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IT ambidexterity for business processes: the importance of balance

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Abstract

Purpose – In highly dynamic industries, business processes require exploitation, i.e. activities that are associated with an increase in productivity through automation, standardization, integrated architectures, and the usage of existing IT resources. As a complementary capability, exploration is needed, i.e. the ability to flexibly implement new and innovative IT resources (Lee *et al.*, 2015). The purpose of this paper is to use the concept of ambidexterity, which is researched intensively outside the domain of business processes (e.g. Gibson and Birkinshaw, 2004; Tang and Rai, 2014), to address this paradoxical trade-off within business processes.

Design/methodology/approach – The paper follows a qualitative approach. A multiple case study comprising 11 interviews and additional document analysis in six organizations is conducted in the German energy sector to examine the proposed framework.

Findings – This paper shows the importance of balancing exploitative and explorative business process IT (BPIT) capabilities. The process-theoretical outcome of this study is the BPIT Capability Framework that provides explanation for the interaction between exploitation and exploration.

Research limitations/implications – This study contributes to the understanding of how to build ambidextrous BPIT capabilities by explaining the underlying mechanisms for feedback loops that occur in cases of imbalance. The scope of the conducted study presents a limitation and thus future research is encouraged to further validate the findings of this paper.

Originality/value – By drilling down to the process level, this paper addresses the gaps that limited empirical studies have in business process management research (Recker and Mendling, 2015) and the focus on business processes that is lacking from the literature on organizational IT management (Gregory *et al.*, 2015).

Keywords Case studies, Energy industry, Ambidextrous IT capability, Business process IT ambidexterity, Exploitation/Exploration, Process-level research

Paper type Research paper

Introduction

In today's globalized economy, many industries simultaneously face increasing competitive pressures and unprecedented speed of change in business conditions. In this competitive and dynamic environment, decision makers are constantly faced with the challenge of having to resolve tensions between efficiency-increasing and flexibility-increasing capabilities. One important area of concern is IT capabilities supporting the execution of business processes. Despite increasing overall spending on IT (IDC, 2014), business process performance has continued to decrease, in particular process costs rise and customer satisfaction decreases (Capgemini Consulting, 2011). Thus, it seems that the trade-offs between efficiency and flexibility for business process IT (BPIT) capabilities are currently not well managed. As companies struggle to stay competitive in the dynamic environment, process owners and IT departments need to decide how to divide attention between efficiency-enhancing

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and flexibility-enhancing IT capabilities to optimally support the execution of business processes.

Previous research provides a thorough conceptualization of antecedents for ambidexterity (e.g. Duncan, 1976; Benner and Tushman, 2003; Gibson and Birkinshaw, 2004), and several studies have shown the impact of organizational ambidexterity on firms' performance (He and Wong, 2004; Jansen *et al.*, 2006, 2009; Cao *et al.*, 2009). Our research connects to existing research streams on ambidexterity in the information systems (IS) discipline: process ambidexterity in IS development projects (e.g. Tiwana, 2010), IT-enabled organizational ambidexterity (e.g. Maghrabi *et al.*, 2011; Xue *et al.*, 2012; Piccinini *et al.*, 2015), ambidextrous organizational IT capability (e.g. Cao *et al.*, 2013; Lee *et al.*, 2015), IS strategy (e.g. Lo and Leidner, 2012; Mithas and Rust, 2016), and ambidexterity in inter-organizational relations (e.g. Tang and Rai, 2014; Im and Rai, 2014; Lavikka *et al.*, 2015). Existing research suggests an influence of business process ambidexterity on competitive performance but does not provide empirical evidence (Xie *et al.*, 2011). Lee *et al.* (2015) described an impact of IT ambidexterity on operational ambidexterity, which they defined as "the ability of a firm to continually innovate and improve its operational processes" (p. 405). Furthermore, they also showed that operational ambidexterity has an influence on organizational agility. While it also deals with the issue of ambidexterity and operational business processes, their study stays at the organizational level and leaves open the question of the role of ambidextrous IT capability at the business process level.

In summary, current research on ambidexterity focuses on the organizational level, but more micro-level research is required to shed light on the question of how ambidexterity can actually be achieved (Turner *et al.*, 2013; Lee *et al.*, 2015; Gregory *et al.*, 2015). Because the impact of organizational-level IT is mediated by business process-level impacts (Melville *et al.*, 2004), it is essential to open up the organizational black box and conduct an analysis at the process level. Drawing on recent findings regarding the combination strategies of exploitative and explorative IT capabilities on the organizational level (Lee *et al.*, 2015) and supply chain processes (Tang and Rai, 2014), this research aims to enhance the understanding of different combination strategies to build an ambidextrous IT capability for a given business process. To date, research analyzing combination strategies for exploitative and explorative BPIT capabilities has been scarce. This research gap leads to the formulation of our research question:

RQ1. How do explorative and exploitative BPIT capabilities interplay?

This question is addressed through a multiple case study that is suited to answer "how" questions, which deal with as yet under-researched phenomena(Yin, 2009).

Turning from thinking of efficiency and flexibility as trade-off toward ambidexterity puts focus on simultaneously pursuing efficiency through exploitative and flexibility through explorative IT capabilities for business processes. While these capabilities have been analyzed independently, there is scarce research on their combined effects. This empirical study addresses this gap by investigating the impact of IT ambidexterity at the business process level. We propose a process theory to capture the feedback effects within the dimensions of BPIT ambidexterity. By providing insights into the interaction between exploitative and explorative BPIT capabilities, this research contributes to the emerging discussion on how to create IT ambidexterity (Lee *et al.*, 2008, 2015; Gregory *et al.*, 2015) with a focus on the process level. This addresses the call for more process-level research in behavioral studies (Benner and Tushman, 2003; Turner *et al.*, 2013) as well as more empirical research in the area of business process management (BPM) (Kohlborn *et al.*, 2014; Recker and Mendling, 2015).

This work informs practice by illuminating the importance of a balance between exploitative and explorative BPIT capabilities as two dimensions of BPIT ambidexterity. This can work as a sensitizing instrument to guide future IT decisions for business processes.

The structure of this paper is as follows: theoretical foundations are presented to cover the concept of BPIT ambidexterity. These are followed by an overview of the trade-off dimensions that ambidexterity can be applied to and substitution and complementarity as mechanisms for feedback effects. The third section introduces case study research as the applied research methodology and provides reasoning for case selection, overviews of cases, and information on data collection and analysis. Results from the case study are presented in the fourth section. The BPIT Capability Framework is presented in the fifth section as this study's process-theoretical outcome. The summary, limitations of this study, and potential avenues for future research can be found in the sixth section.

Theoretical foundations

BPIT ambidexterity

Applying the ambidexterity perspective to the context of the organizational IT capability showed an impact of the simultaneous pursuit of exploitation and exploration in IT capability on organizational agility (Lee *et al.*, 2008, 2015). Exploitative IT capabilities increase productivity to support business needs, while explorative IT capabilities enable the deployment of new IT resources to meet and adapt to changing business needs (Lee *et al.*, 2008). These needs are typically manifested in the concrete demands for particular business processes (Davenport, 1998). Thus, Lee *et al.*'s (2008) conceptualization of IT ambidexterity is adapted to the process level, and BPIT ambidexterity is defined as "the simultaneous pursuit of exploitative and explorative IT capabilities to support a specific business process" (Heckmann, 2015, p. 4). The following introduces the underlying concepts of exploitative and explorative capabilities to support a particular business process that uses IT.

Exploitation is associated with mechanistic structures, tightly coupled systems, as well as routinization and control (He and Wong, 2004; Gibson and Birkinshaw, 2004). Business process automation can be increased by implementing formerly manually performed tasks and data links using IT (Shang and Seddon, 2002). Here the standardization of business processes may allow the leveraging of existing IT resources (Muenstermann *et al.*, 2010). In many cases, process automation relies on highly integrated systems with tight coupling between IT resources (Bahli and Ji, 2007). On the basis of this argument, exploitative BPIT capabilities are defined as the means of automation and standardization, leveraging existing IT resources and integrated architectures to support a specific business process.

Exploration has been characterized by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation (March, 1991). IT flexibility is important to adapt business processes quickly to changing customer demands and implement innovative technologies (Kumar and Stylianou, 2013; Wagner *et al.*, 2011; Gebauer and Schober, 2006; Chen *et al.*, 2013; Afflerbach *et al.*, 2013; Lu and Ramamurthy, 2011). To integrate new and innovative resources easily into existing IT infrastructures, integration mechanisms, such as service-oriented architectures (SOAs), need to be in place (Schelp and Aier, 2009; Joachim *et al.*, 2013). Such mechanisms increase architectural modularity and make it possible to mix and match task implementations to adapt quickly to changing requirements (Schilling, 2000; Tiwana *et al.*, 2010), for example, by complementing the core ERP system with individual spreadsheet solutions (Alter, 2014). Explorative BPIT capabilities are defined as the means that enable the identification and implementation of innovative and new IT resources to support a specific business process.

Paradoxical IT decisions for business processes

Organizations can be viewed as a set of interlinked business processes that significantly influence organizational strategy and performance (Benner and Tushman, 2003). Business processes are the vehicle through which IT business value is generated from organizational and technological IT resources; thus, they mediate the impact of IT on organizational performance (Melville *et al.*, 2004; Ray *et al.*, 2005; Schryen, 2013; Gattiker and Goodhue, 2005). They can be defined as the specific ordering of work activities across time and space with a beginning, an end, and clearly identified inputs and outputs (Davenport, 1998). Business processes are implemented using IT resources, such as functional systems, enterprise systems, or BPM platforms.

To achieve high performance, managers involved in business process implementations are required to resolve various trade-offs, as outlined in Table I (Gregory *et al.*, 2015). First, managers decide whether an existing standard business process can be used or a new individualized business process needs to be engineered. Second, managers have to decide on the degree of automation for the business process (Gebauer and Schober, 2006; Kumar and Stylianou, 2013). For each task, this includes deciding whether it should be performed in an automated way or whether manual task processing is required.

Third, architectural choices range from a fully integral single system design to a modular architecture that allows the flexible reconfiguration of application modules (Tiwana *et al.*, 2010; Schilling, 2000; Gregory *et al.*, 2015).

Decisions need to be made about which technology is used to implement a business process (Rothaermel and Alexandre, 2008). For the IT implementation of a business process, either existing and known or unknown and potentially innovative technology is used (Gregory *et al.*, 2015).

Combination strategies for BPIT capabilities

The recent research on ambidexterity explored different conceptualizations of the relationship between exploration and exploitation: substitution and complementarity (He and Wong, 2004; Cao *et al.*, 2009; Tang and Rai, 2014; Lee *et al.*, 2015). Substitution refers to a situation in which the increase in one thing (e.g. exploitative BPIT capabilities) leads to a decrease in another (e.g. explorative BPIT capabilities) (Huber *et al.*, 2013). By contrast, complementarity refers to the opposite, i.e. an increase in one thing leads to an increase in the positive effects of another (Huber *et al.*, 2013).

In many contexts (e.g. organizational innovation or IT ambidexterity), research suggests that the dimensions of ambidexterity should be balanced (He and Wong, 2004) in order to achieve positive outcomes such as performance increases (Cao *et al.*, 2009;

Trade-off dimension	Exploitation	Exploration	Selected references
Standardization	Standardization/ Cost reduction	Differentiation/ Revenue expansion	Gattiker and Goodhue (2004, 2005), Joachim *et al.* (2013), Tang and Rai (2014), Mithas and Rust (2016)
Automation	Task/Data link automation (efficiency)	Manual task/data link processing (flexibility)	Gebauer and Schober (2006), Wagner *et al.* (2011), Kumar and Stylianou (2013)
IT architecture	Integral IT architecture	Modular IT architecture	Schilling (2000), Tiwana *et al.* (2010), Gregory *et al.* (2015)
Innovation	Existing technology	Innovative technology	Rothaermel and Alexandre (2008), Gregory *et al.* (2015), Lee *et al.* (2008, 2015)

Table I. Overview of paradoxical decisions in business process implementation

Lee *et al.*, 2015). In line with this argument, it is proposed that imbalances in BPIT ambidexterity result in an increase or decrease in the overall level of BPIT capabilities:

P1. An imbalance between exploitative and explorative BPIT capabilities results in complementarity or substitution, which leads to either an increase or a decrease in the overall level of BPIT capabilities.

The following sub-sections present more detail on both outcomes highlighted in *P1*, i.e. the effects of complementarity and substitution between exploitative and explorative BPIT capabilities.

Complementarity. The perspective of complementarity suggests that the combined value of two concepts is higher than the mere sum of both individual values (Huber *et al.*, 2013; Schilling, 2000). Based on this theoretical perspective, it is proposed that a state of imbalance between the two dimensions of exploitative and explorative BPIT capabilities leads to an increase in the overall level of BPIT capabilities. It is important to distinguish between the two situations in which an imbalance can occur.

Domination of exploitative BPIT capabilities, i.e. higher levels of business process automation and deployment of productivity-enhancing tools and systems can lead to overall cost reductions in the line of business (Davenport, 1998; Chen *et al.*, 2013). By freeing up organizational resources through productivity gains, IT management can decide to invest more in explorative BPIT capabilities, which would reduce the imbalance between the two dimensions.

Domination of explorative BPIT capabilities indicates a higher ability to adapt and implement new IT systems for a given business process quickly and easily. For business processes with high levels of explorative BPIT capabilities, process adaptations can be performed with ease and at a low cost (Lee *et al.*, 2015; Gebauer and Schober, 2006). Thus, it is easy to implement efficiency-enhancing mechanisms such as data and process integration, process automation, or the deployment of productivity increasing tools for process workers. By definition, this indicates an increase in the level of exploitative BPIT capabilities, which reduces the imbalance within the ambidextrous BPIT capability:

P2. Complementarity of BPIT capabilities can lead to an increase in exploitative or explorative BPIT capabilities.

Substitution. As a counter-perspective, exploitative and explorative BPIT capabilities can also be considered substitutes (He and Wong, 2004; Tang and Rai, 2014). In this case, the increase in one dimension leads to a decrease in the other dimension. A budget-oriented perspective helps to understand the substitution effect. Assuming fixed budgets for the application of IT to support a particular business process, each investment in exploitative BPIT capabilities reduces the available budget for the other dimension and vice versa.

It is also necessary to distinguish between the two directions of the imbalance: situations in which exploitative BPIT capabilities dominate indicate that process automation and data integration are high, and that various productivity and efficiency-enhancing IT tools and systems are deployed for a business process. Process automation and integration are costly undertakings (Hitt *et al.*, 2002) that reduce the remaining budget for other initiatives, e.g. those that can be grouped into explorative BPIT capabilities.

Issues also arise for the domination of explorative BPIT capabilities. Achieving high levels of explorative BPIT capabilities, i.e. investing heavily in platform technologies, SOAs, and configurability, requires a substantial budget (Gebauer and Schober, 2006; Gebauer and Lee, 2008). Similarly, this results in there being little of the budget left for other activities:

P3. Substitution of BPIT capabilities can lead to a decrease in exploitative or explorative BPIT capabilities.

The following sub-section presents contextual factors that are likely to play an important role in the interplay between exploitative and explorative BPIT capabilities.

Contextual factors. Previous research found that the concept of process uncertainty plays an important role in IT decision making (Gebauer and Schober, 2006; Gebauer and Lee, 2008; Pavlou and El Sawy, 2010; Lu and Ramamurthy, 2011). In cases of high uncertainty, for example, in highly dynamic market environments, it is more important to invest in IT flexibility (Gebauer and Schober, 2006). Consequently, there is a suggestion that business process uncertainty influences the interaction process of exploitative and explorative BPIT capabilities.

Business processes with dominating levels of exploitative BPIT capabilities are highly vulnerable if flexibility is required. Limited explorative BPIT capabilities prevent the quick and easy adaptation of a process, e.g. in situations of changing customer demands or regulatory changes (Gebauer and Schober, 2006; Joachim *et al.*, 2013). The initially highly automated business process may no longer match the actual process. This mismatch results in a loss of various efficiency-enhancing features, as they can no longer be used without the required adaptations. Thus, such an imbalance can result in a lower level of exploitative BPIT capabilities. This is particularly relevant to business processes with low process volume, i.e. the number of process instances that occur within a given period of time (Gebauer and Schober, 2006). The higher the volume, the more important the adequate support through IT in the form of process automation and data integration. For processes with low volume, in most cases the initial cost and effort to implement such systems outweighs the gains. Here manual processing is more adequate. On basis of these arguments, the following proposition is formulated:

P4a. For business processes with high process uncertainty and high process volume, domination of exploitative BPIT capabilities leads to a substitution effect.

However, investing in exploration should only be done where required (Rothaermel and Alexandre, 2008). For business processes that are stable over long periods of time, investing in explorative BPIT capabilities leads to money spent with no return on investment (ROI). For investment cases with no ROI, it is supposed that such projects or products are stopped or downsized in scope:

P4b. For business processes with low process uncertainty, domination of explorative BPIT capabilities leads to a substitution effect.

Business process complexity is proposed as another contingency factor (Karimi *et al.*, 2007). Highly complex business processes require more effort to increase exploitative BPIT capabilities. The more tasks and possible flows there are in a business process, the more tasks and control flows need to be automated and related data integrated. In addition, because of the enormous amounts of potential configurations and options across the process, such processes are complicated to support with explorative BPIT capabilities. Consequently, there is an assumption that substitution between exploitative and explorative BPIT capabilities occurs under these circumstances:

P4c. For business processes with high process complexity, domination of exploitative BPIT capabilities leads to a substitution effect.

An opposing effect is proposed for business processes with low complexity. Here, it is not as costly to focus on explorative BPIT capabilities, and it can be done light-weightily. Thus, it is suggested that complementarity exists between exploitative and explorative BPIT capabilities for these situations:

P4d. Domination of exploitative BPIT capabilities leads to a complementarity effect for business processes with low process complexity.

Research methodology

The research question is addressed through a multiple case study (Dubé and Paré, 2003). Case studies are suited to address questions dealing with contemporary events over which the researcher has little or no control (Yin, 2009; Eisenhardt, 1989), as in the case of organizational IT decisions regarding business processes. In such settings, neither the IT systems nor the operational business processes employed within a company can be controlled.

This case study comprises six business processes in six companies. Many business processes for utilities in Germany are standardized by regulatory agency. By focusing on these regulated business processes, this allows the reduction of variations in contextual factors, when comparing business processes across companies in this specific industry in order to minimize confounding effects (Yin, 2009). The actual cases were selected following a convenience selection approach combined with theoretical sampling to ensure theoretically relevant differences (Eisenhardt, 1989), such as firm characteristics, e.g. size, or business process characteristics, e.g. process complexity or environmental uncertainty (Gebauer and Schober, 2006).

Throughout this study, quality criteria for case study research (i.e. construct validity, internal validity, external validity, and reliability) are followed (Dubé and Paré, 2003; Yin, 2009).

Case selection

Many industries face intense competition and high environmental dynamics demanding high efficiency and flexibility of business processes to adapt to changing requirements, either due to regulatory changes or changes in customer demands (Newell *et al.*, 2003; Melville *et al.*, 2004; Kumar and Stylianou, 2013). Prominent examples are services industries, such as the banking sector, which has faced constant pressure from both the market and the regulatory agencies since the global finance crisis, or the utilities sector, which in many countries is currently in the middle of a transformation process (Goebel *et al.*, 2014).

Liberalization of the German energy sector started in 1998. Previously integrated utilities had to be unbundled into separate business units for generation, distribution system operation (DSO), and sales. Unbundling is also required at the level of IS (Federal Ministry for Economic Affairs and Energy, 2013). Along with the creation of these different market roles, business processes that span multiple market actors (e.g. switching the energy supplier) have been standardized in conjunction with electronic data formats on EDIFACT basis. Format changes occur twice a year and put severe pressure on the flexibility of IS. Combined with a shift in energy production toward decentralized generation using renewable energies, this results in continuous changes in processes and IS. Further advances such as a smart grid, virtual power plants, and electro mobility will be introduced in the near future (Kossahl *et al.*, 2012; Goebel *et al.*, 2014).

Being in the middle of this transformation, the German energy sector exhibits the characteristics of a highly dynamic industry and has high pressures on efficiency because of increasing competition and regulatory requirements. As the energy sector has become of increasing interest to the research community, this sector was selected for inquiry (Kossahl *et al.*, 2012; Goebel *et al.*, 2014; Watson *et al.*, 2010). This study capitalizes on the fact that one of the researchers works at a service company in this industry and is active within various industry associations, which allowed access to a variety of different companies and additional information about specifics of this industry. Table II provides an overview of the case companies.

Data collection and analysis

During data collection, multiple sources of evidence were collected, allowing a triangulation of data from different sources. Semi-structured interviews with 11 process workers were

Table II.
Case companies

Case company	Business process	Industry	Employees	Revenue
Utility1	Meter-to-cash process (shared services for DSO and sales)	Utilities	180	46.5 million euro
Utility2	Renewable energy feed-in credit notes (DSO)	Utilities	258	2.680 million euro
Utility3	Supplier change (sales)	Utilities	388	293 million euro
Utility4	Customer service process (DSO, sales)	Utilities	n/a	24 million euro
Utility5	Meter-to-cash process (shared services for DSO and sales)	Utilities	400	50 million euro
Home	Service worker dispatching process	Building services	150	20 million euro

conducted in person or via phone. Guaranteeing confidentiality allowed interviewees to speak freely. All interviews were recorded and transcribed for further analysis. In addition, document analysis was performed to analyze business process models and descriptions, charts of IT architectures, data flow charts, and specifications of IT systems. This helps to address key informant bias as various additional documents, process descriptions, and additional data from the case companies are used to validate the information from the interviews. To provide a comprehensive overview of all activities conducted over the course of this study, a case study database is created (Yin, 2009).

For data analysis, a theory-driven coding scheme (Boyatzis, 1998) is developed based on existing theory and applied to the data[1]. The coding scheme comprises codes on the past contextual situation, e.g. task flexibility, as well as on the outcomes of these situations, e.g. decrease in exploitative BPIT capabilities. The author and a research assistant, who is familiar with the topic of ambidexterity in the context of IT-enabled business processes, coded the interviews independently using Atlas.ti 6.2 (http://atlasti.com/). The second coder received a detailed explanation of the coding scheme and a short amount of training. In an iterative way, they compared the individual coding and discussed differences after every three or four interviews, which resulted in three coding rounds and allowed most of the differences to be resolved. To ensure the reliability of the findings, inter-rater reliability is calculated (Kolbe and Burnett, 1991), which is presented in Table III. All values except interview 1 are above the acceptable threshold of 70 percent (Fleiss and Cohen, 1973). For interview 7, only a value of 68 percent was achieved, which is close to the threshold.

The authors used code frequencies to calculate the levels of exploitative and explorative BPIT capabilities (see footnote 1). Furthermore, interviewees reported the

Table III.
Inter-coder reliability

Interview transcript		Total number of coded segments in agreement	Total number of coded segments	Inter-coder reliability (%)
1 Business expert	Utility1	80	93	86
2 Business expert	Utility4	53	61	87
3 Team lead	Utility3	55	70	79
4 Project lead	Utility2	69	88	78
5 Project lead	Utility3	70	92	76
6 Consultant	Utility5	47	57	82
7 Business expert	Utility2	62	91	68
8 Process owner	Home	70	93	75
9 Process worker	Home	45	52	87
10 Process worker	Home	44	56	79
11 Process owner	Home	47	56	84
Total		642	809	79

effects of changes in IT systems or business processes, which have identified by specific codings. This approach makes it possible to identify certain interaction patterns, depending on the initial situation.

Results

Differences in the interplay between exploitative and explorative BPIT capabilities were found in the empirical data. The patterns that can be identified in the case data are shown in Table IV. For four cases, imbalances within their BPIT capabilities were identified as an initial condition. These cases show feedback effects as outcomes, which will be presented in the following sub-sections. By contrast, balanced exploitative and explorative BPIT capabilities can be observed for two of the six cases (Utility4 and Utility5). In these cases, no changes can be identified in either exploitative or explorative BPIT capabilities.

Utility4 is a rather small German utility with fewer than 20,000 customers. Here, a deliberate decision was made to implement only limited process automation and data integration, which indicates low exploitative BPIT capabilities. This decision is rooted in the high uncertainty with regard to regulatory changes in this industry and Utility4's intention to decrease its dependence on running IT systems. This is achieved through paper-intensive business processes that can also be executed if the particular billing system is unavailable or not working correctly after regulatory changes are made:

> They work quite a lot with paper here. Each customer relocation comprises thousands of sheets of paper, and on these sheets they [the colleagues] then write down their notes. […] They even have the system functionality ready. They even had this in the legacy system. But they just don't use it (Utility4, I2).

It is interesting to note that, despite it being the same business process type as the one for Utility1, no decrease in exploitative BPIT capabilities can be observed. The reasons for this might be the balanced BPIT capabilities or the difference in business process volume.

Similar to Utility4, the business process volume is rather low at Utility5. A similar decision for only selective automation and data integration has been made at Utility5. However, the interviewee raised the question whether this level is even necessary for their needs. "But we also have a lot of customers, where I don't understand – or at least don't understand at first glance – why they have an SAP solution. Why don't they have one of these smaller solutions, like Wilken? You've got the impression you could also implement everything there" (Utility5, I6).

Both exploitative and explorative BPIT capabilities at Utility5 are higher than at Utility4 but still lower than for the other utilities in this study. An interesting insight can be obtained from the following quote: "If you have some ideas to improve some tasks, this often doesn't work because of master data maintenance, as a lot of data objects are not used and maintained" (Utility5, I6). The interviewee indicates that higher levels of exploitative BPIT capabilities are seen as the foundation for a further increase in explorative BPIT capabilities.

Table IV.
Interaction patterns of case companies

Case	Dominating BPIT capability	Process characteristics			Effect	Outcome
		Volume	Uncertainty	Complexity		BPIT capability
Utility1	EXPLOIT	High	Med	High	Decrease	EXPLOIT
Utility2	EXPLORE	Med	High	High	Increase	EXPLOIT
Utility3	EXPLOIT	High	Med	High	Decrease	EXPLOIT
Utility4	None	Low	Med	Low	None	None
Utility5	None	Low	Med	High	None	None
Home	EXPLORE	Low	Low	Med	Increase	EXPLOIT

This point also supports the importance of balancing exploitative and explorative BPIT capabilities, as *P1* suggests.

Contrary to the balanced BPIT capabilities at Utility4 and Utility5, the other cases exhibit an imbalance between exploitative and explorative BPIT capabilities. In line with the proposed effects, changes in the levels of exploitative BPIT capabilities have been observed. The following sections identify further underlying mechanisms of substitution and complementarity that lead to the observed effects of the decrease or increase in the overall levels of BPIT capabilities.

Substitution

Patterns of weakening effects can be observed for Utility1 and Utility3. Both cases comprise company-spanning business processes that are affected by frequent changes in the regulatory context of the German utilities sector. Not only are data formats for electronic data integration (EDI) updated every six months, but core business processes are also subject to frequent changes.

Utility1 is a large, shared-service center for three utilities that collectively have more than one million customer contracts. Thus, high process volumes can be observed here in combination with highly uncertain business processes. The IT architecture consists mainly of a historically grown SAP ERP for Utilities landscape, which has been complemented by various hard-coupled extension systems to increase data integration and process automation.

In this situation, process changes that require adaptations in the underlying IT platform lead to a significant volume of manual task processing, as is highlighted by the frequent issues that occur after EDI format changes: "This [new data format] didn't work with our system. If such applications were sent to us, our system just declined them with the reason that the transaction is 'implausible'" (Utility1, I1).

An interesting statement from the interviewee at Utility1 shows that these problems experienced at Utility1 are common within the German utilities industry. In particular, utilities that operate a traditional SAP-based landscape face significant problems when system changes are required. For that reason, many utilities use manual workarounds to make sure the processes still work. "But most of them [other utilities] show understanding for that. In particular, those that are also working with SAP. Surprisingly. […] So they basically understand if you say something isn't working in our system, and please send it this and that way" (Utility1, I1).

The second case that exhibits the pattern of weakening effects is Utility3. This company faces the same challenges regarding frequent process changes and large process volume but operates Wilken ENER:GY instead of SAP IS-U as its core billing system. Still, the issues identified are similar to those in Utility1. The frequent changes in business processes result in problems for two reasons: changes resulting from regulatory changes, changed customer demands, or bugs identified by process workers take significant amounts of time before being implemented. Furthermore, there are issues in the testing process when new features should be delivered. New features are not documented as expected, and clients like Utility3 are required to test them themselves. This combination leads to many issues that are identified only after live deployment but cannot be resolved quickly. This leads to high manual post-processing and workarounds, which results in reduced exploitative BPIT capabilities. Despite these issues, there is an awareness at Utility3 that this situation cannot continue for long, in particular because of increasing process volume. "I am not so sure about that [full automation of the process], if I am being honest. But in general I think this should happen sometimes. Because in my opinion this amount can no longer be managed. We now have so many brands, we just started with countrywide gas sales, and there will be more. I think sometimes you can't handle this by hand [anymore]" (Utility3, I5). These episodes from Utility1 and Utility3 provide evidence for the relationship between imbalanced BPIT capabilities and a resulting substitution effect decreasing the overall level of BPIT capabilities, as *P3* proposes.

Complementarity

In contrast to the substitution effects on BPIT capabilities that were found in Utility1 and Utility3 as a result of the imbalance between exploitative and explorative BPIT capabilities, Utility2 and Home show a different pattern.

The case of Utility2 covers a different business process in the utility sector than do Utility1 and Utility3. The process of energy feed-in billing is rather new and has limited process volume. Utility2 is one of the largest DSOs in Germany and operates a best-of-breed IT landscape consisting of various SAP IS-U systems in conjunction with other industry-specific solutions. At Utility2, new features can be implemented in rather short amounts of time and typically without any negative impact on the operational systems. "Regulatory changes are implemented in SAP rather quickly and relatively well. We have really good programmers. They really know how to tinker, especially as the EEG [German renewable energy law] is not compatible with standard SAP anymore" (Utility2, I4).

While for other business processes with higher volumes, exploitative BPIT capabilities are rather high, at Utility2 these mechanisms are not used for the process of energy feed-in billing yet. "In theory, yes, but for feed-in this never or almost never works. In other words, we take the databases to look for devices, which we then need to create and build in within SAP. But in general I think that back then it was planned that this would be automated at some point. I think this is largely automated in grid usage billing, but not for feed-in" (Utility2, I4).

For this business process, manual task processing and even manual input validation are required, as indicated by the following quote: "Yes, I am using a small Excel tool. […] Because if we have new installations and need to create a new bill for which we need to calculate the partial payments for next year, the system doesn't always do that correctly, so I have my own spreadsheet" (Utility2, I7).

As the previous cases in the energy sector were exclusively utility companies, these findings are complemented with results from one contrasting non-utility case, where the focus is on the service worker dispatching process. Home is a medium-sized building services company with around 150 employees. In this industry, IT has played only a minor role for many years, and IS has supported only back-office processes, such as accounting or materials management. Home only operates a simple IT landscape, which consists of a single ERP system. Owing to its role as a frontrunner customer to its ERP vendor, Home is involved in the development of new features and serves as a pilot customer, too. This situation leads to a situation in which the current degree of exploitation is rather low. Higher explorative BPIT capabilities allow a continuous increase in exploitative BPIT capabilities over time: "Some things do not necessarily happen overnight, but many things become automated insidiously" (Home, I9). One example is mentioned by the process owner for the service worker dispatching process: "Just this process, in other words when I have a customer on the phone. The time required to enter this instance on the calendar or print it has been reduced considerably, at least by half" (Home, I8).

Compared with the utilities cases from the utilities industry, this particular process at Home shows the lowest process uncertainty, as the following quote indicates "Change? Change? So what has changed in the past 10 years? Basically, it only changed that we now do calendar planning with INFORM. Before that, it was just paper-based. That's the change" (Home, I8). This is a major difference and the potential reason for the different patterns that can be observed for Utility1 and Home, in addition to the different direction of the imbalance between BPIT capabilities. Furthermore, process volume is significantly higher at Utility1.

Higher explorative BPIT capabilities make it possible to implement changes with ease and without problems for day-to-day operations. One recent example is the integration of iPads for their field workers in the business process, which resulted in increased task automation and data link integration. "Our field technicians are now also equipped with iPads. If they all have these iPads, then working orders are sent as PDFs, returned as filled-out forms, and get imported. That means there is no more scanning, and the file is directly linked to the process instance" (Home, I8).These cases provide evidence that situations in which explorative BPIT capabilities dominate can lead to an increase in exploitative BPIT capabilities, as *P2* states.

Contextual factors

The previous discussion shows that the initial alignment between exploitative and explorative BPIT capabilities influences the resulting feedback effects. Furthermore, our data provide evidence that feedback effects cannot only be determined by analyzing the initial situation, but also requires analysis of contextual factors, such as process complexity, volume, and uncertainty.

Cases Utility2 and Home serve to demonstrate that business processes, which exhibit low process volume, seem to benefit from dominating explorative BPIT capabilities through complementarity effects as proposed in *P4b*. Substitution effects have been observed for cases Utility1 and Utility3, i.e. the increase of exploitative BPIT capabilities goes at the expense of explorative BPIT capabilities. As proposed in *P4a*, these effects occur in a context of high process uncertainty and process volume. In both cases, this has resulted in the inability to adequately adapt business processes and IT systems to changing requirements.

In contrast to *P4c* and *P4d*, no strong evidence could be found in our interview data for an influence of process complexity.

Overall, the findings indicate that the resulting feedback effect depends on both, the initial alignment between exploitative and explorative BPIT capabilities as well as the specific context that is formed by contextual factors, such as process uncertainty and volume.

BPIT Capability Framework

The BPIT Capability Framework as the resulting process theory is shown in Figure 1. This framework provides a first nascent theory toward an understanding of the interplay

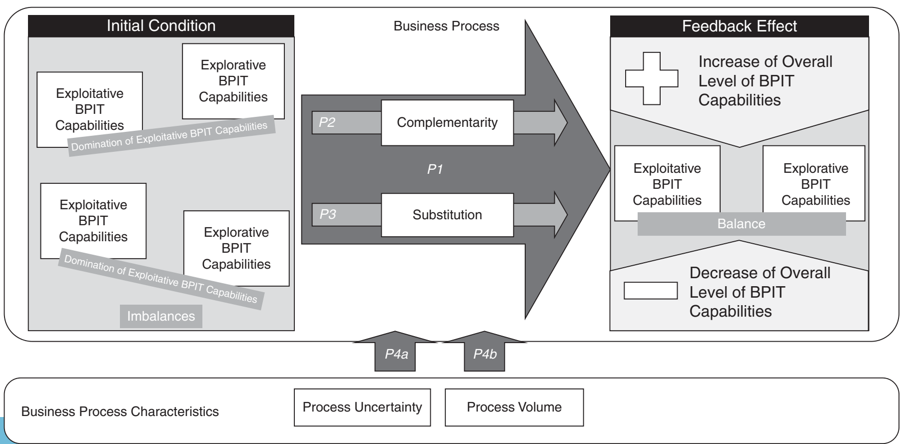

Figure 1.
BPIT Capability Framework

between explorative and exploitative BPIT capabilities as two dimensions of IT capabilities to support a particular business process.

A state of imbalanced BPIT capabilities will lead to a balanced situation (*P1*). Depending on the initial condition, i.e. the direction of imbalance between exploitative and explorative BPIT capabilities, the resulting feedback effect either increases the overall level of BPIT capabilities through complementarity (*P2*) or decreases the level of BPIT capabilities in cases where substitution (*P3*) works as the underlying mechanism. Furthermore, this effect is expected to be influenced by characteristics of the business process such as uncertainty and volume (*P4a-P4d*).

Findings from this study suggest the concept of dynamic equilibrium to be relevant not only at the organizational level (Teece *et al.*, 1997; Xie *et al.*, 2011) but also at the level of business processes. Dynamic equilibria exist in cases where it is not possible to identify a single static equilibrium to which the system evolves in cases of imbalance (Smith and Lewis, 2011). This lens can be applied to the situation of BPIT ambidexterity, as the system does not evolve to a single equilibrium but to multiple possible outcomes, depending on the underlying mechanism of either substitution or complementarity. As discussed in the previous sections, these mechanisms are linked to various contextual factors, i.e. these factors influence the trajectory for a specific business process.

Furthermore, cases have shown the importance of process characteristics, particularly process volume and uncertainty, as contextual factors that determine the underlying interaction mechanism. It is suggested that there are different trajectories for various combinations of business process characteristics and that they determine the actual manifestation of the proposed interplay between BPIT capabilities. Figure 2 shows the schematic trajectories for different business processes that form the path between the dynamic equilibria.

Conclusion

This paper presents a multiple case study that results in a process theory capable of explaining the interplay between exploitative and explorative BPIT capabilities. This context currently lacks empirical studies both to understand the concept of IT ambidexterity at the business process level (Benner and Tushman, 2003; Turner *et al.*, 2013) and to analyze its impact on the performance of business processes (Lee *et al.*, 2008; Ling *et al.*, 2009). Addressing this theoretical gap, this research endeavor contributes by

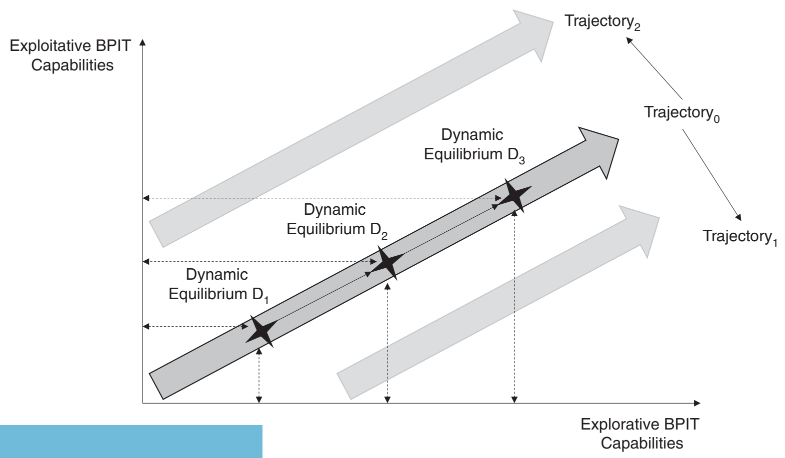

Figure 2.
Process-dependent trajectories

identifying interaction effects between exploitative and explorative BPIT capabilities as dimensions of BPIT ambidexterity as shown in Table V. This addresses the emerging research of IT ambidexterity in the IS community (Lee *et al.*, 2015) by raising awareness of this concept and providing contingency factors influencing the relative importance of exploitative and explorative BPIT capabilities. Furthermore, it contributes by transferring the concepts of exploitative and explorative IT capability as dimensions of IT ambidexterity to the business process level.

Practitioners, i.e. process owners and IT managers who are responsible for the support of particular business processes, can benefit from this work by using the BPIT Capability Framework to identify possible bad investments in exploitative or explorative BPIT capabilities. The framework makes it possible to identify the relevant investment trajectory for the context of a particular business process. For instance, overinvestments in platform technologies for business processes with low process uncertainty can be prevented. Similarly, the threat of underinvesting in explorative BPIT capabilities when needed is identified, and thus issues in operational process performance can be avoided.

This study also has its limitations. First, only six cases from the energy sector in Germany as a single country have been analyzed. However, the German energy sector seems to be comparable to other highly dynamic and competitive industries (Watson *et al.*, 2010; Kranz *et al.*, 2015), and thus the findings from this study are likely to hold for similar industries. Second, the relatively low number of interviews is not representative. The goal of this study was to generate rather than validate theory. Thus it is assumed that, despite having a low number of interviews, near-theoretical saturation could be reached for situations in which exploitative BPIT capabilities dominate. The huge amount of tacit knowledge about the cases and the industry from the involved researchers provided a complementary set of information. However, none of the selected cases exhibits imbalance with domination of explorative BPIT capabilities. While this is a drawback for this study, this observation is not unexpected, as the utilities industry has been a stable sector until very recently. Under such market conditions, exploitative BPIT capabilities play a more important role, which makes it more complicated to identify a case with imbalance leaning toward explorative BPIT capabilities.

Building on these limitations, the next step for further research has to be a further refinement of the developed process theory. In this study, the identified contextual factors have not been analyzed with regard to their various combinations. This leaves the question open as to which combinations lead to which result. A configurational approach is suggested to close this gap (Rihoux and Ragin, 2009).

To validate and generalize our findings further, a replication of our studies in other contexts has potential for future research endeavors. However, there are numerous topics for further studies to focus on. An important unsolved research question is what the impact of BPIT ambidexterity is on an actual business process's overall firm performance. How BPIT ambidexterity evolves over time also remains an open question. Longitudinal approaches could provide the basis for a process theory explaining how business process ambidexterity is developed over time and how it evolves.

		Process characteristics		
Effect	Dominating capability	Volume	Uncertainty	Outcome
Substitution	EXPLOIT	High	Medium	Decrease of EXPLOIT
Complementarity	EXPLORE	Low-Medium	Low-High	Increase of EXPLOIT

Table V. Identified interaction patterns

Note

1. More information on coding procedure and calculation of scores is presented in the Appendices 1 and 2.

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Appendix 1. Interview guideline

Description of daily work

- Could you please describe your typical work day?

Application system architecture

- Which software support exists for each of the tasks?
- Which software do you use to perform the tasks?
- How many different applications?
- How does data that are relevant in multiple systems move from one system to another?
- Can you tell me about the quality of data in the software systems you use?

Process efficiency

- How would you characterize the efficiency of the tasks/business process you are involved in?
- How would you characterize the effectiveness of the tasks/business process you are involved in?
- From your perspective, how does the structure of the application system influence business process performance?

Organizational characteristics

- Which department or person has the responsibility to define a process?

Process flexibility

- Can you tell me about the last time you experienced a change in a process or the introduction of new processes (e.g. WiM)?
- How would you characterize the flexibility of the tasks/business process you are involved in?
- How often do you experience changes in business processes (steps added, steps removed, change of data input or business rules for particular tasks)?
- What is the relationship between changes in business processes and changes in software systems?

Appendix 2. Data analysis

This section intends to provide further details on the procedures used for data analysis. The following describes the steps from data to inference:

(1) The previous section showed that the interview guideline asks respondents to recall the specific situation in which a business process and/or the associated IT system has undergone changes or has been implemented from scratch the last time. This provides the opportunity to differentiate between two states: before and after the change.

(2) Two researchers code the interview data using the coding scheme that can be obtained from Table AI.

(3) Atlas.ti 6.2 is used to calculate the code frequencies per interview and code as well as per case and code.

(4) First, the relative importance of each code is calculated by dividing the count for a single code by the overall count of all codes. Then, the relative importance of these codes is calculated for each case by comparing the relative importance of this code for a single case with the relative importance of this code for all cases.

Table AI. Coding scheme

Theme	Code
Business process characteristics	Business process complexity
	Business process uncertainty
	Business process volume
Low exploitative BPIT capabilities	Manual data link
	Manual task processing
High exploitative BPIT capabilities	Data link automation
	Task automation
Explorative BPIT capabilities	Task flexibility
	Control flow flexibility
	Data link flexibility
	Testing and deployment capabilities
BPIT effects	Decrease of exploitative BPIT capabilities
	Increase of exploitative BPIT capabilities
	Decrease of explorative BPIT capabilities
	Increase of explorative BPIT capabilities

(5) On this basis, each combination of code and case is assigned to a value of "low," "medium," or "high."

(6) Each case is put on a two-dimensional matrix with exploitation and exploration as dimensions. Figure A1 shows this matrix and allows us to identify interaction patterns for each case.

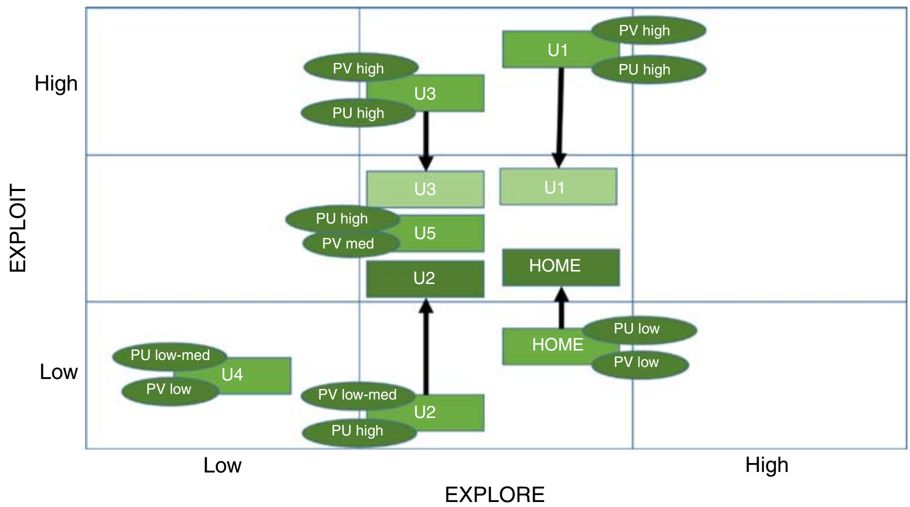

Figure A1. Overview of patterns

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