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ANTECEDENTS AND OUTCOMES OF OPERATIONAL ALIGNMENT IN THE CONTEXT OF ACADEMIC INSTITUTIONS

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Research

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Abstract

The paper examines the topic of operational alignment in the context of academic institutions. It aims to contribute to the understanding of mechanisms constituting operational alignment and the effects of operational alignment. Operational alignment is conceptualized as the adequateness of IT function's support for the research department's goals and priorities. A research model, including social and structural aspects and consequences of operational alignment, is derived and tested in a sample of 162 German research departments. Questionnaire-based analysis using partial least squares highlights the positive influences of shared understanding, IT flexibility, and IT service on operational alignment, whereas communication, trust and respect, and participation are not found to directly improve operational alignment. Our results show that operational alignment significantly enhances performance in terms of effectiveness and efficiency. Post-hoc analysis further suggests that social antecedents largely contribute to operational alignment by a background mechanism, whereas structural antecedents in terms of IT flexibility and IT service are directly linked to operational alignment. Opportunities for further research are outlined.

Keywords: *Operational alignment, academic institutions, IT function, research department.*

1 Introduction

The education system in general, and academic institutions in particular, are seen as an important success factor for societies (e.g., Cortes-Aldana et al., 2009; Etzkowitz and Leydesdorff, 2000) and IT has become a crucial part for organizational performance (Chan et al., 2006; Sabherwal and Kirs, 1996). Therefore, this paper aims at understanding the role of IT alignment in academic institutions and its enabling mechanisms. Building upon existing insights from literature, more research is needed to better understand the complex nomological network for this specific context.

In general, alignment is understood as the degree to which the IT is consistent to, fits to, supports, or remains in harmony with the business or line function (Gerow et al., 2014; Luftman and Brier, 1999; Nadler and Tushman, 1983). Drawing upon Henderson and Venkatraman's (1993) strategic alignment model, this paper focuses on the functional level of academic institutions, which refers to the operational type of alignment. By contrast to strategic alignment which refers to the fit between the business strategy and IT strategy, operational alignment is generally understood as the degree to which the IT infrastructure, processes, and skills fit to and support the business infrastructure, processes, and skills (Gerow et al., 2015). We focus on operational alignment for the following reasons. First, research highlights the general importance of operational alignment to achieve superior organizational performance and create business value from IT (e.g., Wagner et al., 2014). Yet, most research on the operative level focuses on a subarea of operational alignment, which leads to a high specificity of the research (Cragg et al., 2007) and the need for analysing a broader view. Second, compared to the strategic level, the operational level is relatively under-researched, including a limited understanding of the antecedents and performance effects (Cragg et al., 2007; Gerow et al., 2014).

Although the positive effects are widely highlighted, research also emphasizes the general risk of no improvements or even a decline in performance due to inflexible and rigid alignment (e.g., Tallon, 2003). Other researchers find the strengths of alignment effects depending on the specific context, such as the kind of ownership (Gerow et al., 2015). In an earlier work, Gerow et al. (2014) indicate a stronger effect of operational alignment on customer benefit than on financial performance. Accordingly, the stakeholder orientation of the public sector, e.g., in academic institutions, seems to be promising to examine the effects of operational alignment (Cortes-Aldana et al., 2009; Kuin, 1968). Thus, this paper follows Chan and Reich's (2007) suggestion to focus on specific contexts by examining operational alignment within the context of academic institutions. Here, we concentrate on the mission of academic research, first, to fully capture the unique characteristics of academic institutions such as the high knowledge and information intensity (Sabherwal and Kirs, 1996) and, second, to directly link the institution's operational activities to performance, independently from other stakeholder influences such as student characteristics (Kleemann and Richardson, 1985). We aim to answer the following research questions: *(1) What are the mechanisms that constitute business-IT alignment at an operational level? (2) How does operational business-IT alignment impact business value of IT in German academic institutions?*

To answer the research questions, we draw on the resource based view. Accordingly, we assume that resources per se do not explain organizational performance. Rather, the combination and complementary use of resources (capabilities) enhances performance (Ravichandran and Lertwongsatien, 2005). Thus, we provide a research model including operational alignment as a capability to influence organizational performance. Moreover, we assume that operational alignment mediates the effect of different social and structural antecedents on organizational performance. The effects of the antecedents on operational alignment as well as the outcome implications of operational alignment are tested within a sample of German academic institutions. After presenting the theoretical framework, the analysis and results are described. Finally, findings are summarized, contributions, limitations and future research directions are outlined.

2 Theoretical framework

2.1 Literature review on alignment

Research on IT business alignment is often rooted in Henderson and Venkatraman's (1993) strategic alignment model and focuses on the alignment at the strategic level (Gerow et al., 2014), generally understood as "the degree to which the mission, objectives, and plans contained in the business strategy are shared and supported by the IS strategy" (Chan et al. 2006, p.27). It is argued that strategic alignment can be an important source of competitive advantage (e.g., Henderson and Venkatraman, 1993). However, to exploit the full potential of IT, the strategic plans must be brought into daily routines (Wagner and Weitzel, 2012). As mentioned earlier, operational alignment pertains the fit of the business' and IT's infrastructure/architectures, processes and skills. More concrete, operational alignment contains policies, procedures, personnel, systems, structures, and activities (Gerow et al., 2015). If aligned adequately, it is indicated to improve general work flow (Gerow et al., 2015). Moreover, the integration of IT infrastructure along the supply chain is linked to operational excellence, customer relationships and revenue growth (Rai et al, 2006), and the alignment of accounting systems (Ismail and King, 2005) as well as the alignment of processes (Cragg et al., 2007) help to improve performance such as reducing costs, helping to compete and enhancing the organization's image. Finally, these effects underline the crucial role of operational alignment to achieve specific organizational goals. Hence, *operational alignment* is defined as the degree to which the IT function supports the goals and priorities of an organization's line function (Tiwana and Konsynski, 2010).

Within these diverse aspects of alignment, research often focuses on sub dimensions of alignment. At the operational level, two perspectives appear to be important. *First*, the social dimension of operational alignment is strongly gaining researcher's interest. The social perspective focuses on the actors in organizations, their interaction, and their mutual understanding (Chan and Reich, 2007; Wagner and Weitzel, 2012; Wagner et al., 2014). Moreover, it includes topics of "formal and informal teamwork or strong working relationships" (Wagner et al., 2014, p.242). In this context, researchers draw on the social capital theory. For example, Wagner et al. (2014) and Weeger et al. (2015) examine the influence of social capital in terms of structural linkage, cognitive linkage, and relational linkage between two groups. Whereas the structural linkage refers to "the overall pattern of connections between actors" (Nahapiet and Ghoshal, 1998, p.249) and includes topics of communication and interaction settings (Wagner et al., 2014), the cognitive linkage is related to shared codes, language, perspectives, and knowledge about each other's interpretation of reality (Nahapiet and Ghoshal, 1998; Wager et al., 2014). The relational linkage pertains the personal relationship, including trust and respect (Nahapiet and Ghoshal, 1998; Wagner et al., 2014). Finally, it is suggested that social capital enhances the mutual understanding of IT and business, and, therefore, being a crucial part of cross-domain interconnectedness and cooperation as well as an important source for the achievement of organizational goals.

Second, research analyses the structural perspective on alignment. In this context, issues of decision-making rights, formal processes, and (de)centralization of IT are focused (Chan, 2002; Chan and Reich, 2007; Wagner and Weitzel, 2012). For example, Tiwana and Konsynski (2010) examine the interplay between IT architecture modularity and IT governance decentralization, and their impact on IT agility. By drawing on the modular systems theory, it is argued that technical and organizational modularity increases independence among the subsystems of a complex system (Sanchez and Mahoney, 1996). Consequently, it "facilitates rapid changes in individual subsystems by lowering the need for coordinated changes in others" (Tiwana and Konsynski, 2010, p.290; Schilling, 2000). Although they find a negative effect of IT governance decentralization on IT agility, IT architecture modularity positively influences IT agility, and IT agility enhances IT alignment. Within earlier research, Nelson and Cooprider (1996) examine the topic of decision-making conceptualized as mutual influence. They find a mediated effect of mutual influence on IS performance by shared knowledge. Other researchers focusing on specific IT infrastructure topics (e.g., Ismail and King, 2005; Rai et al., 2006)

or on the alignment of processes (e.g., Cragg et al., 2007) could significantly demonstrate the important role of structural influences on operational alignment and organizational performance.

In line with Reich and Benbasat's (2000) suggestion to focus on more than one perspective in order to reveal the complexity and challenges of alignment, both, the social and structural dimension of operational alignment are considered within this paper. Moreover, the consideration of both perspectives fits to the high interdependence between both dimensions (Chan and Reich, 2007).

2.2 Academic institutions as research object

In general, academic institutions follow three missions: (1) teaching that refers to the conservation and dissemination of knowledge, (2) research that refers to building up and verifying of knowledge, and (3) direct contribution to social and economic development that refers to the practical application of knowledge (Cortes-Aldana et. al, 2009; Etzkowitz and Leydesdorff, 2000). To follow these missions, academic institutions are organized in highly specialized units. More specifically, German academic institutions are organized in faculties related to a comprehensive topic (e.g., business faculty), which further are separated in departments that work on specific disciplines (e.g., finance, marketing) embedded in the topic of the faculty. The departments are led by a professor who possesses high expert knowledge in the specific discipline, whereas the research associates support and execute individual operational activities related to the three missions. The departments are mostly self-managed and independent from other departments, leading to a high degree of feudalism, diverse resources, and different sizes. Yet, overarching rules of the institution and government direct administrative issues exist, although the degree of bureaucracy varies across the institutions (Cameron, 1978). Hence, we expect diverse alignment and performance levels that suggest to point out the effects of antecedents and operational alignment (Sabherwal and Kirs, 1994).

Within this paper, the research mission of the department is focused. Besides the important role of research as a basis for other missions of the department, the research task offers unique characteristics such as a high complexity and information intensity. Here, due to their structuring and processing data capability, digitalization efforts and IT are expected to play an important role to performance (Chaudry et al., 2006; Sabherwal and Kirs, 1994). Within German academic institutions, the IT function is mostly centralized for reasons of cost efficiency. Moreover, the IT function acts as a service provider for the departments. IT infrastructure such as central computers, servers, hardware, licenses, software, and support services are provided. In addition, tasks related to IT procurement, configuration, and testing are accomplished and are attempted to adapt to the research department's needs. Here, often liaison roles (a named person as a liaison between IT and the research department; Reich and Benbasat, 2000) are implemented to communicate the requirements of the research department. Under consideration of the legal framework (e.g., license conditions) and topics related to resource restrictions (e.g., avoidance of redundancies in the infrastructure), the IT function is forced to balance between the provision of highly individual IT and the realization of benefits from centralization and standardisation such as a reasonable level of costs. Finally, this context provides an interesting framing due to IT requirements related to the specialised and complex research tasks, implicating particular needs for decentralization and individual freedoms (Brönnimann, 2017).

3 Research model

Based on the works of Wagner et al. (2014), Wagner and Weitzel (2012) and Weeger et al. (2015), the social dimension of alignment is addressed by the antecedents of communication, shared understanding, and trust and respect in our model. We argue consistently that the degree of appropriate IT function's support for the research department's goals is influenced by the social structure in which the research department and IT function are embedded and by its implications for action (Weeger et al., 2015). Rooted in the structural point of view, participation, IT flexibility, and IT service are examined

as antecedents of operational alignment. We argue that structurally determined aspects such as mutual influence on key decisions (Nelson and Cooprider, 1996), modularity of IT infrastructure (Tiwana and Konsynski, 2010), and processes (Cragg et al., 2007) determine the IT function's support for the research department.

Regarding the outcomes of operational alignment, reviewed studies underline the general importance of operational alignment, whereas they fall short in providing comparable performance measures. Thus, this paper follows the differentiation of Luftman (2000, p.6), who highlights two general performance dimensions of IT, namely effectiveness and efficiency. Both dimensions are important for the overall IT success and are substantiated by the specific goals of the underlying context, here the context of research within academic institutions. Thus, this conceptualization is in line with Gerow et al.'s (2015) and Wang et al.'s (2012) ask for consideration of the context's specific goals. Figure 1 summarizes the hypothesized relationships. These are explicated in more detail below.

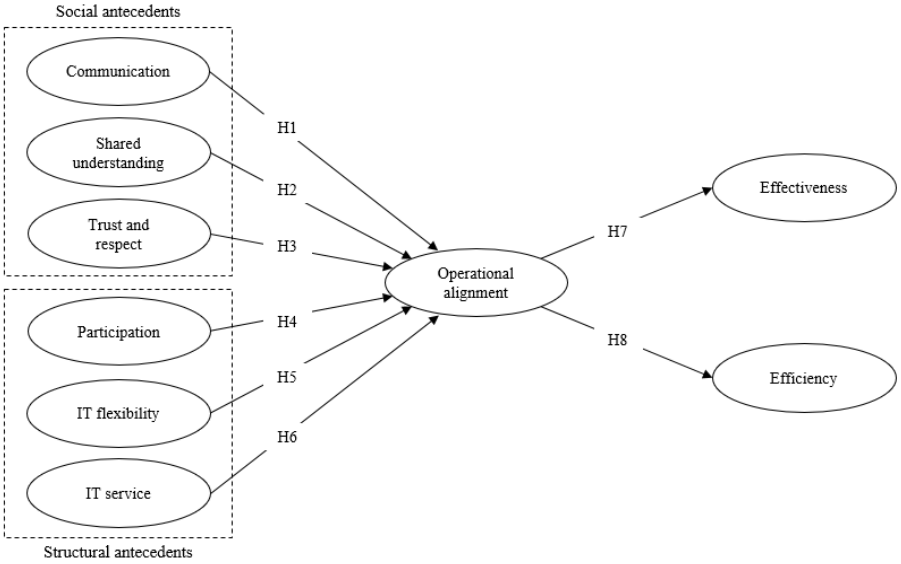

Figure 1. Research model

3.1 Antecedents of operational alignment

Social antecedents

Communication is derived from the structural linkage of social capital and defined as the frequency and quality of interaction between the IT function and the research department (Reich and Benbasat, 2000; Wagner and Weitzel, 2012). Established and continuously used communication channels (e.g., liaison roles, regular meetings) constitute the frequency of communication, which improves the possibility of convergence in understanding (Lind and Zmud, 1991) and helps to see beyond the scope of own work (Wagner et al., 2014). Moreover, it is argued that rich communication (e.g., face-to-face meetings) helps to articulate more explicitly and, therefore, reduces uncertainties and ambiguities (Daft and Lengel, 1986). Furthermore, it enables the exchange and creation of knowledge as well as to improve mutuality (Wagner et al., 2014).

Within the context of academic institutions, communication between the IT function and research department helps to better understand the requirements and needs of the research department. With regards to the high complexity of research work as well as individual requirements for software solutions, problems and ambiguous requests can be avoided through high quality and frequent communication. Thus, communication helps to make the work of the IT function more appropriate.

Hypothesis 1: Communication positively influences operational alignment.

Shared understanding is defined as the degree of shared cognition and mutual understanding between the IT function and the research department (Preston and Karahanna, 2009; Wagner and Weitzel, 2012; Wagner et al., 2014). Following Weeger et al.'s (2015, p.5) understanding of the cognitive dimension of social capital, it includes knowledge of both domains about the fields of each other (e.g., IT function's research knowledge and the research department's technical knowledge, Nelson and Cooprider, 1996) as well as mutual understanding by taking advantage of their overlapping and complementary knowledge (Preston and Karahanna, 2009; Wagner et al., 2014). As shared understanding leads to a consistent view of needs, requirements, priorities, and activities as well as to an interactive and constructive cooperation between the domains, it is also linked to an improvement of operational alignment (e.g., Wagner et al., 2014; Weeger et al., 2015, Van Grembergen et al, 2018).

Transferred to the context of academic institutions, shared understanding is expected to enhance operational alignment as well. Looking at the information intensity of research work, shared understanding of the IT function and the research department is assumed to significantly support the research department's goals because the IT function recommends and implements appropriate IT solutions, helping to effectively structure and analyse information. Moreover, it is more likely that the research department knows about useful areas of application for IT as well as realistically estimates the feasibility of adequate IT solutions, which further leads to constructive requests for IT support.

Hypothesis 2: Shared understanding positively influences operational alignment.

Trust and respect refers to the social relationship between the IT function and the research department (Wagner et al., 2014). A trusted and respected relationship is characterized by the appreciation of each other's work and the expectation of meeting their commitments (Nelson and Cooprider, 1996; Wagner et al., 2014). Therefore, trust and respect improve the willingness to transfer and to accept knowledge from other departments and the formation of informal connections (Nelson and Cooprider, 1996; Wagner and Weitzel, 2012; Wagner et al., 2014). Furthermore, it is argued that trust and respect improve commitment between two groups and can help to establish long-term relationships (Nelson and Cooprider, 1996). This in turn results in reduced likelihood of opportunistic behaviour and thus an improvement of overall collaboration between the parties (Nelson and Cooprider, 1996).

Within the context of academic institutions, research departments are aiming at research excellence, which implicates striving for high quality data analysis and consistent data processing. Here, trust and respect are important for operational alignment, because it is reflected in the work the IT function does for the research department. For example, the willingness to carry out appropriate supporting activities, which are essential, especially within crucial situations such as upcoming deadlines, is constituted by trust and respect. Thus, we expect:

Hypothesis 3: Trust and respect positively influences operational alignment.

Structural antecedents

Participation refers to the distribution of decision-making rights. In the context of our study, participation is understood as the mutual influence of the research department and IT function on each other's key decisions and policies (Nelson and Cooprider, 1996). Following the general explanation for advantages of group work, it is argued that considering more perspectives within decision-making improves the quality of decisions (Nelson and Cooprider, 1996). Regarding decisions on IT, topics such as IT specification, IT implementation, or general policies related to IT support processes can be decided more substantiated and more appropriate regarding specific requirements and needs. Moreover, trends and future IT opportunities are anticipated timelier, which is important to develop long-term oriented IT and achieve superior support of line activities (Sambamurthy and Zmud, 2000).

With regards to the context of academic institutions, we assume that the research department's goals and practices can be better supported by IT if the research department participates in the decisions related to IT topics. Although the high specificity of research projects may implicate different require-

ments for specific software and, thus, are not reflected by a general interest of the research department. However, more general decisions regarding policies (e.g., IT support processes) or infrastructure settings can made in line with a homogeneous interest of the research department. In addition, we assume that the influence of the research department does not negatively influence IT decisions (e.g., through unrealistic demands). We argue that because of the research department's high level of education, they are able to constructively discuss with the IT function, resulting in high quality decisions.

Hypothesis 4: Participation positively influences operational alignment.

IT flexibility refers to the agility of the services the IT function provides for the research department (Sambamurthy et al., 2003; Tiwana and Konsynski, 2010). It is defined as "the ability to adapt to changing requirements quickly and economically" (Wagner et al., 2014, p.247; Kumar, 2004). Furthermore, it encloses technical components, such as the agility of the IT infrastructure (Tiwana and Konsynski, 2010) as well as human components referring to the willingness and skills of the IT unit's employees (Byrd and Turner, 2001; Wagner et al., 2014). Due to general dynamics of business environment, alignment needs to be adjusted continuously over time. IT flexibility plays a crucial role to ensure the fit between IT and business goals and processes. Generally, it is argued that IT flexibility is necessary to rapidly correct states of misalignment, especially within contexts where business processes highly depend on IT (Prahalad and Krishnan, 2002, Luftman et al., 2017). Moreover, it enables to quickly adjust the IT to new goals and activities of the line function implicated by new market opportunities (Tiwana and Konsynski, 2010).

The context of academic institutions is characterized by a highly dynamic environment (Chan et al., 2006) as well as a high dependence on IT (Sabherwal and Kirs, 1994). More specifically, changing relevance of research streams, regularity of new research projects, changes of research personnel, and specific requirements of research reviewers lead to dynamic changes within research goals and activities. This, in turn, implicates dynamic IT requirements. Moreover, the dependence on IT is related to a high pressure on corresponding IT adjustments. IT flexibility allows to rapidly adapt to changing requirements and further to satisfy specific requirements related to the high specificity of research tasks. Thus, we believe IT flexibility to be an important antecedent of operational alignment:

Hypothesis 5: IT flexibility positively influences operational alignment.

IT service is the ability of the IT function to ensure IT stability and functionality with regards to existing IT (Puvvala et al., 2015). Thus, IT service rather refers to stable environmental conditions and requirements, although it pertains of human (e.g., skills and willingness) and technical components (e.g., system stability), too. Moreover, it includes preventive and on-going support activities such as the supply of technical/user manuals, interactive help interfaces (Raymond and Pare, 1992), and quick and constructive incident solving processes (Puvvala et al., 2015). It is simply argued that ensuring stable and continuously working IT (e.g., permanent access to internet, quick incident solving) helps to optimize productivity and minimize risks (e.g., avoid data loss) of the line function and, thus, supports the line function's goals and activities.

Within academic institutions, daily research work is closely linked to IT, including daily use of hardware and internet as well as standard software. Furthermore, complex and specific software is used, which should run flawless to ensure results of scientific excellence and time efficient working practices. Therefore, we expect that ensuring functionality and stability of IT is essential for the support of the research department's goals and activities.

Hypothesis 6: IT service positively influences operational alignment.

3.2 Outcomes of operational alignment

As reviewed earlier, there is evidence of operational alignment effecting organizational performance. To analyse these effects structurally, we separate between *effectiveness* and *efficiency*. Whereas effec-

tiveness evaluates the degree of goal achievement under consideration of the external environment in terms of the importance of specific goals (Kleemann and Richardson, 1985), efficiency refers to the achievement of pre-specified goals by minimal expenditure focusing on the internal dimensions of an organization (Luftman, 2000; Peterson and Blackburn, 1985). Besides the different benchmarking perspectives looking at the performance outcomes, they implicate different logics for what organizations are striving for. Effectiveness implicates the more-is-better principle, whereas efficiency focuses on the optimization of the goal achievement to expenditure ratio. Thus, the effects on effectiveness and efficiency are depending on what the specific organization is aiming at.

Within the context of academic institutions, research departments are striving for scientific excellence, regularity of publications, differentiation from other research departments, as well as a positive reputation (Ambos et al., 2008; Cameron, 1986; Sabherwal and Kirs, 1994). Here, for example, appropriate IT contributes by enabling and improving data access, processing, or analysis. Moreover, restricted resources lead to pursuing goals within the efficiency dimension such as the minimization of internal costs or the improvement of time efficiency. Here, aligned IT contributes due to automation of procedures. Thus, we hypothesize:

Hypothesis 7: Operational alignment positively influences effectiveness.

Hypothesis 8: Operational alignment positively influences efficiency.

4 Methodology and operationalization

Appropriate to the operational alignment and the daily research practices, the measure focuses on the department level of academic institutions and its interaction with the academic institution's IT function. An online survey of 162 business or business-related information research departments was collected. Regarding the sampling we have proceeded as follows: First, we have built up a database including 1,400 research associates from 271 different business or business-information related German research departments from June to July 2017. The online survey, that has been tested before by interviews with two research associates, were sent by mail to randomly selected research associates, but at most three from one research department in the first step. After two and a half weeks, the research departments, from which we have not received an answer so far, were contacted again. Finally, at the mid of September 2017, we have received 174 completed questionnaires of research associates. Here, we could identify 12 answers, that were excluded, because the research department was already represented by a completed questionnaire. This exclusion was made by the first-come-first-served principle. So, our sample include 162 completed questionnaires from different research departments. The questions for communication, shared understanding, trust and respect, participation, IT service as well as for effectiveness and efficiency are adapted from the literature. For the constructs of IT flexibility and operational alignment existing measures are used. The construct of communication is measured formatively. All other variables are operationalized as reflective measures. All of them are measured by 7-point Likert scales. Furthermore, the model is controlled by three variables. These are one-item measures and are directly estimated by the research associates. The control variables are also measured by a 7-point Likert scale. The items and sources of the variables are presented in the appendix.

5 Analysis and results

Analysis is made with partial least squares (PLS), a structural equation modelling technique. The use of PLS is advantageous (in comparison to covariance-based analysis), because it allows the use of both formative and reflective constructs. Moreover, PLS does require relatively small samples and is suitable for complex models, also with an explorative character (Chin, 1998; Chin and Todd, 1995). In the following, the sample will be described and tested for non-response and common method bias. Afterwards, the measurement model will be assessed as well as the structural model.

5.1 Sample characteristics, non-response and common method bias

Within the sample, on average 5.75 research associates work for a research department. Moreover, the mean value of the IT investment intensity relatively to other research departments of the same field is 3.74. So, most of the research associates estimate their research department to invest at a comparable level to other research departments. Finally, the mean value of research experience indicate that the research associates estimate their research department to be slightly more experienced than other research departments within research work (4.35). Non-responses might bias our analysis. Since late respondents might have similar characteristics with non-respondents, we compare early and late respondents as an indicator for a potential non-response bias (Armstrong and Overton, 1977). T-tests of all latent key variables reveal no significant differences. Furthermore, our research design follows a single informant approach. We use several procedural remedies (e.g., cover story, examples, well-developed scales, benefits of participation) as an ex ante measure to avoid the threat of common method variance (Podsakoff et al., 2012). As a post hoc indicator, we test for the Harman's single-factor to detect a potential bias. An exploratory factor analysis is conducted. No single factor emerges from the analysis and no factor accounts for most of the variance.

5.2 Measurement model

Item loadings and internal consistencies of the reflective modelled constructs higher than .70 are generally accepted. Moreover, they should rate the highest loading for the corresponding construct (Fornell and Larcker, 1981). Within our measurement model, all items rate highest for the corresponding constructs, whereas PA01 (.629), FL04 (.522), and SU05 (.614) were below the threshold of .70. Thus, they were dropped. To assess construct reliability and convergence validity, Table 1 presents the Composite Reliability (CR) and Average Variance Extracted (AVE) criteria. Both are satisfied, because all constructs rate higher CR values than .7 as well as higher AVE values than .5 (Fornell and Larcker, 1981). To assess discriminant validity, the Fornell-and-Larcker Criteria, by comparing the square root of the AVE with the correlations across the constructs, is tested. Here, for all reflective constructs it is confirmed, because all constructs rate a higher value for the square root of the AVE than for the correlation with other constructs (see Table 1) (Fornell and Larcker, 1981). The outer model of the formative construct communication is evaluated for the relevance of its respective factors and the threat of multicollinearity (Hair et al., 2011). All factor weights significantly ($p < .01$) account for a relevant share ($w > .10$). Second, the test for multicollinearity does not lead to any concerning results (VIF < 5 and condition index < 30), suggesting that multicollinearity in the formative higher-order constructs is not a threat for our analysis. Altogether, the evidence suggests that the measurement model displays good measurement properties.

	CR	AVE	CO	EE	EI	FL	OA	PA	SV	SU	TR
Communication (CO)	N/A	N/A	N/A								
Effectiveness (EE)	.974	.883	.328	**.939**							
Efficiency (EI)	.954	.839	.309	.675	**.916**						
IT flexibility (FL)	.927	.717	.345	.522	.574	**.847**					
Operational alignment (OA)	.938	.717	.407	.537	.559	.690	**.847**				
Participation (PA)	.927	.760	.369	.394	.357	.413	.400	**.871**			
IT service (SV)	.932	.735	.309	.419	.451	.666	.672	.275	**.857**		
Shared understanding (SU)	.890	.668	.489	.537	.507	.533	.536	.454	.411	**.817**	
Trust and respect (TR)	.852	.591	.502	.397	.486	.701	.641	.521	.655	.569	**.769**

Table 1. Inter-construct correlations, CR, and AVE
(Notes. N/A: measure not applicable to formative construct. CR = Composite Reliability. AVE = Average Variance Extracted. The bold numbers on the leading diagonal are the square root of the AVE.)

5.3 Structural model

To assess the structural model, a bootstrapping procedure operated with 3,000 subsamples was used to estimate the statistical significance. In PLS estimation, the primary indicators of model fit are the R^2 values of the dependent constructs (Hair et al., 2011). These are presented in Figure 2, as well as the path coefficients, which indicate the strength of a contribution, and the significances of these path coefficients. The R^2 value of .605 of operational alignment indicates that the examined antecedents explain round about 60% of the variance of operational alignment. Furthermore, the model explains 31.6% of effectiveness and 32.9% of efficiency. These values are generally considered to be moderate, although in the complex context of academic institutions, these seem to be acceptable values (compare Sabherwal and Kirs, 1994; Chan et al., 2006). Moreover, no effects of communication, trust and respect and participation on operational alignment can be found. Shared understanding is found to have a small effect (.141; significant at .05), whereas the effects of IT flexibility (.285; significant at .01) and IT service (.341; significant at .01) on operational alignment are medium. In addition, the effects of operational alignment on effectiveness (.527 significant at .01) and efficiency (.544; significant at .01) are high. Finally, H2, H5, H6, H7 and H8 are supported, whereas for H1, H3 and H4 no adequate effects are found. Regarding the ratings of the control variables, only the negative effect of size on effectiveness (-.134; significant at .05) as well as the positive effects of IT investment intensity on both effectiveness (.110; significant at .1) and efficiency (.116; significant at .1) should to be noticed.

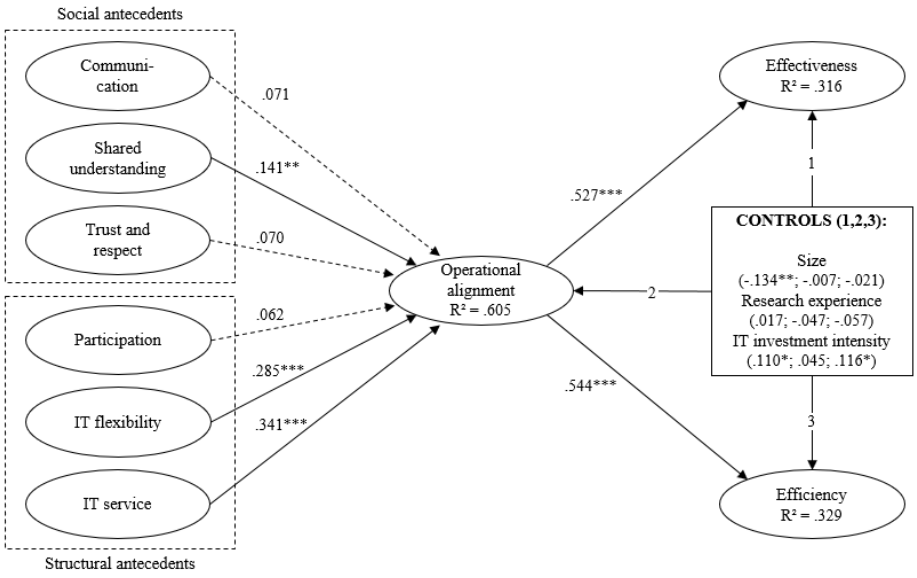

Figure 2. PLS results
(Notes. * significant at .1; ** significant at .05; *** significant at .01)

Post-Hoc Analysis

For communication, trust and respect and participation we do not find a direct effect on operational alignment, whereas existing literature highlights their important role (e.g., Wagner et al., 2014; Weeger et al., 2015; Nelson and Cooprider, 1996). Thus, some further examination of their role is needed. Accordingly, we extend our model by testing the relation of these constructs with IT service, IT flexibility and shared understanding. Following earlier research, we also test for an effect of shared understanding on IT flexibility and IT service (e.g., Wagner et al., 2014). Results show, that communication influences shared understanding with a path coefficient of .302 (significant at .01), whereas it does not have an effect on IT service or IT flexibility. Trust and respect improves shared understanding, indicated by a path coefficient of .302 (significant at .01). Also, IT service (.627, significant at .01) and IT flexibility (.588, significant at .01) are strongly affected by trust and respect. By contrast, for participa-

tion no positive effects are found. Rather, it negatively influences IT service (-.173, significant at .05). Shared understanding positively influences IT flexibility (.218, significant at .01), whereas no significant effect on IT service is found.

6 Discussion

6.1 Summary of findings

To answer the research question of *what mechanisms are constituting operational alignment*, we examine antecedents from two perspectives. First, derived from the theory of social capital, the effects of communication, shared understanding and trust and respect are examined. We find that shared understanding directly influences operational alignment and IT flexibility. Although communication and trust and respect do not directly influence operational alignment, they improve operational alignment indirectly through effects on shared understanding (by communication and trust and respect) and on IT flexibility and IT service (by trust and respect). These results are in line with earlier research works such as Wagner et al.'s (2014), Weeger et al. (2015), and Nelson an Cooprider (1996). Following them, it is argued that the components of social capital constitute the willingness, commitment, and capability of the IT function to conduct appropriate support for the research department by adapting to changing requirements or ensuring IT stability and functionality. Second, rooted in organizational and technical structures, the effects of participation, IT flexibility, and IT service are investigated. IT flexibility and IT service mainly constitute operational alignment within our model, implicating that reacting to changing requirements as well as ensuring IT stability and functionality mainly drives the adequateness of IT function's support for the research department's goals and activities. However, the expected role of participation is not confirmed and a negative effect on IT service is found. It can be argued that mutual influence of two groups within a context of complex and highly individual tasks may be not beneficial (Queiroz et al., 2018). Moreover, with regards to the negative effect on IT service, mutual influence can hamper due to mitigating benefits of specialisation. However, comparing the effects of the social and structural antecedents suggests that the structural antecedents in terms of IT flexibility and IT service directly improve the IT function's support for the research department's goals and priorities, whereas the social antecedents largely act in the background constituting aspects of willingness, commitment, and capability to support. These findings show a possible difference to private organisations, if, for example, Wagner et al.'s (2014) results are regarded. Here, social antecedents and cross-disciplinary collaboration seem to have a much stronger priority for performance.

To answer the research question of *how operational alignment impacts performance within German academic institutions*, we examine the effects of operational alignment on the performance dimensions of effectiveness and efficiency. We find that appropriate support of the IT function enables the improvement of effectiveness related to research quality, research department's reputation, societal impact, and differentiation from other departments. Moreover, it enables the improvement of efficiency referring to the optimization of time economy, research department's productivity, and the reduction of administrative costs. Thus, it is concluded that operational alignment can impact the performance of German academic institutions in several ways which further emphasizes the important role of operational alignment to create business value from IT and outperform competitors. Looking at the *control variables*, other influences on the research department's performance must be considered as well. The negative effect of organizational size on effectiveness suggests that larger research departments decrease in performance. An explanation might be the conceptualization of performance as the average performance of the research department. This, in turn, leads to less attention to superior individual results. In addition, it is suggested that size leads to more formalisation and standardisation of IT (Chan et al., 2006, Van Grembergen et al., 2018). Within the task of academic research, this may mitigate the appropriateness of IT for highly specific requirements. The positive effects of IT invest-

ment intensity on effectiveness and efficiency indicate that digitalization efforts in terms of investments help to exploit the potential of IT.

6.2 Contribution

This paper provides two important contributions to research. First, we contribute to the under-researched (Cragg et al., 2007; Gerow et al., 2014) topic of operational alignment. By deriving and testing a theoretically founded research model, we show how structural and social antecedents and outcomes of operational IT alignment relate in holistic, nomological network. Accordingly, we contribute to a better understanding of the mechanisms that constitute operational IT alignment. Second, we contribute by extending existing theories to the context of academic institutions. We show that contextual conditions of academic institutions as loosely coupled units with high information intensity and specificity of working tasks need to be considered in IT alignment research. More specifically, we show that social antecedents largely act in the background, whereas structural aspects are directly linked to operational alignment. Therefore, we also contribute to a call for examining IT alignment in specific contexts (Chan and Reich's, 2007).

This paper has practical implications as well. Generally, we recommend to consider the specific characteristics of the organization for achieving alignment. Regarding the significant effects of operational alignment on performance, practitioners should consider digitalization efforts at high priority. Within academic institutions, topics such as an understanding about each other's working environment and flexible, stable, and functioning IT determine the support of IT for the research department's activities. Therefore, these aspects should be supported by the IT architecture and organizational structure, whereas it should be considered that participation in terms of mutual influence of both units does not lead to improved operational alignment. Communication approaches and trust and respect also help to improve shared understanding, IT flexibility, and IT service through mechanisms of willingness, effort, and appropriate knowledge. Finally, information events or regular meetings including both units could be implemented to overcome the isolated working behaviours and to sensibilise for cooperation and support for goals. This, in turn, may improve the overall success of the research department and academic institution.

6.3 Limitation and future research directions

This paper is limited in some ways which implicates directions for further research. First, a single informant approach and captured self-reported perceptions of the dependent and independent variables are used. Although this is common in alignment research (e.g., Wagner et al., 2014), we suggest further research to collect more objective performance indicators and data from multiple sources (e.g., including employees of the IT function). In addition, methodology could be complemented by qualitative techniques. Second, data is collected at a single point in time. Therefore, effects may be time sensitive. Longitudinal data collection would help to test our results for robustness and would provide additional insights into the dynamics of the alignment field. Third, the examination of other contexts provides another direction for future research. Whereas, the context of academic institutions provide unique characteristics of information intensity, specialisation and individualisation, other contexts may offer highly standardized and routinized tasks and thus, effects may be different. Moreover, the topic of operational alignment offers many aspects of differentiation (e.g., hardware and software) and, therefore, asks for further investigation to fully understand the effects.

Appendix

Variables, items and sources
Communication: The information exchange between the IT function and the research department occurs in: (CO01) Regular meetings, (CO02) direct communication (e.g., mail or phone contact), (CO03) temporary task forces, (CO04) liaison roles, (CO05) permanent teams. Sources: Galbraith (1977), Reich and Benbasat (2000).
Shared understanding: (SU01) The level of understanding for each other's work environment, (SU02) each other's research knowledge/technical knowledge, (SU03) a shared understanding of how it can be used to increase productivity of the research department's work, (SU04) a common view about the prioritization of IT investments, (SU05*) the ability of the IT function to inform the research department about IT-specific issues using a non-technical and research related terminology. Sources: Nelson and Cooprider (1996), Preston and Karahanna (2009), Tiwana and Konsynski (2010), Wagner et al. (2014).
Trust and respect: (TR01) The level of trust between the IT function and research department, (TR02) each other's reputation for meeting its commitments, (TR03) the frequency of consulting each other, (TR04) the degree of close cooperation when a change to the IS is implemented. Sources: Nelson and Cooprider (1996), Wagner et al. (2014).
Participation: (PA01*) The extent to which individual employees contribute to decision making within specific areas, (PA02) the level of influence that the IT function and research department have on key decisions and policies of each other, (PA03) the general level of influence they have on each other's key decisions and policies, (PA04) the degree of equal distribution of IT decisions (e.g., defining the role of IT in research activities, identifying new ways in which the chair can leverage IT, identifying IT investment opportunities, setting timelines, defining IT service level expectations, etc.), (PA05) the degree of equal distribution of IT activities (e.g., applications development, systems integration and testing, choosing application platforms, choosing programming languages and tools, defining an IT infrastructure strategy). Sources: Nelson and Cooprider (1996), Sabherwal and Kirs (1994), Tiwana and Konsynski (2010).
IT flexibility: The extent to which the IT function, in the work that it does for the chair, is: (FL01) Agile, (FL02) adaptive, (FL03) flexible, (FL04*) able to improvise, (FL05) responsive to changing research department's needs and priorities, (FL06) responsive to a wide range of contingencies. Source: Tiwana and Konsynski (2010).
IT service: (SV01) The IT function's duration of response to problems with IT, (SV02) the IT function's resolution time of incidents, (SV03) the overall SLA[1] compliance (e.g., number of incidents, difficulty of incidents, time to resolve in comparison to the service level expectations) of the IT function, (SV04) the technical support (e.g., user manuals for computer applications, interactive HELP documentation in applications, technical manuals) of the IT function, (SV05) the overall supporting activities of the IT function. Sources: Puvvala et al. (2015), Raymond and Pare (1992).
Operational alignment: The work the IT function does for the research department was well aligned with the research department's: (OA01) Research activities (e.g., access to information, exchange of information with other research associates, data analysis), (OA02) expectations (e.g., stability of applications and systems, IT function's supporting activities), (OA03) needs (e.g., hardware needs like decentralized computers, internet, licenses), (OA04) demands (e.g., specific applications, collaboration software), (OA05) priorities (e.g., shared by the IT function), (OA06) research objectives (e.g., quality, quantity of research). Source: Tiwana and Konsynski (2010).
Effectiveness: The work, the IT function does for the research department, enables: (EE01) The improvement of the research output in terms of originality, significance and rigour[2], (EE02) the extension of the research output's societal impact, (EE03) the differentiation of the research department from other research departments in the same field, (EE04) the enhancement of the research department's reputation, (EE05) the improvement of the research department's overall success. Sources: Cameron (1978, 1986), Dickinsons et al. (2014), Sabherwal and Kirs (1994).
Efficiency: The work, the IT function does for the research department, enables: (EO01) The optimization of the research department's productivity, (EI02) the optimization of the time needed by the research department to finish research projects, (EI03) the improvement of the research department's efficiency of internal research operations, (EI04) the reduction of the research department's administrative costs regarding a research project. Sources: Chan et al. (2006), Wu et al. (2015).
Organizational size (control variable): The number of research associates working at the research department. Sources: Chan et al. (2006), Tiwana and Konsynski (2010).
Research experience (control variable): The aggregated research experience of the research department relative to other research departments of the same field. Source: Wagner et al. (2014).
IT investment intensity (control variable): The IT investment intensity relative to other research departments of the same field. Source: Tiwana and Konsynski (2010).

Appendix 1. Operationalization of variables

*(Notes. Items are translated from German. Dropped items are indicated by *.)*

[1] *Service level agreements (SLA)* are contractually determined quality standards that must be at least provided by a service provider to its recipient (Puvvala et al., 2015).

[2] *Originality* is understood as the innovative character of the research output. *Significance* covers the influence of the research output on the development of the intellectual agenda in the specific field and may be theoretical, methodological and/or substantive. *Rigour* refers to the intellectual precision, robustness and appropriateness of the concepts, analyses, theories and methodologies deployed within the research output (Dickinsons et al., 2014).

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