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Innovating Mindfully with Service-Oriented Grids - The Role of Organizational Mindfulness in Turbulent Environments

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ABSTRACT

Environmental turbulence as being illustrated by the current international financial crisis leads to a high degree of uncertainty in decision-making processes. However, even in conventional economic cycles, demanding decision processes are exposed to varying levels of environmental turbulence and institutional pressure. Consistent with the extant literature, organizational mindfulness as cognitive pattern is supposed to attenuate arising uncertainty and error in the IS assimilation process. So far, little empirical research has been conducted to quantify the impact of organizational mindfulness on the IS assimilation and business value generation process in industry. Grounded in the technology-organization-environment framework this research approach contributes to the diffusion of innovations and IS assimilation theory by validating the role of organizational mindfulness in interacting with institutional pressure against the background of environmental turbulence. The planned cross-country (North America, Europe) questionnaire-based field study aims at IS decision makers among the 3000 largest financial services providers worldwide allowing for cross-country comparisons.

Keywords

Organizational Technology Assimilation, Organizational Mindfulness, Institutional Theory, IT Business Value, Technology-Organization-Environment Framework, Environmental Turbulence.

MOTIVATION

In line with most businesses' strategies, enterprises increasingly adopt value chain improving technologies in order to retain a competitive position in a rapidly changing environment (Barua, Konana, Whinston and Fang, 2004; Dong, Xu and Zhu, 2009; Sugumaran, Tanniru and Storey, 2008). One way to meet this challenge is the assimilation of a Grid-based architecture (Foster and Kesselman, 1999) that facilitates enterprises to change processes and procedures "on the fly" by providing a collaborative, service-oriented, scalable, and cost-efficient infrastructure (Guentzel and Leymann, 2003). Following the widely accepted definition by Foster (2002), a Grid is a system that coordinates IT resources that are not subject to centralized control, uses standards, open protocols and interfaces, and delivers non-trivial qualities of service. Regardless of their operating characteristics, Grid computing enables heterogeneous and geographically dispersed IT resources to be virtually shared and accessed across an industry, enterprise, or workgroup. Increasingly, large-scale enterprise applications are no longer running on dedicated, centralized computing facilities. Instead, they operate on heterogeneous Grid resources that may span multiple administrative units across different locations within an enterprise. Another major benefit of a service-oriented Grids is the ability to accelerate resource-demanding computations to instantly respond to environmental turbulence, e.g., financial risk management applications (Hackenbroch and Henneberger, 2007). Due to an international Quocirca study (2006) the Grid adoption rate is estimated to be around 10 to 30 percent with regard to compute grid utilization. Thereby, the geographical dissemination significantly varies between the US (high adoption rate), Europe (moderate adoption rate), and Asia (low adoption rate).

One of the most promising application domains of Grid-based architectures is the financial services industry with its information-driven business processes, high computational demands, and fast changing customer needs (Hackenbroch and Henneberger, 2007). Additionally, the increasing level of institutional pressure due to the intensified competition and regulation (Ang and Cummings, 1997), and a tremendous level of uncertainty arising from the current environmental turbulence in the banking sector further reinforce this demand for scalable Grid infrastructures.

So far, the organizational assimilation of different technologies has been extensively depicted in the extant literature (Iacovou, Benbasat and Dexter, 1995; Kuan and Chau, 2001; Zhu, Dong, Xu and Kraemer, 2006; Zhu, Kraemer and Xu, 2006). However, little empirical research has been conducted on the interplay of institutional forces driving information systems (IS) assimilation (Liang, Nilesh, Hu and Xue, 2007; Teo, Wei and Benbasat, 2003) in conjunction with uncertainty arising from environmental turbulence (Pavlou and El Sawy, 2006) and opposing cognitive patterns attenuating these effects.

In this respect, organizational mindfulness as proposed by Weick, Sutcliffe and Obstfeld (1999) reflects the organizational cognitive capability to successfully overcome unexpected erroneous events and master scenarios with uncertain information which otherwise might lead to disastrous negative consequences. In the context of IS assimilation, organizational mindfulness might help to identify and resist pure mimetic assimilation behaviour (Swanson and Ramiller, 2004) and cope with incomplete information and environmental turbulence (Weick and Sutcliffe, 2007) which both potentially decrease IS-based business value generation. Despite several calls to integrate organizational mindfulness into studies on innovation assimilation (Fichman, 2004; Swanson and Ramiller, 2004), it has never been operationalized in the stated context to our knowledge. In order to model the interplay of institutional pressure (mimetic, coercive, normative) driving the assimilation process and organizational mindfulness we draw on institutional theory to amend the environmental component of the technology-organization-environment (TOE) framework. As a measure of general conditions of uncertainty or unpredictability arising from market or technological turbulence (Jap, 2001) we draw on the well-established literature stream on environmental turbulence (Jaworski and Kohli, 1993; Pavlou and El Sawy, 2006).

RESEARCH QUESTIONS AND RELEVANCE

Our overall research objective is to identify and quantify the determinants of Grid assimilation and its business value generation in the financial services industry. Against this background, the research especially focuses on the interplay of institutional pressure on the one hand and organizational mindfulness on the other hand. Thus, the overall research objective can be decomposed to the following research questions (see Figure 1):

Q1: *How does institutional pressure influence the assimilation process against the background of a holistic set of other technological and organizational influence factors?*

Q2: *How does Grid assimilation contribute to business value generation?*

Q3a: *How does organizational mindfulness or mindlessness interplay with institutional pressure?*

Q3b: *How does organizational mindfulness or mindlessness influence business value generation potentially resulting from Grid assimilation?*

The research contributes to the existing assimilation of innovations theory based on the TOE framework by integrating institutional theory and the current research streams on mindfulness in IS innovation (Butler and Gray, 2006; Swanson and Ramiller, 2004) against the background of environmental turbulence (Pavlou and El Sawy, 2006). Furthermore, the research

provides a first quantitative operationalization of organizational mindfulness and validates its impact in the context of IS assimilation. For practitioners the research provides an insight in the success and hindering factors of Grid assimilation and business value generation against the background of varying levels of environmental turbulence. Thus, the research model facilitates the systematic evaluation of the appropriateness of a service-oriented Grid in terms of local context. Moreover, the organizational promotion of cognitive patterns leading to organizational mindfulness may contribute to a firm's technology assimilation success and the resulting contribution towards business value.

RESEARCH MODEL

In order to gain a comprehensive view on the determinants shaping Grid assimilation and its business value generation on firm level, a parsimonious model based on the TOE framework by Tornatzky and Fleischer (1990) is utilized as depicted in Figure 1. The TOE framework is consistent with the diffusion of innovations theory (Rogers, 1995) which emphasizes on technological differences, internal, and external organizational characteristics as main drivers for organizational technology diffusion. So far, the TOE has been successfully used in different (post-) adoption studies on E-Business (Zhu et al., 2006), EDI (Kuan and Chau, 2001), and ERP (Pan and Jang, 2008) assimilation at firm level. All constructs of the utilized research model listed were deductively derived from well-established IS journals (e.g., MISQ, ISR, JMIS, and Management Science) and were adapted to the Grid context where necessary. The references to the original sources of the measures are provided in the following introduction to the hypothesized causal relationships. The TOE framework identifies three different contextual aspects of an enterprise that determine the process of technological assimilation: the technological context, the organizational context, and the environmental context.

The ***technological context*** relates to the IT infrastructure and information systems that are internally or externally available to an organization and is represented by Grid infrastructure capability and Grid technology integration (adapted from Zhu et al., 2006). Grid infrastructure capability is based on the infrastructure capability construct proposed by Zhu and Kraemer (2005) and captures the firm's technical capability resulting from having access to distributed computing power and purpose specific technologies (e.g. a high-capacity, low latency network) within the organization. Grid technology integration refers to a set of investigation, evaluation, and refinement activities aimed at creating a match between technological options and the application context (Iansiti, 1998), e.g., the deployment of the Grid-based solution in an enterprise application integration infrastructure. Consistent with prior studies (Zhu and Kraemer, 2005; Zhu et al., 2006), we propose that Grid infrastructure capability and Grid technology integration positively drive Grid assimilation.

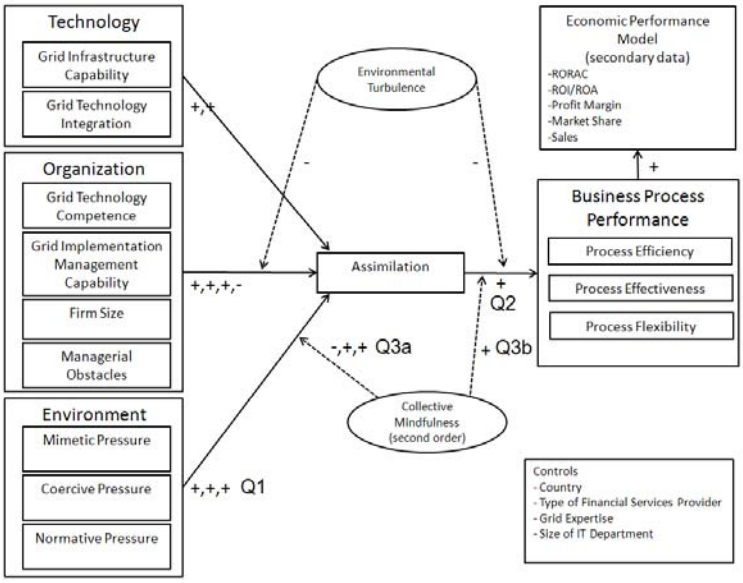

Figure 1. Research Model

The ***organizational context*** is defined as the characteristics that shape an organization and encompasses Grid technology competence (adapted from Zhu and Kraemer, 2005), Grid implementation management competence (adapted from Dong et al., 2009; Pavlou and El Sawy, 2006), firm size (Tornatzky and Fleischer, 1990), and managerial obstacles (Zhu et al., 2006). Grid technology competence reflects general, explicit skills (e.g., distributed systems programming skills) owned by the firm's IT staff that are needed to successfully develop Grid architectures and Grid applications (adapted from Ray, Muhanna and Barney, 2005) and thus drives Grid assimilation. In order to capture the conversion capability (Rai, Patnayakuni and Patnayakuni, 1996) of the involved IS department Grid implementation management competence reflects the degree of managerial competence to successfully monitor and guide through the process of Grid assimilation. In the diffusion of innovations theory, firm size is a major factor impacting on innovation diffusion (Rogers, 1995). Still, there is an ongoing discussion in the extant literature on the role of firm size in the diffusion of innovation process. On the one hand, large firms exhibit a certain level of slack resources further facilitating the diffusion of innovations (Rogers, 1995). On the other hand, smaller firms are assumed to be more flexible with regard to innovative technologies (Zhu and Kraemer, 2005). Consistent with the latter, we assume that smaller firms are more open-minded towards Grid technology assimilation, since the inherent risk of reputation losses arising from ill-conceived technological innovation affects well-established and larger firms more seriously than smaller and probably new firms in the financial market due to a lower level of public attention. Additionally, rather small firms might see Grid technology assimilation as a strategic action to gain market share compared to their well-

established competitors. Finally, the construct managerial obstacles is defined by the existing necessity of organizational adaptations in order to accommodate IT assimilation (Zhu et al., 2006) and thus inhibits Grid assimilation. Since neither technological nor human factors solely result in successful IT assimilation and business value generation (Melville, Kraemer and Gurbaxani, 2004), the inherent conceptual complementarity is reflected by the utilized IT resource model. Therefore and consistent with the resource-based view of the firm, the research model distinguishes between two different kinds of IT resources complementing one another and their interdependencies (Melville et al., 2004): Technological IT resources (i.e., Grid infrastructure capability and Grid technology integration), human IT resources (Grid technology competence), and the operational middle management capability (Grid implementation management capability) to bring together both technological and business-related capabilities. In general, technological IT resources capture the degree of organizational technological readiness, whereas human IT resources encompass purpose-specific skills both positively impacting on the business value generation momentum (Byrd and Turner, 2001).

The ***environmental context*** captures the setting in which an organization conducts its business and is represented by several institutional forces that directly influence the assimilation process of IS. Therefore, the environmental part of the research model draws from institutional theory (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). Since financial services providers are especially exposed to a high level of institutional pressure due to its hyper-competitive and highly regulated market, the financial sector exhibits the special opportunity to study strategic responses of financial services providers and the impact of instutionalization (Ang and Cummings, 1997). Institutional theory in general posits that structural and behavioural changes in firms are rather driven by an inherent organizational need for legitimacy than sole considerations of competitive advantages and hidden efficiency potentials (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). This continuous search for organizational legitimacy eventually facilitates the process of institutionalization and organizational isomorphism especially against the background of an uncertain and turbulent environment. Due to DiMaggio and Powell (1983) basically three different types of institutional pressure can be distinguished. An uncertain environment especially fosters mimicry among firms. Thus, even if the consequences and goals of an innovation are poorly understood or are ambiguous, mimetic pressure can foster the assimilation of it if adopting firms are perceived as successful by the environment. Coercive pressure arises from societal expectations in a broader sense where firms try or have to conform to expectations, policies, or regulation from the government, customers, or the competitive environment. Finally, normative pressure arises from the ongoing process of professionalization, which is further enforced by the close collaboration with suppliers, business partners, and governmental promotion. These institutional forces were already successfully identified as drivers of IS adoption and

assimilation in prior studies (Liang et al., 2007; Teo et al., 2003) but have been integrated in a more holistic context, e.g., as provided by the TOE framework. Consistent with the extant literature we propose that institutional pressure positively impacts on Grid assimilation.

As proposed by Fichman (2001), the degree of ***assimilation*** as the extent to which a firm has progressed through stages of innovation deployment (initiation, adoption, routinization) is captured by a single construct. Since a technology-focused assimilation study on firm level is conducted, an aggregated measure for the assimilation stages is employed. As unit of analysis for measuring assimilation progress and business value generation a business process level perspective was chosen, due to the fact that IT investments are supposed to first affect the performance of specific business processes (Davamanirajan, Kauffman, Kriebel and Mukhopadhyay, 2006). In general, a firm encompasses approximately 18 key processes being vital for the overall firm performance (Davenport, 1993). In order to indentify the key business process being primarily influenced by Grid assimilation in the financial services industry, several expert interviews with IS executives were conducted. Additionally, a careful review of the current banking services landscapes provided by Oracle and the "Banking Industry Architecture Network" (BIAN) was utilized to further ground the set of identified business processes. The finally utilized measure aggregates over the whole assimilation lifecycle of a single technology (i.e., Grid technology) for the three identified key business processes (i.e., new product development process, risk management process, and asset management processes) of a single financial services provider (adapted from Rai, Brown and Tang, 2009). Overall, the presented operationalization implicates several benefits, e.g., greater robustness and generalizability, at the cost of a possible loss of context specificity and reduced clarity of the theoretical interpretation (Fichman, 2001). Since it is expected that the drivers and inhibitors of Grid assimilation influence all assimilation stages in the same direction, this bias can be assumed to be of minor importance compared to its potential benefits.

Environmental Turbulence encompasses environmental conditions of uncertainty and unpredictability due to massive and rapid changes in technological development and market preferences (Buganza, Dell'Era and Verganti, 2009; Pavlou and El Sawy, 2006). These can be either caused by market turbulences leading to unpredictability in market demands, consumer needs and competitor strategies or technological turbulence caused by the unpredictability of new technological innovations (Jap, 2001). The consequences of environmental turbulence (increased market/technological rapidity and/or increased market/technological uncertainty) (Buganza et al., 2009) demand for complex sensemaking cognitive patterns of the involved personnel in order to safeguard organizational outcome performance (McGill, Johnson and Bantel, 1993). Grounded in the well-established literature on environmental turbulence, we hypothesize that environmental turbulence negatively moderates

both the link between organizational context and Grid assimilation as well as the relationship between Grid assimilation and business value. Since environmental turbulence was conceptualized as a moderator impacting on inter-contextual determinants, it was not subsumed in the environmental context. Consistent with Bhattacharya et al. (1998), we choose the industry level as level of conceptualization for environmental turbulence, which is based on an operationalization by Pavlou and El Sawy (2006) (originally drawing from Jaworski and Kohli (1993)).

Grounded in psychological literature the concept of individual ***mindfulness*** as a cognitive pattern (Langer, 1989; Langer and Moldoveanu, 2000) was transferred by Weick et al. (1999) to the organizational theory domain of high reliability organizations (HROs). These HROs as exemplarily depicted by nuclear power-generation plants and naval aircraft carriers have to deal with unexpected events in an unforgiving and turbulent environment, where error is omnipresent and most likely of disastrous nature. These requirements call for a set of specialized cognitive processes that exacerbate erroneous behaviour due to human cognitive limitations and improve the resilience of an enterprise in case of inevitable failure. The mentioned organizational capabilities are not only suitable for the HRO domain but also serve as an example of an efficient organization under demanding conditions. This becomes especially evident in case of the organizational IS assimilation decision and management where contextual information has to be gathered against the background of uncertainty arising from environmental turbulence. Furthermore, the mindful evaluation of contextual information improves a firm's capability to resist or intentionally follow potential bandwagon phenomena (Fiol and O´Connor, 2003). In the past, there have been several calls to employ organizational mindfulness in existing conceptualization of IS innovation assimilation (Fichman, 2004; Swanson and Ramiller, 2004). However, no study so far operationalized the second-order construct Organizational Mindfulness as proposed by Weick and Sutcliffe (2007) which is formed by five complementary cognitive dimensions: preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise.

Preoccupation with failure defines the ability of a firm to leverage experiences made in close call situations and the ongoing encouragement to proactively report and define mistakes. The ability of a firm to ground decision making on a more complete and nuanced picture of its operations instead of drawing from existing categories or solutions without considering contextual characteristics is encompassed by its reluctance to simplify. Attentiveness and situational awareness of a firm to its operational front line is captured by its sensitivity to operations. In case of a high degree of sensitivity to operations, system anomalies can be isolated while they are still tractable. Commitment to resilience is defined by the ability of a firm to detect, contain, and bounce back from inevitable errors to a dynamically stable state. Finally, the characteristic of a firm to delegate

the decision making process to the people at the operational front line with the most expertise, regardless of their hierarchical rank, defines the degree of deference to expertise. Since organizational mindfulness eventually leads to a state of high situational awareness and self-control, we propose that organizational mindfulness helps to resist bandwagon phenomena based on pure mimetic behaviour and improves the capability to leverage professionalization tendencies and interorganizational synergies stemming from institutional pressure. Furthermore, due to the capability to process and overcome unexpected operational events appropriately, we propose that organizational mindfulness improves the generation of Grid-based business value against the background of environmental turbulence.

From the resource-based view of the firm theory, business processes provide a context within which business value can be examined (Karimi, Somers and Bhattacherjee, 2007). In this context, ***business process performance*** as perceptual measure of business value was operationalized as dependent variable for each of the aforementioned key business processes of a financial services provider (i.e., new product development process, risk management process and asset management processes) in order to capture the business value generation momentum of Grid assimilation. As proposed by Karimi et al. (2007) in the domain of ERP assimilation, process efficiency, process effectiveness, and process flexibility form the overall business process performance construct. While process efficiency reflects the extent to which the use of IS implementation reduces the operational costs and decreases the input/output conversion ratio, process effectiveness defines the extent to which IS implementation provides an improved functionality and enhances the quality of the users' work. The extent to which IS implementation provides firms with more flexibility in response to changing business environments defines the process flexibility of the business process outcome construct.

Since the business process outcome measure is a perceptual intermediate performance measure at process level, additional archival secondary data at firm level (return on risk adjusted capital (RORAC), return on asset (ROA), return on investment (ROI), market share, and sales) as part of an overall economic performance model (EPM) are triangulated against this measure in order to ensure the validity of the results and map gains from a process level view to financial firm performance (Chan, 2000). Furthermore, a combination of performance measures from distinct sources improves the robustness of the study (Chan, 2000) and helps to avoid a common method bias (Hendricks and Singhal, 2005; Mingers, 2001). We identified the type of the financial services provider, country, the size of the IT-department, and the available Grid expertise in years as controls for other influence factors on Grid-induced business value generation.

RESEARCH DESIGN AND METHODOLOGY

For the depicted research model (see Figure 1) both reflective and formative measures are utilized. All constructs except for organizational mindfulness of the depicted research model were deductively derived from well-established IS journals and were adapted to the Grid context where necessary. To ensure content validity of the utilized measures, several expert interviews were conducted and the survey instrument was provided to a panel of judges of both practitioners and academics (Straub, 1989; Straub, Boudreau and Gefen, 2004). In case of the new operationalization of organizational mindfulness, we started off from first wording approaches by Weick and Sutcliffe (2001) and Knight (2004) which were subsequently refined and adapted to an initial pool of 25 items for the five distinct dimensions of organizational mindfulness. To ensure content validity of the formative second-order construct organizational mindfulness, we followed a two staged approach. First, we conducted four expert interviews resulting in a minor refinement of the wording of some of the initial items and the exclusion of two ambiguous items (Straub, 1989; Straub et al., 2004). In the second stage, we conducted two rounds of unstructured and structured Q-sorting with different participants (2 PhD students and 2 experts from the financial services industry each) (Moore and Benbasat, 1991). A strong inter-judge reliability was found and the required Cohen's Kappa of all constructs met the criterion of 0.65 proposed by Moore and Benbasat (1991). In addition, the survey will be pre-tested before final roll-out in a small-scale setting. As part of this, the results of a confirmatory factor analysis of the organizational mindfulness construct will be analyzed.

Finally, a questionnaire-based field study will be conducted among IT decision makers of the 3000 largest financial services providers worldwide (with regard to total assets) currently assimilating Grid technology. An international market research company with in-depth expertise in academic research projects will be hired for this purpose. Therefore, the company will administer the online questionnaire to participants of a business-to-business panel satisfying our requirements with regard to hierarchical position, industry, firm size, and Grid adoption status. Consistent with our target regions (North America, Europe), the business-to-business panel covers the regions involved in our study. The contractually assured 300 complete responses will be split among the two regions (North America 200, Europe 100) involved, thus allowing for further group analysis on regional level. The research model was operationalized as a structural equation model (SEM) and will be analyzed using the Partial Least Squares (PLS) approach (Chin, 1998) with the software implementation SmartPLS (Version 2.0 M3). Due to the explanatory approach, the measurement model of both formative and reflective constructs with mixed scales (Chin, 1998), and the intended data set of 300 responses, we deemed a partial least square based approach instead of

covariance-based approaches as appropriate for the complexity and design of our research model. Additional statistical tests will be conducted to ensure reliability, convergent, and discriminant validity of the employed measures. Additionally, suitable tests for the presence of common method bias (Liang et al., 2007; Podsakoff, MacKenzie, Jeong-Yeon and Podsakoff, 2003) and non-response bias (Sivo, Saunders, Chang and Jiang, 2006) are identified and will be conducted.

The intended theoretical contribution of the depicted research is twofold: First, it contributes to the assimilation and diffusion of innovations theory by validating the role of organizational mindfulness in mitigating risks potentially arising from purely mimetic behaviour. As part of this, organizational mindfulness is operationalized in the stated context for the first time. Second, the interplay between institutional pressure and organizational mindfulness is assessed reflecting the growing importance of regulatory pressure in many industries. For practitioners the research provides a means of assessing the success and hindering factors of Grid assimilation and provides first insights on its contribution to business value generation. Furthermore, organizational mindfulness may serve as overall organizational concept to ensure successful IS assimilation and business value generation in demanding environments.

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