoo, Y. (2012): Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System. In: Information Systems Research, Vol. 23 (2012) No. 2, pp. 376-396.

Beverungen, D. (2014): Exploring the Interplay of the Design and Emergence of Business Processes as Organizational Routines. In: Business & Information Systems Engineering, Vol. 6 (2014) No. 4, pp. 191-202.

Bhattacherjee, A.; Hikmet, N. (2007): Physicians' Resistance toward Healthcare Information Technology: A Theoretical Model and Empirical Test. In: European Journal of Information Systems, Vol. 16 (2007) No. 6, pp. 725-737.

Birkinshaw, J.; Gibson, C. (2004): Building Ambidexterity into an Organization. In: MIT Sloan Management Review, Vol. 45 (2004), pp. 47-55.

Bocciarelli, P.; D'Ambrogio, A. (2011): A BPMN Extension for Modeling non Functional Properties of Business Processes. Paper presented at the 2011 Symposium on Theory of Modeling & Simulation, pp. 160-168.

Borthick, A.F. (2012): Designing Continuous Auditing for a Highly Automated Procure-to-Pay Process. In: Journal of Information Systems, Vol. 26 (2012) No. 2, pp. 153-166.

Boss, S.R.; Kirsch, L.J.; Angermeier, I.; Shingler, R.A.; Boss, R.W. (2009): If Someone is Watching, I'll do What I'm asked: Mandatoriness, Control, and Information Security. In: European Journal of Information Systems, Vol. 18 (2009) No. 2, pp. 151-164.

Boudreau, M.-C.; Robey, D. (2005): Enacting Integrated Information Technology: A Human Agency Perspective. In: Organization Science, Vol. 16 (2005) No. 1, pp. 3-18.

Brady, T.; Davies, A. (2004): Building Project Capabilities: From Exploratory to Exploitative Learning. In: Organization Studies, Vol. 25 (2004) No. 9, pp. 1601-1621.

Breu, R. (2010): Ten principles for living models-a manifesto of change-driven software engineering. Paper presented at the 4th International Conference on Complex, Intelligent and Software Intensive Systems Krakow, Poland, pp. 1-8.

Brinkkemper, S. (1996): Method Engineering: Engineering of Information Systems Development Methods and Tools. In: Information and Software Technology, Vol. 38 (1996) No. 4, pp. 275-280.

Bulgurcu, B.; Cavusoglu, H.; Benbasat, I. (2010): Information Security Policy Compliance: An Empirical Study of Rationality-Based Beliefs and Information Security Awareness. In: MIS Quarterly, Vol. 34 (2010) No. 3, pp. 523-548.

Button, G.; Mason, D.; Sharrock, W. (2003): Disempowerment and Resistance in the Print Industry? Reactions to Surveillance–Capable Technology. In: New Technology, Work and Employment, Vol. 18 (2003) No. 1, pp. 50-61.

Cabitza, F.; Simone, C. (2013): “Drops Hollowing the Stone”: Workarounds as Resources for Better Task-Artifact Fit. Paper presented at the Proceedings of the 13th European Conference on Computer Supported Cooperative Work,, Paphos, Cyprus, pp. 103-122.

Campbell, D. (2011): Policy Workaround Stories Are Valuable Evaluative Indicators But Should They be Told? In: American Journal of Evaluation, Vol. 32 (2011) No. 3, pp. 408-417.

Campbell, D. (2012): Public Managers in Integrated Services Collaboratives: What works is Workarounds. In: Public Administration Review, Vol. 72 (2012) No. 5, pp. 721-730.

Campbell, S.; Lu, Y. (2007): Managing the Dark Side of Computer Use at Work: A Typology of Information Technology Abuse and Management Strategy. Paper presented at the 13th Americas Conference on Information Systems, Keystone, USA, pp. 482.

Carlo, J.L.; Lyytinen, K.; Boland Jr, R.J. (2012): Dialectics of Collective Minding: Contradictory Appropriations of Information Technology in a High-Risk Project. In: MIS Quarterly, Vol. 36 (2012) No. 4, pp. 1081-1108.

Cegarra-Navarro, J.G.; Dewhurst, F. (2007): Linking Organizational Learning and Customer Capital through an Ambidexterity Context: An Empirical Investigation in SMEs In: The International Journal of Human Resource Management, Vol. 18 (2007) No. 10, pp. 1720-1735.

Chapman, C.S.; Kihn, L.-A. (2009): Information System Integration, Enabling Control and Performance. In: Accounting, Organizations and Society, Vol. 34 (2009) No. 2, pp. 151-169.

Chua, C.; Storey, V.; Chen, L. (2014): Central IT or Shadow IT? Factors Shaping Users' Decision to Go Rogue With IT. Paper presented at the 35th International Conference on Information Systems, Auckland, New Zealand.

Ciborra, C. (2000): From Control to Drift: The Dynamics of Corporate Information Infastructures, Oxford University Press, Oxford 2000.

Conforti, R.; La Rosa, M.; Ter Hofstede, A.H.; Fortino, G.; de Leoni, M.; van der Aalst, W.M.; Adams, M.J. (2013): A software framework for risk-aware business process management. Paper presented at the 25th International Conference on Advanced Information Systems Engineering, Valencia, Spain, pp. 130-137.

Cook, S.D.; Brown, J.S. (1999): Bridging Epistemologies: The Generative Dance between Organizational Knowledge and Organizational Knowing. In: Organization Science, Vol. 10 (1999) No. 4, pp. 381-400.

Cooper, H.M. (1988): Organizing Knowledge Syntheses: A Taxonomy of Literature Reviews. In: Knowledge in Society, Vol. 1 (1988), pp. 104-126.

Cooper, R.B.; Zmud, R.W. (1990): Information Technology Implementation Research: A Technological Diffusion Approach. In: Management Science, Vol. 36 (1990) No. 2, pp. 123-139.

Corso, M.; Pellegrini, L. (2007): Continuous and Discontinuous Innovation: Overcoming the Innovator Dilemma. In: Creativity and Innovation Management, Vol. 16 (2007) No. 4, pp. 333-347.

Courtright, J.F.; Acton, W.H.; Frazier, M.L.; Lane, J.W. (1988): Effects of "Workarounds" on Perceptions of Problem Importance during Operational Test. Paper presented at the Human Factors Society 32nd Annual Meeting, Anaheim, California, pp. 1150-1153.

Craig, R. (1999): Laurier Enterprise System Upgrade. Paper presented at the 20th International Conference on Information Systems, Charlotte, USA, pp. 654-662.

Creswell, J.W. (2014): Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, Sage Publications, Thousand Oaks, CA 2014.

Cyert, R.M.; March, J.G. (1963): A Behavioral Theory of the Firm. In: Organizational Behavior: Essential Theories of Process and Structure (Vol. 2). Eds.: Miner, J.B. M.E. Sharpe, New York 1963.

D'Arcy, J.; Herath, T.; Shoss, M.K. (2014): Understanding Employee Responses to Stressful Information Security Requirements: A Coping Perspective. In: Journal of Management Information Systems, Vol. 31 (2014) No. 2, pp. 285-318.

D'Arcy, J.; Hovav, A.; Galletta, D. (2009): User Awareness of Security Countermeasures and its Impact on Information Systems Misuse: A Deterrence Approach. In: Information Systems Research, Vol. 20 (2009) No. 1, pp. 79-98.

da Cunha, J.V.; Carugati, A. (2009): Information Technology and the First-line Manager's Dilemma: Lessons from an Ethnographic Study. Paper presented at the 17th European Conference on Information Systems, Verona, Italy, pp. 2834-2845.

Datta, A. (2011): Combining Networks, Ambidexterity and Absorptive Capacity to Explain Commercialization of Innovations: A Theoretical Model from Review and Extension. In: Journal of Management & Strategy, Vol. 2 (2011) No. 4.

Davenport, T.H. (1993): Process Innovation: Reengineering Work through Information Technology, Harvard Business Press, Boston 1993.

Davenport, T.H. (2005): The Coming Commoditization of Processes. In: Harvard Business Review, Vol. 83 (2005) No. 6, pp. 100-108.

Davern, M.J.; Wilkin, C.L. (2008): Evolving Innovations through Design and Use. In: Communications of the ACM, Vol. 51 (2008) No. 12, pp. 133-137.

Davison, R.M.; Ou, C.X. (2013): Sharing Knowledge In Technology Deficient Environments: Individual Workarounds Amid Corporate Restrictions. Paper presented at the 21st European Conference on Information Systems, Milan, Italy.

Debono, D.S.; Greenfield, D.; Travaglia, J.F.; Long, J.C.; Black, D.; Johnson, J.; Braithwaite, J. (2013): Nurses' Workarounds in Acute Healthcare Settings: A Ccoping Review. In: BMC Health Services Research, Vol. 13 (2013) No. 1.

DeSanctis, G.; Poole, M.S. (1994): Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. In: Organization Science, Vol. 5 (1994) No. 2, pp. 121-147.

Dourish, P. (2001): Process descriptions as organisational accounting devices: the dual use of workflow technologies. Paper presented at the Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work, pp. 52-60.

Dubé, L.; Paré, G. (2003): Rigor in information systems positivist case research: current practices, trends, and recommendations. In: MIS Quarterly, Vol. 27 (2003) No. 4, pp. 597-636.

Duncan, R.B. (1976): The Ambidextrous Organization: Designing Dual Structures for Innovation. In: The Management of Organization: Strategy and Implementation. Eds.: Kilmann, R.H.; Pondy, L.R.; Slevin, D.P., New York 1976, pp. 167-188.

Eisenhardt, K.M. (1989): Building Theories from Case Study Research. In: Academy of Management Review, Vol. 14 (1989) No. 4, pp. 532-550.

Eisenhardt, K.M.; Graebner, M.E. (2007): Theory Building from Cases: Opportunities and Challenges. In: Academy of Management Journal, Vol. 50 (2007) No. 1, pp. 25-32.

El Kharbili, M.; Stein, S.; Markovic, I.; Pulvermüller, E. (2008): Towards a Framework for Semantic Business Process Compliance Management. Paper presented at the Workshop on Governance, Risk and Compliance for Information Systems - CAISE Conference, pp. 1-15.

El Sawy, O.A.; Pavlou, P.A. (2008): IT-Enabled Business Capabilities for Turbulent Environments. In: MIS Quarterly Executive, Vol. 7 (2008) No. 3, pp. 139-150.

Erol, S.; Mödritscher, F.; Neumann, G. (2010): A Meta-Design Approach for Collaborative Process Modeling. Paper presented at the 2nd International Workshop on Open Design Spaces, Aarhus, Denmark, pp. 46.

Faraj, S.; Azad, B. (2012): The Materiality of Technology: An Affordance Perspective. In: Materiality and Organizing: Social Interaction in a Technological World. Eds.: Leonardi, P.; Nardi, B.; Kallinikos, J. Oxford University Press, New York 2012, pp. 237-258.

Faraj, S.; Jarvenpaa, S.L.; Majchrzak, A. (2011): Knowledge Collaboration in Online Communities. In: Organization Science, Vol. 22 (2011) No. 5, pp. 1224-1239.

Ferneley, E.H.; Sobreperez, P. (2006): Resist, Comply or Workaround? An Examination of Different Facets of User Engagement with Information Systems. In: European Journal of Information Systems, Vol. 15 (2006) No. 4, pp. 345-356.

Fürstenau, D.; Rothe, H. (2014): Shadow IT Systems: Discerning the Good and the Evil. Paper presented at the 22nd European Conference on Information Systems, Tel Aviv, Israel.

Gasparas, J.; Monteiro, E. (2009): Counteracting Forces in Implementation of IS-enabled Global Business Processes. Paper presented at the 17th European Conference on Information Systems, Verona, Italy.

Gasser, L. (1986): The Integration of Computing and Routine Work. In: ACM Transactions on Information Systems, Vol. 4 (1986) No. 3, pp. 205-225.

Gaver, W.W. (1991): Technology Affordances. Paper presented at the SIGCHI Conference on Human Factors in Computing Systems, New Orleans, Louisiana, pp. 79-84.

Germonprez, M.; Hovorka, D.; Gal, U. (2011): Secondary Design: A Case of Behavioral Design Science Research. In: Journal of the Association for Information Systems, Vol. 12 (2011) No. 10.

Germonprez, M.; Hovorka, D.S.; Gal, U. (2009): Theorizing on Secondary Design. In: Sprouts: Working Papers on Information Systems, Vol. 9 (2009) No. 1.

Gerson, E.M.; Star, S.L. (1986): Analyzing Due Process in the Workplace. In: ACM Transactions on Information Systems, Vol. 4 (1986) No. 3, pp. 257-270.

Gibson, C.B.; Birkinshaw, J. (2004): The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity. In: The Academy of Management Journal, Vol. 47 (2004) No. 2, pp. 209-226.

Gibson, J.J. (1979): The Ecological Approach to Visual Perception, Houghton Mifflin, Boston 1979.

Gilsing, V.; Nooteboom, B. (2006): Exploration and Exploitation in Innovation Systems: The Case of Pharmaceutical Biotechnology. In: Research Policy, Vol. 35 (2006) No. 1, pp. 1-23.

Glaser, B.G. (1978): Theoretical Sensitivity: Advances in the Methodology of Grounded Theory (Vol. 2), Sociology Press Mill Valley, CA 1978.

Glaser, B.G.; Strauss, A.L. (1967): The Discovery of Grounded Theory: Strategies for Qualitative Research, Aldine de Gruyter, Hawthorne, NY 1967.

Gouldner, A.W. (1954): Patterns of Industrial Bureaucracy, Free Press, New York 1954.

Graham, I.; Pollock, N.; Smart, A.; Williams, R. (2003): Institutionalisation of e-Business Standards. Paper presented at the Workshop on Standard Making: A Critical Research Frontier for Information Systems, Seattle, WA, pp. 1-9.

Green, K.M.; Covin, J.G.; Slevin, D.P. (2008): Exploring the Relationship between Strategic Reactiveness and Eentrepreneurial Orientation: The Role of Structure – Style Fit. In: Journal of Business Venturing, Vol. 23 (2008) No. 3, pp. 356-383.

Greenberg, J. (1990): Employee Theft as a Reaction to Underpayment Inequity: The Hidden Cost of Pay Cuts. In: Journal of Applied Psychology, Vol. 75 (1990) No. 5.

Gregor, S.; Hevner, A.R. (2013): Positioning and Presenting Design Science Research for Maximum Impact. In: MIS Quarterly, Vol. 37 (2013) No. 2, pp. 337-356.

Gregor, S.; Jones, D. (2007): The Anatomy of a Design Theory. In: Journal of the Association for Information Systems, Vol. 8 (2007) No. 5, pp. 312-335.

Grüninger, M.; Fox, M.S. (1995): Methodology for the Design and Evaluation of Ontologies. Paper presented at the Workshop on Basic Ontological Issues in Knowledge Sharing, Montreal, Kanada.

Guarino, N. (1998): Formal Ontology in Information Systems. Paper presented at the Formal Ontology in Information Systems, Trento, Italy.

Guo, K.H.; Yuan, Y.; Archer, N.P.; Connelly, C.E. (2011): Understanding Nonmalicious Security Violations in the Workplace: A Composite Behavior Model. In: Journal of Management Information Systems, Vol. 28 (2011) No. 2, pp. 203-236.

Gupta, A.K.; Smith, K.G.; Shalley, C.E. (2006): The Interplay Between Exploration and Exploitation. In: The Academy of Management Journal, Vol. 49 (2006) No. 4, pp. 693-706.

György, A.; Cleven, A.; Uebernickel, F.; Brenner, W. (2012): Exploring the Shadows: IT Governance Approaches to User-Driven Innovation. Paper presented at the 20th European Conference on Information Systems, Barcelona, Spain, pp. 222.

Haag, S.; Eckhardt, A. (2014): Normalizing the Shadows–The Role of Symbolic Models for Individuals' Shadow IT Usage. Paper presented at the 35th International Conference on Information Systems, Auckland, New Zealand.

Hammer, M. (2010): What is Business Process Management? In: Handbook on Business Process Management 1. Eds.: vom Brocke, J.; Rosemann, M. Springer, Berlin 2010, pp. 3-16.

Handel, M.J.; Poltrock, S. (2011): Working Around Official Applications: Experiences from a Large Engineering Project. Paper presented at the ACM 2011 Conference on Computer Supported Cooperative Work, Hangzhou, China, pp. 309-312.

Harmon, P.; Wolf, C. (2014): The State of Business Process Management. Technical Report, Bussiness Process Trends, www.bptrends.com, accessed at 20th January 2016.

Harrington, S.J. (1996): The Effect of Codes of Ethics and Personal Denial of Responsibility on Computer Abuse Judgments and Intentions. In: MIS Quarterly, Vol. 20 (1996) No. 2, pp. 257-278.

Heumann, J.; Wiener, M.; Remus, U.; Mähring, M. (2014): To Coerce or to Enable? Exercising Formal Control in a Large Information Systems Project. In: Journal of Information Technology, Vol. 11 (2014), pp. 1-15.

Hevner, A.R.; March, S.T.; Park, J.; Ram, S. (2004): Design Science in the Information Systems Discipline: An Introduction to the Special Issue on Design Science Research. In: MIS Quarterly, Vol. 32 (2004) No. 4, pp. 725–730.

Hunt, R.; Jackson, M. (2010): An Introduction to Continuous Controls Monitoring. In: Computer Fraud & Security, Vol. 2010 (2010) No. 6, pp. 16-19.

Hussinger, K.; Wastyn, A. (2012): Internal Resistance and External Knowledge (Sources): A Theoretical Framework on the Not-Invented-Here Syndrome. Paper presented at the International Conference on Management of Innovation and Technology, Bali, Indonesia, pp. 261-265.

Huuskonen, S.; Vakkari, P. (2013): "I Did It My Way": Social Workers as Secondary Designers of a Client Information System. In: Information Processing & Management, Vol. 49 (2013) No. 1, pp. 380-391.

Ignatiadis, I.; Nandhakumar, J. (2009): The Effect of ERP System Workarounds on Organizational Control. In: Scandinavian Journal of Information Systems, Vol. 21 (2009) No. 2.

Ilie, V. (2013): Psychological Reactance And User Workarounds. A Study In The Context Of Electronic Medical Records Implementations. Paper presented at the 21st European Conferenc on Information Systems, Utrecht, Netherlands.

Indulska, M.; Recker, J. (2010): Design Science in IS Research: A Literature Analysis. Paper presented at the 4th Biennial ANU Workshop on Information Systems Foundations, Canberra, Australia.

Indulska, M.; Recker, J.; Rosemann, M.; Green, P. (2009): Business Process Modeling: Current Issues and Future Challenges. Paper presented at the Advanced Information Systems Engineering, Amsterdam, The Netherlands, pp. 501-514.

Ireland, R.D.; Hitt, M.A.; Sirmon, D.G. (2003): A Model of Strategic Entrepreneurship: The Construct and its Ddimensions. In: Journal of Management, Vol. 29 (2003) No. 6, pp. 963-989.

Jansen, J.J.; Tempelaar, M.P.; Van den Bosch, F.A.; Volberda, H.W. (2009): Structural Differentiation and Ambidexterity: The Mediating Role of Integration Mechanisms. In: Organization Science, Vol. 20 (2009) No. 4, pp. 797-811.

Jansen, J.J.P.; Van Den Bosch, F.A.J.; Volberda, H.W. (2006): Exploratory Innovation, Exploitative innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators. In: Management Science, Vol. 52 (2006) No. 11, pp. 1661-1674.

Jenkins, J.; Durcikova, A. (2013): What, I Shouldn't Have Done That?: The Influence of Training and Just-in-Time Reminders on Secure Behavior. Paper presented at the 34th International Conference on Information Systems, Milano, Italy.

Jeston, J.; Nelis, J. (2014): Business Process Management: Practical Guidelines to Successful Implementations, Elsevier, Oxford 2014.

Jones, D.; Behrens, S.; Jamieson, K.; Tansley, E. (2004): The Rise and Fall of a Shadow System: Lessons for Enterprise System Implementation. Paper presented at the 15th Australasian Conference on Information Systems, Hobart, Australia.

Joshi, K. (1991): A Model of Users' Perspective on Change: The Case of Information Systems Technology Implementation. In: MIS Quarterly, Vol. 15 (1991) No. 2, pp. 229-242.

Jun, G.T.; Ward, J.; Morris, Z.; Clarkson, J. (2009): Health Care Process Modelling: Which Method When? In: International Journal for Quality in Health Care, Vol. 21 (2009) No. 3, pp. 214-224.

Jung, Y.; Lyytinen, K. (2014): Towards an Ecological Account of Media Choice: A Case Study on Pluralistic Reasoning while Choosing Email. In: Information Systems Journal, Vol. 24 (2014) No. 3, pp. 271-293.

Junglas, I.; Goel, L.; Abraham, C.; Ives, B. (2013): The Social component of information systems—How sociability contributes to technology acceptance. In: Journal of the Association for Information Systems, Vol. 14 (2013) No. 10, pp. 585-616.

Kaptelinin, V.; Nardi, B. (2012): Affordances in HCI: toward a mediated action perspective. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 967-976.

Karahanna, E.; Straub, D.W.; Chervany, N.L. (1999): Information Technology Adoption across Time: A Cross-sectional Comparison of Pre-adoption and Post-adoption Beliefs. In: MIS Quarterly, Vol. 23 (1999) No. 3, pp. 183-213.

Karat, J.; Karat, C.-M.; Ukelson, J. (2000): Affordances, Motivation, and the Design of User Interfaces. In: Communications of the ACM, Vol. 43 (2000) No. 8, pp. 49-51.

Katila, R.; Ahuja, G. (2002): Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction. In: Academy of Management Journal, Vol. 45 (2002) No. 6, pp. 1183-1194.

Keating, E.; Oliva, R.; Repenning, N.; Rockart, S.; Sterman, J. (1999): Overcoming the Improvement Paradox. In: European Management Journal, Vol. 17 (1999) No. 2, pp. 120-134.

Kim, H.-W.; Kankanhalli, A. (2009): Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective. In: MIS Quarterly, Vol. 33 (2009) No. 3, pp. 567-582.

Kirsch, L.; Boss, S. (2007): The Last Line of Defense: Motivating Employees to Follow Corporate Security Guidelines. Paper presented at the 28th International Conference on Information Systems, Montreal, Canada.

Kirsch, L.J. (1996): The Management of Complex Tasks in Organizations: Controlling the Systems Development Process. In: Organization Science, Vol. 7 (1996) No. 1, pp. 1-21.

Kirsch, L.S. (1997): Portfolios of control modes and IS project management. In: Information Systems Research, Vol. 8 (1997) No. 3, pp. 215-239.

Kitzinger, J. (1995): Qualitative Research: Introducing Focus Groups. In: British Medical Journal, Vol. 311 (1995), pp. 299-302.

Ko, R.K.; Lee, S.S.; Wah Lee, E. (2009): Business Process Management (BPM) Standards: A Survey. In: Business Process Management Journal, Vol. 15 (2009) No. 5, pp. 744-791.

Kobayashi, M.; Fussell, S.R.; Xiao, Y.; Seagull, F.J. (2005): Work Coordination, Workflow, and Workarounds in a Medical Context. Paper presented at the Conference on Human Factors in Computing Systems, Portland, USA, pp. 1561-1564.

Koch, H.; Zhang, S.; Giddens, L.; Milic, N.; Yan, K.; Curry, P. (2014): Consumerization and IT Department Conflict. Paper presented at the 35th Fifth International Conference on Information Systems, Auckland, Australia.

Köffer, S.; Junglas, I.; Chiperi, C.; Niehaves, B. (2014): Dual Use of Mobile IT and Work-to-Life Conflict in the Context of IT Consumerization. Paper presented at the 35th International Conference on Information Systems, Auckland, Australia.

Köhler, J. (2011): The Role of BPMN in a Modeling Methodology for Dynamic Process Solutions. In: Business Process Modeling Notation. Eds.: Mendling, J.; Weidlich, M.; Weske, M. Springer-Verlag, Berlin Heidelberg 2011, pp. 46-62.

Koopman, P.; Hoffman, R.R. (2003): Work-Arounds, Make-Work, and Kludges. In: Intelligent Systems, IEEE, Vol. 18 (2003) No. 6, pp. 70-75.

Koppel, R.; Wetterneck, T.; Telles, J.L.; Karsh, B.-T. (2008): Workarounds to Barcode Medication Administration Systems: Their Occurrences, Causes, and Threats to Patient Safety. In: Journal of the American Medical Informatics Association, Vol. 15 (2008) No. 4, pp. 408-423.

Langer, E.J. (1975): The Illusion of Control. In: Journal of Personality and Social Psychology, Vol. 32 (1975) No. 2, pp. 311.

Lapointe, L.; Rivard, S. (2005): A Multilevel Model of Resistance to Information Technology Implementation. In: MIS Quarterly, Vol. 29 (2005) No. 3, pp. 461-491.

Laumer, S.; Eckhardt, A. (2010): Why do People Reject Technologies?-Towards an Understanding of Resistance to IT-induced Organizational Change. Paper presented at the 31st International Conference on Information Systems, Saint Louis, USA, pp. 151.

Laumer, S.; Maier, C.; Eckhardt, A. (2010): Why do they Resist?-An Empirical Analysis of an Individual's Personality Trait Resistance regarding the Adoption of New Information Systems. Paper presented at the 18th European Conference on Information Systems, Prague, Czech Republic

Lawrence, T.B.; Robinson, S.L. (2007): Ain't Misbehavin: Workplace Deviance as Organizational Resistance. In: Journal of Management, Vol. 33 (2007) No. 3, pp. 378-394.

Lenz, R.; Reichert, M. (2007): IT Support for Healthcare Processes - Premises, Challenges, Perspectives. In: Data & Knowledge Engineering, Vol. 61 (2007) No. 1, pp. 39-58.

Leonardi, P.M. (2011): When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies. In: MIS Quarterly, Vol. 35 (2011) No. 1, pp. 147-168.

Levinthal, D.A.; March, J.G. (1993): The Myopia of Learning. In: Strategic Management Journal, Vol. 14 (1993) No. 2 pp. 95-112.

Li, Y.; Zhang, C.; Liu, Y.; Li, M. (2010): Organizational Learning, Internal Control Mechanisms, and Indigenous Innovation: The Evidence from China. In: IEEE Transactions on Engineering Management, Vol. 57 (2010) No. 1, pp. 63-77.

Lim, V.K. (2002): The IT Way of Loafing on the Job: Cyberloafing, Neutralizing and Organizational Justice. In: Journal of Organizational Behavior, Vol. 23 (2002) No. 5, pp. 675-694.

Lowry, P.B.; Moody, G.D. (2015): Proposing the Control-Reactance Compliance Model (CRCM) to Explain Opposing Motivations to Comply with Organisational Information Security Policies. In: Information Systems Journal, Vol. 25 (2015) No. 5, pp. 433-463.

Lubatkin, M.H.; Simsek, Z.; Ling, Y.; Veiga, J.F. (2006): Ambidexterity and Performance in Small-to Medium-sized Firms: The Pivotal Role of Top Management Team Behavioral Integration. In: Journal of Management, Vol. 32 (2006) No. 5, pp. 646-672.

Lumpkin, G.T.; Dess, G.G. (1996): Clarifying the Entrepreneurial Orientation Construct and Linking it to Performance. In: Academy of Management Review, Vol. 21 (1996) No. 1, pp. 135-172.

Lyytinen, K.; Rose, G.M. (2003): The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations. In: MIS Quarterly, Vol. 27 (2003) No. 4, pp. 557-596.

Madhavan, T.; Theivananthampillai, P. (2005): Business Process Re-design in Enterprise Systems Projects: Radical and Evolutionary Change. Paper presented at the 11th Americas Conference on Information Systems, Omaha, USA, pp. 156.

Mainemelis, C. (2010): Stealing Fire: Creative Deviance in the Evolution of New Ideas. In: Academy of Management Review, Vol. 35 (2010) No. 4, pp. 558-578.

Majchrzak, A.; Markus, M.L. (2012): Technology Affordances and Constraints in Management Information Systems (MIS), Sage Publications, Forthcoming 2012.

Malaurent, J.; Avison, D.E. (2011): ERP Global Template and Organizational Informal Structures: A Practice-Based Study. Paper presented at the 19th European Conference on Information Systems, Helsinki, Finland.

Manrodt, K.B.; Vitasek, K. (2004): Global Process Standardization: A Case Study. In: Journal of Business Logistics, Vol. 25 (2004) No. 1, pp. 1-23.

March, J.G. (1991): Exploration and Exploitation in Organizational Learning. In: Organization Science, Vol. 2 (1991) No. 1, pp. 71-87.

Markus, M.L.; Keil, M. (1994): If We Build it, They will Come: Designing Information Systems that People Want to Use. In: Sloan Management Review, Vol. 35 (1994) No. 4, pp. 11-25.

Markus, M.L.; Silver, M.S. (2008): A Foundation for the Study of IT Effects: A New Look at DeSanctis and Poole's Concepts of Structural Features and Spirit. In: Journal of the Association for Information Systems, Vol. 9 (2008) No. 10, pp. 5.

Martin, A.; Lopez, S.; Roscigno, V.; Hodson, R. (2013): Against the Rules: Synthesizing Types and Processes of Bureaucratic Rulebreaking. In: Academy of Management Review, Vol. 38 (2013) No. 4.

McGann, S.T.; Lyytinen, K. (2008): The Improvisation Effect: A Case Study of User Improvisation and its Effects on Information System Evolution. Paper presented at the 29th International Conference on Information Systems, Paris, France.

McGrenere, J.; Ho, W. (2000): Affordances: Clarifying and Evolving a Concept. Paper presented at the Graphics Interface, Montreal, Canada, pp. 179-186.

Mendling, J.; Reijers, H.A.; Recker, J. (2010): Activity Labeling in Process Modeling: Empirical Insights and Recommendations. In: Information Systems, Vol. 35 (2010) No. 4, pp. 467-482.

Miles, M.B.; Huberman, A.M. (2014): Qualitative Data Analysis (Vol. Third Edition), Sage Newbury Park,, CA 2014.

Miller, D.; Friesen, P.H. (1982): Innovation in Conservative and Entrepreneurial Firms: Two Models of Strategic Momentum. In: Strategic Management Journal, Vol. 3 (1982) No. 1, pp. 1-25.

Miller, P.; Wedell-Wedellsborg, T. (2013): The Case for Stealth Innovation. In: Harvard Business Review, Vol. 91 (2013) No. 3.

Miner, A.S.; Bassof, P.; Moorman, C. (2001): Organizational Improvisation and Learning: A Field Study. In: Administrative Science Quarterly, Vol. 46 (2001) No. 2, pp. 304-337.

Morgan, D.L. (1997): The Focus Group Guidebook, Sage Publications, Thousand Oaks 1997.

Muhr, T. (2008): Atlas.Ti - the knowledge workbench. Berlin, Germany: Scientific Software Development.

Müller, R.; Rogge-Solti, A. (2011): BPMN for Healthcare Processes. Paper presented at the 3rd Central-European Workshop on Services and their Composition, Karlsruhe, Germany pp. 65-72.

Münstermann, B.; Eckhardt, A.; Weitzel, T. (2010): The Performance Impact of Business Process Standardization: An Empirical Evaluation of the Recruitment Process. In: Business Process Management Journal, Vol. 16 (2010) No. 1, pp. 29-56.

Myhill, C. (2004): Commercial Success by Looking for Desire Lines. Paper presented at the 6th Asia Pacific Conference on Computer Human Interaction, Rotorua, New Zealand, pp. 293-304.

Mykkänen, J.; Riekkinen, A.; Sormunen, M.; Karhunen, H.; Laitinen, P. (2007): Designing Web Services in Health Information Systems: From Process to Application Level. In: International Journal of Medical Informatics, Vol. 76 (2007) No. 2, pp. 89-95.

Nadhrah, N.; Michell, V. (2013): A Normative Method to Analyse Workarounds in a Healthcare Environment: Motivations, Consequences, and Constraints. Paper presented at the 14th International Conference on Informatics and Semiotics in Organisation, Stockholm, Sweden, pp. 195-205.

Narendra, N.C. (2004): Flexible Support and Management of Adaptive Workflow Processes. In: Information Systems Frontiers, Vol. 6 (2004) No. 3, pp. 247-262.

Niazkhani, Z.; Pirnejad, H.; van der Sijs, H.; Aarts, J. (2011): Evaluating the Medication Process in the Context of CPOE Use: The Significance of Working around the System. In: International Journal of Medical Informatics, Vol. 80 (2011) No. 7, pp. 490-506.

Nichols, L. (2014): Social Desire Paths: A New Theoretical Concept to Increase the Usability of Social Science Research in Society. In: Theory and Society, Vol. 43 (2014) No. 6, pp. 647-665.

Niehaves, B.; Köffer, S.; Ortbach, K. (2012): IT Consumerization – A Theory and Practice Review. Paper presented at the 18th Americas Conference on Information Systems, Seattle, USA.

Norman, D.A. (1988): The Design of Everyday Things, Currency Doubleday, New York 1988.

Norman, D.A. (1999): Affordance, Conventions, and Design. In: Interactions, Vol. 6 (1999) No. 3, pp. 38-43.

Noy, C. (2008): Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research. In: International Journal of Social Research Methodology, Vol. 11 (2008) No. 4, pp. 327-344.

Noy, N.F.; McGuinness, D.L. (2001): Ontology Development 101: A Guide to Creating your first Ontology. *Knowledge Systems Laboratory*: Stanford University.

Nysetvold, A.G.; Krogstie, J. (2006): Assessing Business Process Modeling Languages Using a Generic Quality Framework. In: Advanced Topics in Database Research, Vol. 5 (2006), pp. 79-93.

O'Leary, R. (2010): Guerrilla Employees: Should Managers Nurture, Tolerate, or Terminate them? In: Public Administration Review, Vol. 70 (2010) No. 1, pp. 8-19.

O'Reilly, C.A.; Tushman, M.L. (2007): Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma (Vol. 1963), Stanford University Graduate School of Business Research 2007.

OMG (2011): Business Process Model Notation (BPMN). Version 2.0. http://www.omg.org/spec/BPMN/2.0/Beta2/PDF.

OMG (2014): Meta Object Facility (MOF) Core. Version 2.4.2. http://www.omg.org/spec/.

Opp, J. (2010): Discovering Desire Lines: How to Break Down Barriers and Let Paths Emerge. http://opensource.com/business/10/12/discovering-desire-lines-how-break-down-barriers-and-let-paths-emerge, accessed at September 15th 2015.

Orlikowski, W.J. (1991): Integrated Information Environment or Matrix of Control? The Contradictory Implications of Information Technology. In: Accounting, Management and Information Technologies, Vol. 1 (1991) No. 1, pp. 9-42.

Orlikowski, W.J. (1992): The Duality of Technology: Rethinking the Concept of Technology in Organizations. In: Organization Science, Vol. 3 (1992) No. 3, pp. 398-427.

Orlikowski, W.J. (2000): Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. In: Organization Science, Vol. 11 (2000) No. 4, pp. 404-428.

Ortbach, K.; Bode, M.; Niehaves, B. (2013a): What Influences Technological Individualization? An Analysis of Antecedents to IT Consumerization Behavior. Paper presented at the 19th Americas Conference on Information Systems, Chicago, USA.

Ortbach, K.; Köffer, S.; Bode, M.; Niehaves, B. (2013b): Individualization of Information Systems-Analyzing Antecedents of IT Consumerization Behavior. Paper presented at the 34th International Conference on Information Systems, Milan, Italy

Ortiz de Guinea, A.; Webster, J. (2013): An investigation of information systems use patterns: technological events as triggers, the effect of time, and consequences for performance. In: Management Information Systems Quarterly, Vol. 37 (2013) No. 4, pp. 1165-1188.

Orton, J.D.; Weick, K.E. (1990): Loosely Coupled Systems: A Reconceptualization. In: Academy of Management Review, Vol. 15 (1990) No. 2, pp. 203-223.

Overby, E.; Bharadwaj, A.; Sambamurthy, V. (2006): Enterprise Agility and the Enabling Role of Information Technology. In: European Journal of Information Systems, Vol. 15 (2006) No. 2, pp. 120-131.

Palmer, N. (2015): What is BPM? http://bpm.com/what-is-bpm, accessed at 20th January 2016.

Patterson, E.S.; Cook, R.I.; Render, M.L. (2002): Improving Patient Safety by Identifying Side Effects from Introducing Bar Coding in Medication Administration. In: Journal of the American Medical Informatics Association, Vol. 9 (2002) No. 5, pp. 540-553.

Pentland, B.T.; Feldman, M.S.; Becker, M.C.; Liu, P. (2012): Dynamics of Organizational Routines: A Generative Model. In: Journal of Management Studies, Vol. 49 (2012) No. 8, pp. 1484-1508.

Pentland, B.T.; Hærem, T.; Hillison, D. (2011): The (N)ever-changing world: stability and change in organizational routines. In: Organization Science, Vol. 22 (2011) No. 6, pp. 1369-1383.

Pesic, M.; van der Aalst, W. (2006): A Declarative Approach for Flexible Business Processes Management. Paper presented at the Business Process Management Workshops, pp. 169-180.

Petrides, L.A.; McClelland, S.I.; Nodine, T.R. (2004): Costs and Benefits of the Workaround: Inventive Solution or Costly Alternative. In: International Journal of Educational Management, Vol. 18 (2004) No. 2, pp. 100-108.

Pfaffenberger, B. (1992): Technological Dramas. In: Science, Technology & Human Values, Vol. 17 (1992) No. 3, pp. 282-312.

Pittenger, L.; Boland, D.; Perelli, S. (2011): Stretching Role Breadth: Overachieving IT Managers in Underperforming IT Organizations. Paper presented at the International Technology Management Conference, San Jose, CA, pp. 89-99.

Pollock, N. (2005): When is a Work-Around? Conflict and Negotiation in Computer Systems Development. In: Science, Technology & Human Values, Vol. 30 (2005) No. 4, pp. 496-514.

Pozzi, G.; Pigni, F.; Vitari, C. (2014): Affordance Theory in the IS Discipline: a Review and Synthesis of the Literature. Paper presented at the 20th Americas Conference on Information Systems, Savannah, USA.

Probst, G.; Raisch, S. (2005): Organizational Crisis - The Logic of Failure. In: The Academy of Management Executive, Vol. 19 (2005) No. 1, pp. 90-105.

Pugh, D.S.; Hickson, D.J.; Hinings, C.R.; Turner, C. (1968): Dimensions of Organization Structure. In: Administrative Science Quarterly, Vol. 13 (1968) No. 1.

Quast, M.; Handel, M. (2012): Social Information Systems: The End of Shadow Applications? Paper presented at the International Conference on Enterprise Information Systems, Wroclaw, Poland, pp. Paper 98.

Raisch, S.; Birkinshaw, J.; Probst, G.; Tushman, M.L. (2009): Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. In: Organization Science, Vol. 20 (2009) No. 4, pp. 685-695.

Ramakumar, A.; Cooper, B. (2004): Process Standardization Proves Profitable. In: Quality, Vol. 43 (2004) No. 2, pp. 42.

Recker, J. (2010): Opportunities and Constraints: The Current Struggle with BPMN. In: Business Process Management Journal, Vol. 16 (2010) No. 1, pp. 181-201.

Recker, J. (2014a): Suggestions for the Next Wave of BPM Research: Strengthening the Theoretical Core and Exploring the Protective Belt. In: Journal of Information Technology Theory and Application, Vol. 15 (2014a) No. 2, pp. 5-20.

Recker, J. (2014b): Towards a Theory of Individual-Level Discontinuance of Information Systems Use. Paper presented at the 35th International Conference on Information Systems, Auckland, Australia.

Recker, J.; Indulska, M.; Green, P. (2006): How Good is BPMN Really? Insights from Theory and Practice. Paper presented at the 14th European Conference on Information Systems, Göteborg, Sweden.

Recker, J.; Indulska, M.; Rosemann, M.; Green, P. (2010): The Ontological Deficiencies of Process Modeling in Practice. In: European Journal of Information Systems, Vol. 19 (2010) No. 5, pp. 501-525.

Recker, J.; Rosemann, M.; Indulska, M.; Green, P. (2009): Business Process Modeling - A Comparative Analysis. In: Journal of the Association for Information Systems, Vol. 10 (2009) No. 4, pp. 1.

Rentrop, C.; Zimmermann, S. (2012): Shadow IT Evaluation Model. Paper presented at the Federated Conference on Computer Science and Information Systems, pp. 1023-1027.

Robey, D.; Anderson, C. (2013): Information Technology, Materiality, and Organizational Change : A Professional Odyssey Organizational Change. In: Journal of the Association for Information Systems, Vol. 14 (2013) No. 7, pp. 379-398.

Robey, D.; Ross, J.W.; Boudreau, M.-C. (2002): Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change. In: Journal of Management Information Systems, Vol. 19 (2002) No. 1, pp. 17-46.

Robinson, S.L.; Bennett, R.J. (1995): A Typology of Deviant Workplace Behaviors: A Multidimensional Scaling Study. In: Academy of Management Journal, Vol. 38 (1995) No. 2, pp. 555-572.

Röder, N.; Wiesche, M.; Schermann, M. (2014a): A Situational Perspective on Workarounds in IT-Enabled Business Processes: A Multiple Case Study. Paper presented at the 22nd European Conference on Information Systems, Tel Aviv, Israel.

Röder, N.; Wiesche, M.; Schermann, M.; Krcmar, H. (2014b): Why Managers Tolerate Workarounds – The Role of Information Systems. Paper presented at the 20th Americas Conference on Information System, Savannah, USA.

Röder, N.; Wiesche, M.; Schermann, M.; Krcmar, H. (2015): Workaround Aware Business Process Modeling. Paper presented at the 12th International Conference on Wirtschaftsinformatik, Osnabrück, Germany.

Röder, N.; Wiesche, M.; Schermann, M.; Krcmar, H. (2016): Toward an Ontology of Workarounds: A Literature Review on Existing Concepts. Paper presented at the 49th Hawaii International Conference on System Sciences, Hawaii, Kauai.*

Rodríguez, A.; Fernández-Medina, E.; Piattini, M. (2007): A BPMN Extension for the Modeling of Security Requirements in Business Processes. In: IEICE Transactions on Information and Systems, Vol. 90 (2007) No. 4, pp. 745-752.

Rosemann, M. (2006): Potential Pitfalls of Process Modeling: Part A. In: Business Process Management Journal, Vol. 12 (2006) No. 2, pp. 249-254.

Rosemann, M.; Recker, J.C.; Flender, C.; Ansell, P.D. (2006): Understanding Context-Awareness in Business Process Design. Paper presented at the 17th Australasian Conference on Information Systems, Adelaide, Australia.

Rosemann, M.; van der Aalst, W.M. (2007): A Configurable Reference Modelling Language. In: Information Systems, Vol. 32 (2007) No. 1, pp. 1-23.

Rosemann, M.; Vessey, I. (2008): Toward Improving the Relevance of Information Systems Research to Practice: The Role of Applicability Checks. In: MIS Quarterly, Vol. 32 (2008) No. 1, pp. 1-22.

Rosing, K.; Frese, M.; Bausch, A. (2011): Explaining the Heterogeneity of the Leadership-Innovation Relationship: Ambidextrous Leadership. In: The Leadership Quarterly, Vol. 22 (2011) No. 5, pp. 956-974.

Rowley, J.; Slack, F. (2004): Conducting a Literature Review. In: Management Research News, Vol. 27 (2004) No. 6, pp. 31-39.

Russell, B. (2007): 'You Gotta lie to IT': Software Applications and the Management of Technological Change in a Call Centre. In: New Technology, Work and Employment, Vol. 22 (2007) No. 2, pp. 132-145.

Sadiq, S.; Governatori, G.; Namiri, K. (2007): Modeling Control Objectives for Business Process Compliance. In: Business Process Management. Eds.: Alonso, G.; Dadam, P.; Rosemann, M. Springer-Verlag, Berlin, Heidelberg 2007, pp. 149-164.

Sadiq, S.; Sadiq, W.; Orlowska, M. (2001): Pockets of Flexibility in Workflow Specification. In: Conceptual Modeling - ER 2001. Eds. Springer 2001, pp. 513-526.

Safadi, H.; Faraj, S. (2010): The Role of Workarounds During an Opensource Electronic

Saleem, J.J.; Flanagan, M.; Militello, L.G.; Arbuckle, N.; Russ, A.L.; Burgo-Black, A.L.; Doebbeling, B.N. (2011): Paper Persistence and Computer-Based Workarounds with the Eelectronic Health Record in Primary Care. Paper presented at the Human Factors and Ergonomics Society Annual Meeting, pp. 660-664.

Sallaz, J.J. (2002): The House Rules Autonomy and Interests among Service Workers in the Contemporary Casino Industry. In: Work and Occupations, Vol. 29 (2002) No. 4, pp. 394-427.

Sambamurthy, V.; Bharadwaj, A.; Grover, V. (2003): Shaping Agility Through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. In: MIS Quarterly, Vol. 27 (2003) No. 2, pp. 237-263.

Sambamurthy, V.; Wei, K.-K.; Lim, K.; Lee, D. (2007): IT-Enabled Organizational Agility and Firms' Sustainable Competitive Advantage. Paper presented at the 28th International Conference on Information Systems, Montreal, Canada.

Savoli, A.; Barki, H. (2013): Functional Affordance Archetypes: A New Perspective for Examining the Impact of IT Use on Desirable Outcomes. Paper presented at the 34th International Conference on Information Systems, Milan, Italy.

Scheer, A.-W.; Nüttgens, M. (2000): ARIS Architecture and Reference Models for Business Process Management, Springer 2000.

Schermann, M.; Wiesche, M.; Krcmar, H. (2012): The Role of Information Systems in Supporting Exploitative and Exploratory Management Control Activities. In: Journal of Management Accounting Research, Vol. 24 (2012) No. 1, pp. 31-59.

Schmidt, R. (2005): Flexible Support of Inter-Organizational Business Processes Using Web Services. Paper presented at the Proceedings of the CAiSE'05 Workshops, Porto, Portugal, pp. 51-58.

Sebora, T.C.; Theerapatvong, T. (2010): Corporate Entrepreneurship: A Test of External and Internal Influences on Managers' Idea Generation, Risk Taking, and Proactiveness. In: International Entrepreneurship and Management Journal, Vol. 6 (2010) No. 3, pp. 331-350.

Seidel, S.; Recker, J.; vom Brocke, J. (2013): Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations. In: MIS Quarterly, Vol. 37 (2013) No. 4, pp. 1275-1299.

Sheffi, Y.; Rice Jr., J.B. (2005): A Supply Chain View of the Resilient Enterprise. In: MIT Sloan Management Review, Vol. 47 (2005) No. 1.

Sher, P.J.; Lee, V.C. (2004): Information Technology as a Facilitator for Enhancing Dynamic Capabilities through Knowledge Management. In: Information & Management, Vol. 41 (2004) No. 8, pp. 933-945.

Sherehiy, B.; Karwowski, W.; Layer, J.K. (2007): A Review of Enterprise Agility: Concepts, Frameworks, and Attributes. In: International Journal of Industrial Ergonomics, Vol. 37 (2007) No. 5, pp. 445-460.

Sia, S.K.; Tang, M.; Soh, C.; Boh, W.F. (2002): Enterprise Resource Planning (ERP) Systems as a Technology of Power: Empowerment or Panoptic Control? In: The DATA BASE for Advances in Information Systems, Vol. 33 (2002) No. 1, pp. 23-37.

Siau, K.; Rossi, M. (2011): Evaluation Techniques for Systems Analysis and Design Modelling Methods – A Review and Comparative Analysis. In: Information Systems Journal, Vol. 21 (2011) No. 3, pp. 249-268.

Siau, K.L. (1996): Empirical Studies in Information Modeling: Interpretation of the Object Relationship, University of British Columbia 1996.

Silic, M.; Back, A. (2014): Shadow IT - A View from Behind the Curtain. In: Computers & Security, Vol. 45 (2014), pp. 274-283.

Siponen, M.; Vance, A. (2010): Neutralization: New Insights into the Problem of Employee Information Systems Security Policy Violations. In: MIS Quarterly, Vol. 34 (2010) No. 3, pp. 487-502.

Smith, W.K.; Lewis, M.W. (2011): Toward a Theory of Paradox: A Dynamic Equilibrium Model of Organizing. In: Academy of Management Review, Vol. 36 (2011) No. 2, pp. 381-403.

Sobreperez, P.; Ferneley, E.; Wilson, F.A. (2005): Tricks or Trompe L'Oeil?: An Eexamination Workplace Resistance in an Information rich Managerial Environment. Paper presented at the 13th European Conference on Information Systems, Regensburg, Germany.

Srivardhana, T.; Pawlowski, S.D. (2007): ERP Systems as an Enabler of Sustained Business Process Innovation: A Knowledge-Based View. In: The Journal of Strategic Information Systems, Vol. 16 (2007) No. 1, pp. 51-69.

Stake, R.E. (2013): Multiple Case Study Analysis, Guilford Press, New York 2013.

Stoffregen, T.A. (2003): Affordances as Properties of the Animal-Environment System. In: Ecological Psychology, Vol. 15 (2003) No. 2, pp. 115-134.

Straub, D.W.; Nance, W.D. (1990): Discovering and Disciplining Computer Abuse in Organizations: A Field Study. In: MIS Quarterly, Vol. 14 (1990) No. 1, pp. 45-60.

Straub, D.W.; Welke, R.J. (1998): Coping with Systems Risk: Security Planning Models for Management Decision Making. In: MIS Quarterly, Vol. 22 (1998) No. 4, pp. 441-469.

Strauss, A.; Corbin, J.M. (1998): Grounded Theory in Practice, Sage Publications, Thousand Oaks 1998.

Strong, D.M.; Miller, S.M. (1995): Exceptions and Exception Handling in Computerized Information Processes. In: Transactions on Information Systems, Vol. 13 (1995) No. 2, pp. 206-233.

Strong, D.M.; Volkoff, O. (2010): Understanding Organization-Enterprise System Fit: A Path to Theorizing the Information Technology Artifact. In: MIS Quarterly, Vol. 34 (2010) No. 4, pp. 731-756.

Strong, D.M.; Volkoff, O.; Johnson, S.A.; Pelletier, L.R.; Tulu, B.; Bar-On, I.; Trudel, J.; Garber, L. (2014): A Theory of Organization-EHR Affordance Actualization. In: Journal of the Association for Information Systems, Vol. 15 (2014) No. 2, pp. 53-85.

Subramaniam, N.; Nandhakumar, J. (2013): Exploring Social Network Interactions in Enterprise Systems: The Role of Virtual Co-Presence. In: Information Systems Journal, Vol. 23 (2013) No. 6, pp. 475-499.

Suwannakoot, C.; Sarkar, P.; Dick, M. (2011): Usage of Student and Administrative Management Systems: A Case Study of User Perceptions at an Australia University. Paper presented at the 17th Americas Conference on Information Systems, Detroit, USA.

Swaminathan, J.M. (2001): Using Standardized Operations. In: California Management Review, Vol. 43 (2001) No. 3, pp. 125.

Swanson, E.B. (1994): Information Systems Innovation Among Organizations. In: Management Science, Vol. 40 (1994) No. 9, pp. 1069-1092.

Sykes, G.M.; Matza, D. (1957): Techniques of Neutralization: A Theory of Delinquency. In: American Sociological Review, Vol. 22 (1957) No. 6, pp. 664-670.

Tallon, P.P. (2008): Inside the Adaptive Enterprise: An Information Technology Capabilities Perspective on Business Process Agility. In: Information Technology and Management, Vol. 9 (2008) No. 1, pp. 21-36.

Tallon, P.P.; Pinsonneault, A. (2011): Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model. In: MIS Quarterly, Vol. 35 (2011) No. 2, pp. 463-486.

Thatte, S.; Grainger, N.; McKay, J. (2012): Feral Practices. Paper presented at the 23rd Australasian Conference on Information Systems Geelong, Australia.

Thoresen, K. (1997): Workflow Meets Work Practice. In: Accounting, Management and Information Technologies, Vol. 7 (1997) No. 1, pp. 21-36.

Timmons, S. (2003): A Failed Panopticon: Surveillance of Nursing Practice via New Technology. In: New Technology, Work and Employment, Vol. 18 (2003) No. 2, pp. 143-153.

Tiwana, A. (2010): Systems Development Ambidexterity: Explaining the Complementary and Substitutive Roles of Formal and Informal Controls. In: Journal of Management Information Systems, Vol. 27 (2010) No. 2, pp. 87-126.

Trkman, P. (2010): The Critical Success Factors of Business Process Management. In: International Journal of Information Management, Vol. 30 (2010) No. 2, pp. 125-134.

Tucker, A.L.; Edmondson, A.C. (2003): Why Hospitals Don't Learn from Failures: Organizational and Psychological Dynamics that Inhibit System Change. In: California Management Review, Vol. 45 (2003) No. 2, pp. 55-72.

Tushman, M.L.; O'Reilly, C.A. (1996): Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. In: California Management Review, Vol. 38 (1996), pp. 8-30.

Tushman, M.L.; O'Reilly, C.A. (1997): Winning Through Innovation: A Practical Guide to Leading Organizational Change and Renewal, Harvard Business School Press, Boston 1997.

Tushman, M.L.; Romanelli, E. (1985): Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation. In: Research in Organizational Behavior. Eds.: Staw, B.M.; Cummings, L.L. JAI Press, Greenwich, CT 1985.

Un, C.A. (2007): Managing the Innovators for Exploration and Exploitation. In: Journal of Technology Management & Innovation, Vol. 2 (2007) No. 3, pp. 4-20.

Ungan, M.C. (2006): Standardization Through Process Documentation. In: Business Process Management Journal, Vol. 12 (2006) No. 2, pp. 135-148.

van der Aalst, W. (2004): Process Mining: Desire Lines or Cow Paths? http://wwwis.win.tue.nl/~wvdaalst/old/etc/desire-lines-or-cowpaths.htm, accessed at September 16th.2015.

van der Aalst, W. (2011): Process Mining: Discovery, Conformance and Enhancement of Business Processes, Springer Science & Business Media 2011.

van der Aalst, W. (2013): "Mine Your Own Business": Using Process Mining to Turn Big Data into Real Value. Paper presented at the 21st European Conference on Information Systems Utrecht, Netherlands.

van der Aalst, W.; ter Hofstede, A.H.; Weske, M. (2003): Business Process Management: A Survey. *Proceedings of the International Conference on Business Process Management* (pp. 1-12). Eindhoven, Netherlands: Springer.

van der Aalst, W.; Weske, M.; Grünbauer, D. (2005): Case Handling: A New Paradigm for Business Process Support. In: Data & Knowledge Engineering, Vol. 53 (2005) No. 2, pp. 129-162.

van Offenbeek, M.; Boonstra, A.; Seo, D. (2013): Towards Integrating Acceptance and Resistance Research: Evidence from a Telecare Case Study. In: European Journal of Information Systems, Vol. 22 (2013) No. 4, pp. 434-454.

van Osch, W.; Mendelson, O. (2011): A Typology of Affordances: Untangling Sociomaterial Interactions Through Video Analysis. Paper presented at the 32nd International Conference on Information Systems, Shanghai, China.

Venkatesh, V. (2006): Where To Go From Here? Thoughts on Future Directions for Research on Individual-Level Technology Adoption with a Focus on Decision Making. In: Decision Sciences, Vol. 37 (2006) No. 4, pp. 497-518.

Venkatraman, N. (1994): IT-Enabled Business Transformation: From Automation to Business Scope Redefinition. In: Sloan Management Review, Vol. 35 (1994) No. 2, pp. 73-73.

Vogelsmeier, A.A.; Halbesleben, J.R.; Scott-Cawiezell, J.R. (2008): Technology Implementation and Workarounds in the Nursing Home. In: Journal of the American Medical Informatics Association, Vol. 15 (2008) No. 1, pp. 114-119.

Volkoff, O.; Strong, D.M. (2013): Critical Realism and Affordances: Theorizing IT-Associated Organizational Change Processes. In: MIS Quarterly, Vol. 37 (2013) No. 3, pp. 819-834.

Volkoff, O.; Strong, D.M.; Elmes, M.B. (2007): Technological Embeddedness and Organizational Change. In: Organization Science, Vol. 18 (2007) No. 5, pp. 832-848.

vom Brocke, J.; Simons, A.; Niehaves, B.; Riemer, K.; Plattfaut, R.; Cleven, A. (2009): Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. Paper presented at the 17th European Conference on Information Systems Verona, Italy, pp. 2206-2217.

von Stetten, A.; Muenstermann, B.; Eckhardt, A.; Laumer, S. (2008): Towards an Understanding of the Business Value of Business Process Standardization - A Case Study Approach. Paper presented at the 14th Americas Conference on Information Systems, Toronto, Ontario.

Wand, Y.; Weber, R. (1993): On the Ontological Expressiveness of Information Systems Analysis and Design Grammars. In: Information Systems Journal, Vol. 3 (1993) No. 4, pp. 217-237.

Webster, J.; Watson, R.T. (2002): Analyzing the Past to Prepare the Future: Writing a Literature Review. In: MIS Quaterly, Vol. 26 (2002) No. 2, pp. xiii-xxiii.

Webster, M. (2016): Definition of Affordances. (Vol. 2016).

Wiesche, M.; Schermann, M.; Krcmar, H. (2013): When IT Risk Management Produces More Harm than Good: The Phenomenon of 'Mock Bureaucracy'. Paper presented at the 46th Hawaii International Conference on System Sciences, Maui, pp. 4502-4511.

Wijen, F. (2014): Means versus Ends in Opaque Institutional Fields: Trading Off Compliance and Achievement in Sustainability Standard Adoption. In: Academy of Management Review, Vol. 39 (2014) No. 3, pp. 302-323.

Wilde, T.; Hess, T. (2007): Forschungsmethoden der Wirtschaftsinformatik. In: Wirtschaftsinformatik, Vol. 49 (2007) No. 4, pp. 280-287.

Willison, R.; Warkentin, M. (2013): Beyond Deterrence: An Expanded View of Employee Computer Abuse. In: MIS Quarterly, Vol. 37 (2013) No. 1, pp. 1-20.

Winkler, T.J.; Brown, C.V. (2013): Horizontal Allocation of Decision Rights for On-Premise Applications and Software-as-a-Service. In: Journal of Management Information Systems, Vol. 30 (2013) No. 3, pp. 13-48.

Withagen, R.; de Poel, H.J.; Araújo, D.; Pepping, G.-J. (2012): Affordances can Invite Behavior: Reconsidering the Relationship Between Affordances and Agency. In: New Ideas in Psychology, Vol. 30 (2012) No. 2, pp. 250-258.

Wouters, M.; Wilderom, C. (2008): Developing Performance-Measurement Systems as Enabling Formalization: A Longitudinal Field Study of a Logistics Department. In: Accounting, Organizations and Society, Vol. 33 (2008) No. 4, pp. 488-516.

Wüllenweber, K.; Weitzel, T. (2007): An Empirical Exploration of How Process Standardization Reduces Outsourcing Risks. Paper presented at the 40th Annual Hawaii International Conference on Information Systems, Waikoloa.

Yang, Z.; Ng, B.-Y.; Kankanhalli, A.; Luen Yip, J.W. (2012): Workarounds in the Use of IS in Healthcare: A Case Study of an Electronic Medication Administration System. In: International Journal of Human-Computer Studies, Vol. 70 (2012) No. 1, pp. 43-65.

Yin, R.K. (2009): Case Study Research: Design and Methods, Sage Publications, Thousand Oaks 2009.

Zain, M.; Rose, R.C.; Abdullah, I.; Masrom, M. (2005): The Relationship between Information Technology Acceptance and Organizational Agility in Malaysia. In: Information & Management, Vol. 42 (2005) No. 6, pp. 829-839.

Zairi, M. (1997): Business Process Management: A Boundaryless Approach to Modern Competitiveness. In: Business Process Management Journal, Vol. 3 (1997) No. 1, pp. 64-80.

Zamani, E.; Giaglis, G.; Pouloudi, N. (2013): A Sensemaking Approach to Tablet Users' Accommodating Practices. Paper presented at the 34th International Conference on Information Systems, Milan, Italy.

Zhang, P. (2008): Technical Opinion Motivational Affordances: Reasons for ICT Design and Use. In: Communications of the ACM, Vol. 51 (2008) No. 11, pp. 145-147.

Zhou, X.; Ackerman, M.; Zheng, K. (2011): CPOE Workarounds, Boundary Objects, and Assemblages. Paper presented at the SIGCHI Conference on Human Factors in Computing Systems, Vancouver, Canada, pp. 3353-3362.

Zimmermann, S.; Rentrop, C. (2014): On the Emergence of Shadow IT: A Transaction Cost-Based Approach. Paper presented at the 22nd European Conference on Information Systems, Tel Aviv, Israel.

Zorn, T.; Campbell, N. (2006): Improving the Writing of Literature Reviews through a Literature Integration Exercise. In: Business Communication Quarterly, Vol. 69 (2006) No. 2, pp. 172-183.

Appendix

A - Outline of Semistructured Interview Questions

Introduction

- Introduction of interviewer background
- Short presentation of research project and research team
- Questions about informant background: career, position, function
- Questions about research site: structure, organization, stakeholders, IT

Health Care

- How do you work with electronic health records?
- How does your typical work day look like? (e.g. visit, documentation, discussion and information exchange with colleagues/nurses, etc.)
- With which actors do you normally interact on a typical working day?
- How do the existing processes and systems support you when working with patients? (e.g. laptop, taking work home, studies, colleagues, etc.)
- Are there any special patients where you change your working behavior when using systems and following processes?
- Are you informed about the consequences of privacy breaches?

Accounting

- What are the reasons to automate the controlling mechanisms?
- With regard to which criteria have the business process been chosen for implementing control mechanisms?
- Are controls changed/adjusted with regard to the discovery of fraud?
- What specific data is included in the controlling process?
- Which running costs arise through automation?
- How has the structure of the department changed?

Innovation Process

- What are the main characteristics of innovations in your field?
- Does the department provide a standardized innovation process?
- How is the process designed?
- Where do you see the strengths of the current process?
- What would you see as a typical innovation risks?
- Which impacts does the innovation process have on these risks?
- If you could create an innovation process "out of the box" how would it look like and how would you do that?

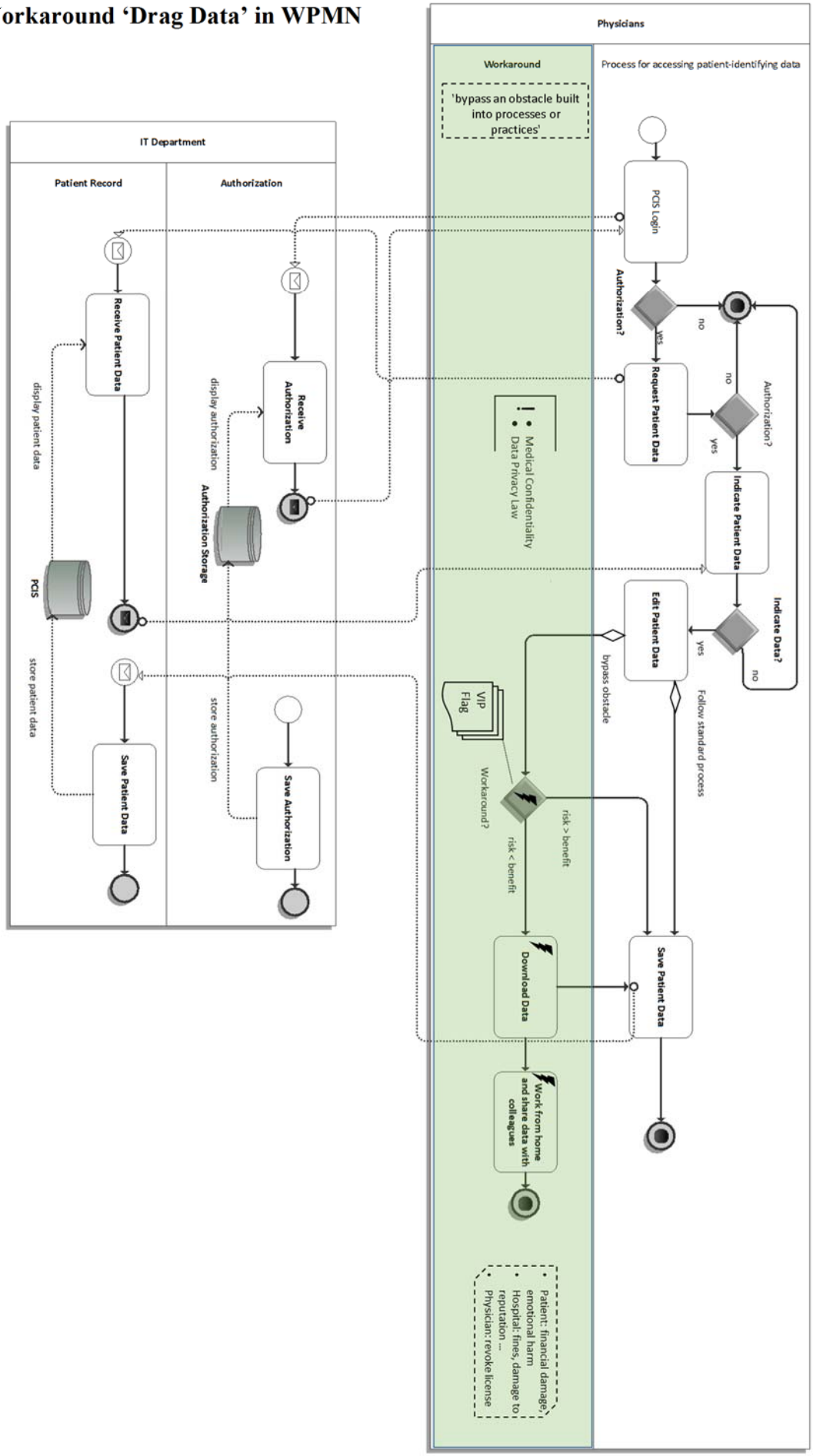
B - An Overview of Workaround Research

#	Source[1]	Year	Type of Study[2]	Type of WA[3]	Level of WA[4]	Industry	Country	Information System	Orientation[5]	Intentio	Focus[6]
1	(Alter 2014)	2014	conc	C, D, E, F, NC, R, RI, S, W	all	general	US	general	proc	/	T
2	(Alter 2012)	2012	conc	W	all	general	-	ERP	proc	+	s
3	(Alvarez 2008)	2008	conc	C, R, S, W	I	higher education	US	ES	proc	/	s
4	(Ansari et al. 2010)	2010	conc	D, NC, R	all	general	-	general	proc	+	t
5	(Azad/King 2008)	2008	conc	R, S, T, W	I	health care	-	HIS	proc	/	t
6	(Azad/King 2012)	2012	emp	D, N, RB, S, W	G	tax collection, health care	-	tax arrears collection	proc	+	t
7	(Bagayogo et al. 2013)	2013	conc	C, F, NC, SM, R, W	all	general	-	general	proc	/	t
8	(Baker/Nelson 2005)	2005	emp	NC, T, W	all	general	-	general	proc	+	s
9	(Bala/Venkatesh 2013)	2013	conc	C, R, S, W	all	manufacturing	US	ERP	proc	+	s
10	(Behrens 2009)	2009	conc	S, W	I, G	higher education	AU	platform	proc	/	s
11	(Behrens/Sedera 2004)	2004	conc	S, W	all	higher education	AU	ERP	proc	+	s
12	(Beimborn/Palitza 2013)	2013	conc	C, S	all	general	US	general	tech	+	s
13	(Bennett/Robinson 2000)	2000	emp	E	I	general	US	general	proc	/	t
14	(Berente/Yoo 2012)	2012	conc	D, R, RI, S, W	I, G	aeronautics administration	US	ES	proc	+	t
15	(Bhattacherjee/Hikmet 2007)	2007	emp	R, W	I	health care	US	HIS	proc	-	t
16	(Boss et al. 2009)	2009	emp	N, R	I	health care	US	general	proc	-	s
17	(Boudreau/Robey 2005)	2005	conc	RI, S, SM, T, W	I	government	US	ERP	proc	+	s
18	(Bulgurcu et al. 2010)	2010	emp	N	I	general	US	general	proc	/	t
19	(Campbell 2012)	2012	conc	W	I	investment	US	general	proc	+	t
20	(Campbell/Lu 2007)	2007	conc	CA, E, D, SM, RB	I	general	-	general	tech	-	t
21	(Chua et al. 2014)	2014	conc	S, W	I	IT service provision	US	general	proc	/	s
22	(Courtright et al. 1988)	1988	emp	W	all	general	-	general	proc	/	t
23	(Craig 1999)	1999	emp	C, S	G	general	CAN	ES	tech	+	s
24	(D'Arcy et al. 2014)	2014	emp	CA, E, D, RI, SM	I	general	-	general	proc	/	s
25	(D'Arcy et al. 2009)	2009	emp	CA, SM	I	general	US	general	tech	/	t
26	(da Cunha/Carugati 2009)	2009	emp	D	G	telecommunication	EU	CRM	tech	/	t

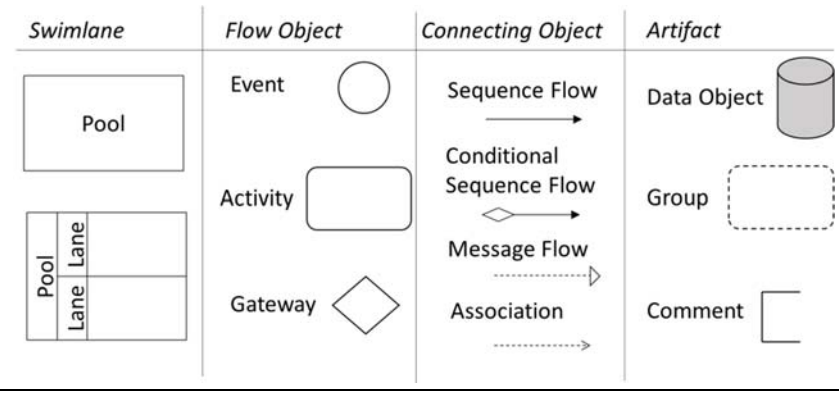
27	(Davern/Wilkin 2008)	2008	conc	W	I	accommodation	AU	booking system	tech	/	s
28	(Davison/Ou 2013)	2013	conc	S, W	I	hospitality industry	CN	networks	proc	+	t
29	(Ferneley/Sobreperez 2006)		conc	D, E, N, R, SM, W	I	service industry, public sector	UK	incident reporting	tech	+	t
30	(Fürstenau/Rothe 2014)	2014	emp	T, W	I	recycling	-	all systems	proc	/	s
31	(Gasparas/Monteiro 2009)	2009	emp	R, T, W	I	engineering	EU	all systems	proc	+	s
32	(Gasser 1986)	1986	emp	W	I	manufacturing	US	all systems	proc	/	s
33	(Gerson/Star 1986)	1986	conc	NC, W	I	insurance	US	insurance	proc	+	s
34	(Guo et al. 2011)	2011	emp	CA, E, D, RB, SM, W	I	general	-	general	proc	+	t
35	(György et al. 2012)	2012	emp	N, S	I	general	CH, DE	general	tech	+	t
36	(Haag/Eckhardt 2014)	2014	conc	C, D, E, N, S, SM, W	O	general	-	general	proc	/	t
37	(Handel/Poltrock 2011)	2011	emp	S, W	I, G	software development	US	Excel	proc	+	t
38	(Harrington 1996)	1996	emp	CA, F, SM	O	general	US	general	tech	/	s
39	(Heumann et al. 2014)	2014	emp	E	I	manufacturing	DE	product lifecycle	proc	/	s
40	(Huuskonen/Vakkari 2013)	2013	emp	S, W	I, G	social work	FI	client IS	proc	+	t
41	(Ignatiadis/Nandhakumar 2009)	2009	conc	CA, R, W	I	transport	UK	ERP	proc	-	t
42	(Ilie 2013)	2013	conc	N, R, SM, W	I	health care	US	EMR	proc	/	t
43	(Jones et al. 2004)	2004	conc	D, S, W	O	higher education	AU	ERP	proc	+	s
44	(Kirsch/Boss 2007)	2007	emp	E, N	I	medical area	US	general	tech	/	s
45	(Koch et al. 2014)	2014	emp	C, S	I	general	-	general	proc	+	t
46	(Köffer et al. 2014)	2014	emp	C, S	I	general	DE, RO, US	general	tech	+	s
47	(Koopman/Hoffman 2003)	2003	conc	W	I	general	-	general	tech	+	t
48	(Koppel et al. 2008)	2008	conc	W	I	health care	US	BCMA	proc	+	t
49	(Lapointe/Rivard 2005)	2005	emp	E, N, R, SM, W	I, G	hospital	-	medical report	tech	+	s
50	(Laumer/Eckhardt 2010)	2010	emp	R, W	I	automotive supplier	DE	administration	proc	+	s
51	(Laumer et al. 2010)	2010	emp	R, W	I	general	-	general	tech	+	s
52	(Li et al. 2010)	2010	emp	E, SM	I	general	CN	general	proc	+	s
53	(Madhavan/Theivanthampillai 2005)	2005	emp	D	O	brewery	NZ	ES	proc	+	s
54	(Mainemelis 2010)	2010	conc	E, NC, RB	I	-	-	general	proc	+	s
55	(Martin et al. 2013)	2013	conc	D, E, R, RB	all	general	-	-	proc	/	t
56	(Malaurent/Avison 2011)	2011	emp	C, E, W	I, G	-	CN	ERP	/	+	s
57	(McGann/Lyytinen 2008)	2008	emp	C, W	all	manufacturing	US	supply chain	proc	+	s

								collaboration			
58	(Orlikowski 1992)	1992	conc	D, E, N, W	G	manufacturing	-	automated manufacturing	tech	+	s
59	(Ortbach et al. 2013a)	2013	emp	C, S, W	I	general	DE	general	tech	+	s
60	(Ortbach et al. 2013b)	2013	conc	C, S, W	I	general	DE	general	tech	+	s
61	(Petrides et al. 2004)	2004	emp	W	I	higher education	US	general	proc	/	t
62	(Recker 2014b)	2014	conc	R, W	I	general	-	general	/	+	s
63	(Rentrop/Zimmermann 2012)	2012	conc	S	G	general	-	general	proc	+	t
64	(Robey et al. 2002)	2002	conc	D, R, RI, W	I	manufacturing	US	ERP	proc	/	s
65	(Robinson/Bennett 1995)	1995	emp	E, F, RB	all	various	US	general	proc	/	s
66	(Röder et al. 2014a)	2014	emp	F, N, R, RB, S, W	I	health care, accounting, automotive	-	HIS	proc	+	t
67	(Röder et al. 2014b)	2014	emp	D, N, S, W	I	health care	-	general	tech	+	t
68	(Safadi/Faraj 2010)	2010	emp	N, R, W	I	health care	CAN	EMR	/	/	t
69	(Saleem et al. 2011)	2011	emp	W	I	health care	US	HIS	proc	+	t
70	(Sallaz 2002)	2002	emp	CA, D, N	I	gambling, casino	US	-	proc	+	s
71	(Silic/Back 2014)	2014	emp	N, S, W	all	general	-	general	tech	+	t
72	(Siponen/Vance 2010)	2010	emp	CA, N, RB, SM	I	various	-	general	proc	-	t
73	(Sobreperez et al. 2005)	2005	emp	D, E, N, W	I	garment manufacturing	-	workflow systems	proc	/	t
74	(Srivardhana/Pawlowski 2007)	2007	conc	D, T, W	all	general	-	ERP	tech	/	S
75	(Straub/Nance 1990)	1990	conc	CA, F, SM	I	various	US	general	tech	-	S
76	(Straub/Welke 1998)	1998	emp	CA, D, F, R	I	information services companies	US	general	tech	-	s
77	(Strong/Volkoff 2010)	2010	emp	W	all	industrial equipment	US	ES	/	/	s
78	(Subramaniam/Nandhakumar 2013)	2013	emp	W	I	telecommunication	FI, DE, UK	ES	proc	+	s
79	(Suwannakoot et al. 2011)	2011	emp	T, W	I	university	AU	administration	proc	+	t
80	(Thoresen 1997)	1997	emp	E, W	G	material administration	NO	group work systems	proc	+	s
81	(Willison/Warkentin 2013)	2013	conc	CA, E, F, N, RB	I	general	-	general	proc	-	t
82	(Winkler/Brown 2013)	2013	emp	S	O	manufacturing	DE	SAAS	proc	+	s
83	(Zamani et al. 2013)	2013	emp	RI, R, S, W	I	general	-	general	tech	+	s
84	(Zimmermann/Rentrop 2014)	2014	emp	N, S	O	general	FR, DE, CH	general	proc	+	t

C – Workaround 'Drag Data' in WPMN



D – BPMN 2.0 Modeling Elements



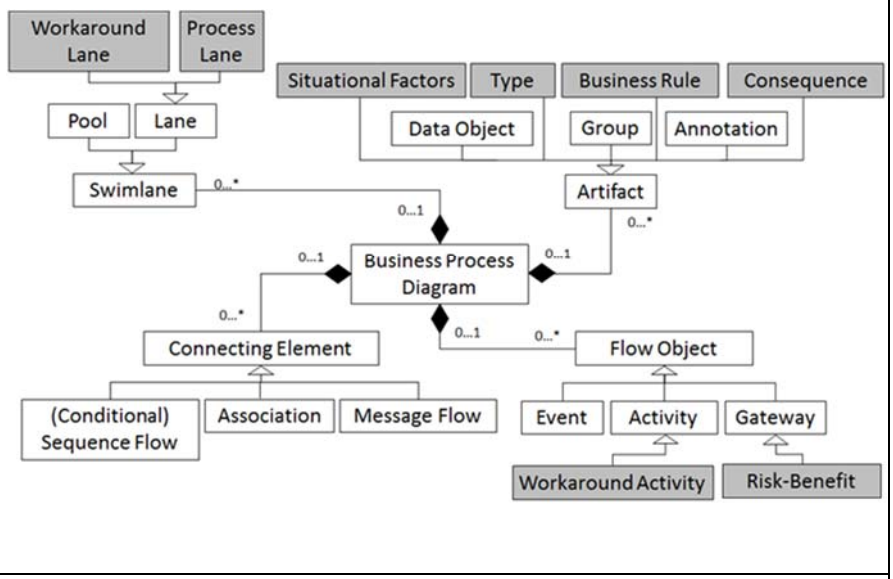
Relevant Constructs of BPMN 2.0 Modeling Elements
(Source: OMG 2011)

Pools and lanes are used to structure different organizational units (pools) and roles or functions within those units (lanes). Connecting objects relate flow objects (events, activities, and gateways) to each other. Within the same pool, sequence flow is used to indicate the order in which the activities are performed - including sequence flows that have to fulfill a condition before traversing the process. Message flows are used between pools to model communication with other organizations. Associations relate artifacts (data objects, groups or comments) to other modeling elements (Müller/Rogge-Solti 2011). Additional information can be integrated using annotations. With BPMN 2.0 this basic model has been refined and enhanced to attain a new level of integrated business-user-friendly modeling (OMG 2011). The next section explains our approach for extending BPMN 2.0 with constructs which will allow BPMN 2.0 to describe workarounds.

Meta-Model Extension for WPMN

To develop a conceptual modeling notation for workarounds, we follow a meta-model extension (Bocciarelli/D'Ambrogio 2011). We provide constructs for integrating workarounds in BPMN 2.0 by adding new meta-classes and meta-associations to the meta-model. We follow the guidelines of the OMG Meta Object Facility (MOF), which is an object-oriented framework for describing meta-objects (OMG 2014). As the meta-model is a valid instance of the MOF meta-meta-model, extending the BPMN 2.0 meta-model means defining a new modeling notation by instantiating a new MOF model.

The core characteristics of the process environment were identified after analyzing the existing workaround with the theoretical construct. We build on this process preparation in order to integrate workarounds in formal business process representation. The Business Process Diagram (BPD) meta-model is extended by adding the required meta-classes. As a BPMN process is graphically represented by use of BPD, we rely on the conceptual model to introduce workaround aware business process modeling (Bocciarelli/D'Ambrogio 2011). Figure B presents the meta-model extension.



Business Process Diagram (BPD) Meta-model Extension
(Source: Adapted from Rodríguez et al. 2007)

The white boxes represent the basic constructs provided by BPMN 2.0, the boxes highlighted in grey are an extension for modeling workaround constructs. The main class Business Process Diagram relates all other elements and is used to represent a specific business process (Rodríguez et al. 2007). Workaround lanes and process lanes are seen as lane construct. Workaround activities and risk-benefit constructs are connected to activity and gateway, respectively. Situational factors, type of workaround, business rules and consequences are generalizations of artifacts. Each of the modeling elements is related to the main class. Artifact mutability (Gregor/Jones 2007) is ensured by the usage of a meta-model extension as this facilitates the extension of WPMN with additional constructs. All child classes inherit from the higher classes. If further research shows that additional constructs are needed, they can be easily integrated into the existing WPMN meta-model.

E – Workaround Overview

Workaround	Description	Intended Process	Effect/Consequence
Health Care Case			
workaholic	physicians copy patient data from the secure information system	work on patient data from hospital computer	no guarantee of security of the patient data
sharing passwords	sharing passwords with colleagues or pinning them to the monitor	keep password in private	passwords hinder work and are seen as time-consuming
log out	physicians do not log out of the system	log out when leaving computer	not logging out in is time saving and convenient
taking patient records home	physicians take patient records home	leave them at the hospital and work there	keeping work-life balance
copy patients report	physicians copy reports from other patients and edit necessary parts	write new/individual report	mistakes appear when missing necessary parts
patient records trolley	leaving the trolley with patient records standing unattended on the corridor	keep records in a safe place	thinking that others have no interest in reading them
data access reason	physicians do not provide reason for accessing patient data	insert information for access reason	access transparency is not guaranteed
standard password	all employees in ward use the emergency standard password	use personal password	privacy and security regulations are not respected
Innovation Case			
broken ID card	organizational members break the ID card for permanent access	remove card when leaving desk	unauthenticated people may use the computer
favoritism	compromise with other business units to ensure that in later projects own requirements will be implemented	discuss the necessity of suggestion	unnecessary or wrong requirements will be implemented
innovation camouflage	innovations are treated as change requests; confront with a prototype (fait accompli) to overcome obstacles	approval from steering board, discuss the necessity of specification	no transparent allocation of resources which has an influence on organizational culture
functionality integration	bypassing requirements by creating new functions during project specification	avoiding the interrelation of functions	overkill of functions
relocate capacity	use resources from other projects and record them	invest capacity in specific project	“no time to fail” mentality
standard application	IT department pretends to implement standard application	dynamic certification should be implemented	reduce workload, extra effort, build on existing implementation
manipulation of decision-maker	pushing people with strong ties to the steering board to pave the way for their project	follow the standard process through steering board decision	unnecessary requirements may be implemented
build up pressure	reoccurring problems remain unsolved till it escalates	solve the problem	not time to solve problem
reap resources	pro forma gathering of resources during planning phase	record correct requirements	lack of trust
task redirection on platform	redirecting assigned tasks on the platform abandons more work	reviewing task	anticipate effort
ignoring basic conditions	abandon more work through not integrating new ideas in projects	discuss the necessity of suggestion	if important it will re-emerge
seizing the window of opportunity	ignoring time specifications in order to complete project implementation	some innovations have to be launched faster due to quick technology changes	strategy is not followed and does not meet milestones