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INDIVIDUAL MINDFULNESS AND IT SYSTEMS USE - MITIGATING NEGATIVE CONSEQUENCES OF INFORMATION OVERLOAD

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Abstract

At modern IT workplaces, employees have access to a high amount of information that is provided by enterprise IT systems. In such environments, too much information can lead to information overload. One means to counteract negative consequences of information overload is a high extent of cognitive mindfulness among users. In this article, we analyze the interplay between information overload and mindfulness with regard to the realization of business process outcomes. The associated hypotheses are tested based on 221 complete responses from a survey among sales professionals of a large financial institution who were required to use a newly introduced customer relationship management system. The results from partial least squares analyses suggest that the presence of information overload decreases the subsequent use of the system and reduces the overall business process outcome. However, we found that cognitive capabilities in form of mindfulness mitigate the negative consequences of information overload.

Keywords: Mindfulness, Information Overload, IT Use, Business Process Outcomes.

1 Introduction

According to a recent market study by IDC, 1 trillion US-\$ will be invested in IT innovation globally in 2010 (IDC 2010). Especially information-intensive industries, such as the financial services industry, strongly invest in IT innovation (Zhu et al. 2004). As a consequence of the increasing diffusion of IT systems within organizations, employees have access to a large amount of information that puts additional burden on them in selecting, identifying, and processing task-relevant information provided by these systems. In essence, the steadily growing availability of digitized information within organizations demands increased cognitive processing capabilities of employees to master the difficulty of dealing with this information. In extreme cases, if either information load or time constraints are too high and the available cognitive processing capabilities are too low, a situation of information overload is likely to occur. Surprisingly, while extant literature posits a strong positive relationship between information load, subsequent information processing, and decision quality (Farhoomand & Drury 2002, Miller 1972), there is also evidence that situations of information overload counteract possible gains from IT systems usage (Edmunds & Morris 2000). This problem becomes even more apparent, when the realization of business value from enterprise IT systems use is analyzed (Farhoomand & Drury 2002). In this context, arising situations of information overload decrease the likeliness to use an enterprise IT system and to subsequently realize business value from its use. One possible starting point to account for the aforementioned, contradictory findings is the integration of constructs reflecting cognitive capabilities that facilitate the extraction, selection, and focusing on context-relevant information. Consequently, cognitive capabilities are required to master information overload in the context of enterprise IT systems use (San Miguel 1976, Schröder & Benbasat 1975). Among the cognitive capabilities, the psychological learning construct of individual mindfulness is assumed to account for the effective processing of context-relevant information load by users in the realm of complex enterprise IT systems use and the realization of business value in highly dynamic industries (Dane 2010). In essence, mindfulness reflects a state of high situational awareness and contextualized decision-making (Langer 1989) that is required to realize business value from complex enterprise IT systems. Additionally, the extant literature on the consequences of individual mindfulness is still in a premature stage with regard to a quantification of the impact of mindfulness on task performance (Dane 2010).

In order to validate the hypothesized relationships between enterprise systems use, information overload, mindfulness, and business process outcomes, we conducted a questionnaire-based field study among 489 sales professionals from a large German financial services provider. In the surveyed sales department, a new customer relationship management (CRM) system was implemented whose subsequent use was mandatory to all employees. Results from PLS analyses based on 221 complete responses indicate that the use of the CRM system leads to increased business process outcomes with regard to its flexibility, effectiveness, and efficiency. However, information overload negatively affects the use of the CRM system and its consequences in a twofold way: first, information overload directly negatively influences the actual use of the CRM system. Second, information overload negatively affects business process outcomes realized from CRM systems use. Finally, this relationship is negatively moderated by individual mindfulness indicating that the presence of mindfulness among CRM systems users mitigates the negative consequences of information overload on the benefits realized from its use. Surprisingly, we could not find a moderating impact of mindfulness on the generation of business process outcomes by enterprise IT systems use and the decreased system use caused by higher levels of information overload.

The remainder of this article is organized as follows: in section 2 the theoretical background on information overload and the concept of individual mindfulness is depicted. Subsequently, in section 3, our research model and the associated hypotheses are introduced and motivated. Section 4 elaborates on the study design and methodology as well as depicts the results of our data analyses and

discusses the results. Finally, this article concludes with a short overview on its prevalent limitations as well as further venues for research.

2 Theoretical Background

Much of the prior research has focused on the analysis of IT systems use and its induced consequences (Jaspersen et al. 2005, Venkatesh & Bala 2008). Extant research was often grounded on a conceptualization of IT use that assumed homogeneous cognitive processing capabilities among various users (Fichman 2004). Consequently, variations in use behavior and resulting outcomes were often attributed to latent characteristics of IT systems, such as performance expectancy, effort expectancy, as well as facilitating conditions and social influence (Venkatesh et al. 2003). In the following, we depict an alternative approach that analyzes the consequences of IT systems use from a cognitive perspective reflected by the interplay between mindful cognitive processing and information overload. Accordingly, in the following, we depict the concept of information overload as well as the concept of individual mindfulness that is assumed to especially unfold in complex and dynamic scenarios, such as scenarios of information overload (Dane 2010).

2.1 Information Overload

Information overload is often characterized by a situation of “*receiving too much information*” (Eppler & Mengis 2004, p. 326). The definition of information overload depends on the specific research domain and is spanned along two dimensions that are information quantity and time. Consequently, people are either exposed to more information than they can cognitively process or they have less time at one’s command than required to complete a certain task or job (Edmunds & Morris 2000, Eppler & Mengis 2004, Farhoomand & Drury 2002). Therefore, information overload is often defined as “*the state in which the volume and speed of incoming stimuli with which an individual has to cope (i.e., information load) is beyond his or her processing capacity*” (Schultze & Vandenbosch 1998, p. 129). In our context, we define information overload as a state that manifests itself as follows: (1) “*a lack of time to accomplish a task*” and (2) “*making it more difficult for people to identify relevant information and therefore causes them to miss important cues*” (Schultze & Vandenbosch 1998, p. 137). In particular, information load represents the amount of information that must be processed by an individual to complete a certain task. In detail, information processing capacity encompasses cognitive processes, such as “*selecting, sorting, and organizing information as well as sensing and decision-making*” (Schultze & Vandenbosch 1998, p. 129).

In general, information load and cognitive processing capacity can be assumed to be closely intertwined because a person’s processing capacity strongly determines the perception of the extent of information load (Schultze & Vandenbosch 1998, p. 130). Additionally, prior studies indicate that people with a pronounced processing capacity are likely to search for more information than people with a lower processing capacity and, as such, are able to process more information before overload occurs (San Miguel 1976, Schröder & Benbasat 1975). Further results suggest that a continuous exposure to information load stimulates the development of cognitive complexity, eventually leading to a higher processing capacity (Miller 1972). Still, the perception of information overload (to a certain degree) is determined by individual traits and thus partially depends on individual characteristics (Schroder et al. 1967).

In contrast to private life, where people can choose to ignore or omit information sources, at the workplace, the situation is different with regard to the voluntariness of information source utilization. In globally dispersed business environments, digitized information is a key determinant for sustained success and competitiveness, eventually leading to the need that many employees have to deal with tremendous amounts of information (Edmunds & Morris 2000, Swanson 1992). In general, the main causes of information overload can be associated with five areas: (1) the organizational design, (2) the information itself, (3) the task or process, (4) the person’s attitude, qualification and experience, and

(5) information technology (Eppler & Mengis 2004). In the following, we focus on the impact of information overload caused by information technology (i.e., enterprise IT systems) utilization.

Paradoxically, IT is expected to improve workers' performance, to enhance decision quality, and to reduce work time, but concurrently leads to opposing effects as well, such as additional paperwork and data inconsistencies (Farhoomand & Drury 2002). Due to inherent IT characteristics, such as high storage capacities, low duplications costs, or fast speed of data access, IT often "generates" information much faster than people can actually process (Edmunds & Morris 2000, Schultze & Vandenbosch 1998). Consequently, the use of information systems can lead to several symptoms that additionally challenge employees: (1) ignoring information or being extremely selective, (2) missing information or important cues, (3) losing control over information, (4) making improper decisions, or (5) struggling with the selection and identification of relevant information (Edmunds & Morris 2000, Farhoomand & Drury 2002). In essence, organizations have to align "*the information load, time, and individuals' processing capacity*" in order to avoid negative consequences arising from information overload (Schultze & Vandenbosch 1998, p. 131).

2.2 Individual Mindfulness

Recently, the psychological construct of mindfulness has gained considerable attention in IS research due to its paradigm-bridging implications (Fichman 2004). It extends prevalent theorizing that is predominately based on economic-rationalistic reasoning by explicating influencing cognitive capabilities and limitations. In general, mindfulness (with mindlessness as its opposite cognitive state) can be understood as a psychological construct that reflects cognitive qualities of either organizations (groups) or individuals and materializes as a highly contextual attentiveness and deduction of course of action (Langer 1989, Weick et al. 1999). So far, mindfulness has been conceptualized in various ways: a trait, a state, or a cognitive ability (Brown & Ryan 2003, Langer 1989, Sternberg 2000). In the following, we draw upon Langer's conceptualization of individual mindfulness that defines it as a cognitive ability that can be actively influenced (Bodner & Langer 2001, Langer 1989). Consistent with Langer (1997), mindfulness is defined by the following different manifestations: "*When we are mindful, we implicitly or explicitly (1) view a situation from several perspectives, (2) see information presented in the situation as novel, (3) attend to the context in which we are perceiving the information, and eventually (4) create new categories through which this information may be understood*" (Langer 1997, p. 111). In contrast to a conceptualization as a trait or a state, mindfulness as a cognitive ability can be actively influenced. For instance, different mindfulness training sessions are offered by professional human resource development consultants that aim at positively influencing the extent of individual mindfulness among participants.

In essence, individual mindfulness refers to one's ability to continuously reflect and align its own environment and behavior. This in turn means that mindful individuals always evaluate a certain routine behavior based on grounds of efficiency and potential alternatives in doing otherwise (Bodner & Langer 2001). Langer and Bodner's (2001) refined construct of individual mindfulness is formed by four dimensions: (1) novelty-producing, (2) novelty-seeking, (3) engagement, and (4) flexibility. Therefore, individual mindfulness manifests in various ways. For instance, individuals exhibiting a high degree of mindfulness are likely to be highly sensitive to context and perspective (Burpee & Langer 2005), to consider different alternatives within a problem-solving process and leverage their actions in a changing environment (Langer 1989), and to omit behaving automatically or in sticky routines without drawing distinctions between the past and present (Bodner & Langer 2001). In contrast, mindlessness is defined as a cognitive state in which an individual "*operates like a robot*" due to "*a lack of mental involvement*" (Bodner & Langer 2001). Being mindless means that an individual strongly relies on behavioral routines proven to be effective in the past without conscious control or awareness. Thus, the person will tend to never critically reflect its own behaviour. Hence, different alternatives that might be more efficient, suitable or compatible for a certain task or action are not considered. Consequently, mindlessness can limit human task performance (Langer 1989).

3 Research Model and Hypotheses

Based upon the extant literature, the interplay between information overload and individual mindfulness were conceptualized in a research model. In the following, the derived hypotheses and their theoretical background are introduced.

Employees that are exposed to a high degree of information overload are likely to avoid using the IT system to a greater extent since this leads to an even higher information load. In the context of electronic knowledge repositories (EKR) as one specific instance of an enterprise system, Bock et al. (2010) find first evidence that information overload negatively influences the use of EKRs. Here, information overload forces users to spend more time in order to identify and extract relevant information. As a result, the costs the user associates with the use of the IT system might outweigh its associated benefits, thus decreasing the likeliness of reuse (Bock et al. 2010). Analogously, one core function of a CRM system is to edit, update, and provide a huge master data set on customer relationships to employees of the sales department. Consequently, we hypothesize

H1: Information overload negatively influences the use of the enterprise system.

During recent years, considerable effort has been spent on investigating the IT business value link (Chau et al. 2007, Kohli & Grover 2008). Prior studies note that IS use does not necessarily lead to the generation of business value (the so-called IT paradox) (Brynjolfsson 1993). However, there is also significant work indicating a positive relationship between IS use and related outcomes (Karimi et al. 2007, Petter et al. 2008). Recently, Davamanirajan et al. (2006) suggested focusing on the analysis of business value on the process level, since IT investments are likely to impact on the process level first. One construct that assesses business process outcomes was proposed by Karimi et al. (2007) in the domain of enterprise resource planning systems use. In essence, the utilized business process outcome construct is reflected by three sub dimensions of process efficiency, process effectiveness, and process flexibility. Due to the depicted multi-dimensional specification, the business process performance construct was operationalized as a reflective second-order construct. While process efficiency reflects the extent to which the use of an enterprise system reduces the operational costs and decreases the input/output conversion ratio, process effectiveness defines the extent to which enterprise systems use provides an improved functionality and enhances the quality of the users' work. The extent to which enterprise systems use provides firms with more flexibility in their response to changing business environments is reflected by the process flexibility dimension of the business process outcome construct. In sum, we hypothesize

H2: The use of the enterprise system positively influences business process outcomes.

A high degree of information overload represented by a high information load can jeopardize several positive consequences induced by the use of IT. Prior research indicates that information overload eventually leads to a situation where less information is utilized (Burton & Tuttle 2002) or only very selective search patterns are utilized (Cook 1993). Additionally, information overload has a direct negative influence on decision-making quality and time required for decision-making (O'Reilly 1980). This negatively affects potential business process outcomes, e.g., a high amount of available information can decrease the time-to-market of new products since it takes longer to process all the available data. Hence, we hypothesize

H3: Information overload negatively impacts on business process outcomes.

At the individual level, the extant management literature indicates that mindfulness positively influences individual task performance, especially in complex and dynamic settings (Dane 2010). In detail, individual mindfulness facilitates the identification and creation of contextually-relevant information out of the overall set of available information (Langer & Moldoveanu 2000). Consequently, mindful individuals are more aware of the contextual appropriateness of digitized information by focusing on the task-relevant information. Concurrently, additional "disturbing" information is omitted. This reduction of information that has to be processed for decision-making

eventually leads to a decreased negative impact of perceived information overload (O'Reilly 1980). Through these mechanisms, mindfulness is likely to increase the benefits realized from enterprise IT systems use that is concurrently negatively affected by information overload. Thus, we hypothesize

H4a: Individual mindfulness negatively moderates (weakens) the relationship between information overload and enterprise systems use.

H4b: Individual mindfulness negatively moderates (weakens) the relationship between information overload and business process outcomes.

Additionally, mindful individuals are characterized by a high contextual awareness and the capabilities to derive novel solutions for arising problems (Langer 1989). In particular, mindfulness fosters the effective consideration of varying contingencies (Swanson & Ramiller 2004) and the subsequent derivation of an appropriate action repertoire (Westrum 1988). Since individual mindfulness is reflected by the consideration of new solution alternatives and a highly context-dependent use of systems, a close matching of business requirements and utilized IT capabilities is more likely, eventually leading to improved business process outcomes from IT utilization (Wolf et al. 2010). Consistently, firms that exhibit a high extent of mindfulness are likely to achieve superior organizational performance (Swanson & Ramiller 2004). Consequently, we hypothesize

H4c: Individual mindfulness positively moderates (strengthens) the relationship between enterprise systems use and business process outcomes.

3.1 Measures

Reflective first-order measures were used for all of the constructs, except for individual mindfulness (formative second-order measure, type II model) and business process outcomes (reflective second-order measure, type I model). All constructs of the depicted research model were deductively derived from well-established IS journals and were adapted to the context of IT systems use within enterprises where necessary (see Table 1). Anchored 7-point Likert scales (from 1 ('strongly disagree') to 7 ('strongly agree')) were used for all reflective constructs, except for enterprise IT systems use which was measured on a 7-point Likert scale with 1 ('infrequent') to 7 ('frequent') as anchors.

Construct	Abbreviation	Number of Items	Scale	Source
Enterprise Systems Use (reflective)	USE	2	7-point Likert	– Davis et al. (1989), Appendix
Information Overload (reflective)	IO	6	7-point Likert	– Schultze and Vandenbosch (1998), p. 147
Individual Mindfulness (formative second-order)	IM	4/3/2/2	7-point Likert	– Bodner and Langer (2001), p. 10
Business Process Outcomes (reflective second-order)	BPO	5/3/4	7-point Likert	– Karimi et al. (2007), p. 134

Table 1. Set of measurement items

4 Research Design and Methodology

4.1 Data Collection and Sample Profile

In order to validate the research model presented in Figure 1 and the associated hypotheses proposed in section 3, we conducted a quantitative survey-based field study. From January 18th, 2010 to

February 3rd, 2010, the online survey was administered to 489 employees of a German financial services provider. In order to ensure that each respondent participated only once, customized links to the online survey were sent to the potential participants by email. After one week, a reminder was sent out via email, followed by a second email reminder after two weeks. Finally, 221 complete questionnaires from 65.61 percent male and 34.39 percent female respondents were gathered (45.19% response rate). The relatively high response rate might be grounded on the prevailing user support to measure user system perception among the work force as well as a strong top management support. Further details on the sample profile are depicted in Table 2.

Job Position		Age	
Sales Manager	11.31% (25)	18-30 years	9.5% (21)
Sales Specialist	49.32% (109)	31-40 years	26.24% (58)
Sales Assistant	25.79% (57)	41-50 years	47.51% (105)
Miscellaneous	13.57% (30)	51-70 years	16.67% (37)

Table 2. Sample profile

Measurement Model Validation

In the following, first the measurement model of the unidimensional constructs is validated before the measurement models of the multidimensional constructs (BPO, MND) are assessed.

The measurement model of the *unidimensional, reflective first-order constructs* was assessed by reviewing (1) the construct reliability, (2) the convergent validity, and (3) the discriminant validity. As far as the construct reliability is concerned, all composite reliability (CR) scores exceeded the recommended threshold of 0.70, ranging from 0.864 to 0.923. Also, the average variance extracted (AVE) was above the required threshold of 0.50, indicating sufficient construct reliability (see Table 3). Subsequently, we assessed the convergent validity by analyzing the factor loadings. In sum, all factor loadings exceeded the required 0.707 threshold. Additionally, all loadings were statistically significant at a two-tailed 0.001 significance level utilizing a bootstrapping technique with 500 samples (Chin 1998b). Finally, discriminant validity was assessed by computing the intercorrelations between the latent variables. Consistent with the Fornell & Larcker (1981) criterion, the square root of the AVE of each of the different latent variables was higher than the correlations between the latent variable and each other construct (see Table 4). Further analyses revealed that all items had higher loadings on their respective latent variable than on any other latent variable. In summary, all aforementioned results indicate good construct reliability as well as convergent and discriminant validity of the utilized reflective first-order constructs.

Constructs	Abbr.	Mean	SD	AVE	CR
Information Overload	IO	2.77	1.31	0.517	0.864
Enterprise Systems Use	USE	5.08	1.82	0.857	0.923

Table 3. Measurement model results of unidimensional constructs

Construct	USE	IO	BPO
USE	0.925		
IO	-0.140	0.719	
BPO	0.314	-0.473	0.916

Table 4. Correlations among major constructs; square root of average variance extracted shown diagonal; italicized correlations significant at $p < .05$ (two-tailed)

As far as the *second-order constructs* are concerned, BPO is specified as a type I model (Karimi et al. 2007) (reflective first- and second-order specification) whereas MND is specified as a type II second-order construct (Bodner & Langer 2001) (reflective first-order and formative second-order specification) (Jarvis et al. 2003). Since the estimated latent variable scores (LVS) of the first-order constructs represent the indicators of the second-order construct for type I models, we first analyzed the measurement model of the underlying first-order constructs in order to assess the measurement model of the multidimensional constructs (Wetzels et al. 2009). According to the depicted approach for reflective first-order constructs, measurement validity was verified for each of the first-order constructs (OEFT, OEFC, and OFLX). In sum, all CRs and AVEs exceeded the proposed thresholds of 0.70 and 0.50 respectively (see Table 5). Convergent validity of all first-order constructs was assessed by considering the factor loadings that were all above the 0.707 threshold. In detail, all loadings were in the range between 0.737 and 0.926 and were significant at a two-tailed 0.001 level. As indicator of sufficient discriminant validity, the square root of AVE of each first-order construct was higher than the correlations between the latent variable and each other construct. Finally, the factor loadings of the items were higher on their associated construct than on all other constructs. Finally, a similar validation process was applied to assess the measurement model of the second-order construct. A CR score of 0.940 and an AVE of 0.839 indicate good construct reliability (see Table 5). Further, convergent validity was assessed by analyzing the path coefficients from the first-order constructs to the second-order construct that were clearly above the provided threshold of 0.70 (ranging from 0.907 to 0.930) (Chin 1998a). Furthermore, all paths were significant at two-tailed 0.001 level.

Constructs	Abbr.	Mean	SD	Loadings	AVE	CR
Business Process Outcomes	BPO	-	-	-	0.839	0.940
Operational Effectiveness	OEFT	4.23	1.32	0.930**	0.639	0.898
Operational Efficiency	OEFC	3.66	1.29	0.907**	0.674	0.861
Operational Flexibility	OFLX	3.49	1.41	0.911**	0.819	0.948
Mindfulness	MND	-	-	-	-	-
Engagement	MENG	4.89	1.14	-0.575*	0.528	0.645
Flexibility	MFLX	5.88	0.81	0.595*	0.605	0.753
Novelty Producing	MNP	5.41	1.00	0.662*	0.685	0.897
Novelty Seeking	MNS	5.96	0.78	-0.304 ^{n.s.}	0.640	0.842
<i>Notes: ** p<0.01 (two-tailed); * p<0.05 (two-tailed); n.s. = not significant;</i>						

Table 5. Measurement model of multidimensional constructs

Finally, we assessed the measurement model of mindfulness (specified as type II model) by reviewing all reflective first-order constructs (MENG, MFLX, MNP, and MNS). Here, the CR scores exceeded the required threshold of 0.70 (except for MENG) and the AVE ranged from 0.528 to 0.685, indicating a good level of construct reliability (see Table 5). Furthermore, the factor loadings were considered to assess the convergent validity. Here, all loadings except for MENG1 exceeded the threshold of 0.707 at a two-tailed 0.001 significance level. Finally, we decided to keep MENG1 within the model since it loaded most on its respective construct (MENG) exhibiting only weak cross-loadings on the other constructs. Finally, discriminant validity was assessed by computing the intercorrelations between the first-order constructs, whereby all constructs fulfilled the required Fornell-Larcker-criterion (Fornell & Larcker 1981). Additionally, the loading of each indicator on its referring construct was higher than on all other constructs.

To assess the formative second-order specification of MND, based on Chin's (1998b) suggestion, multicollinearity was assessed by calculating the variance inflation factors (VIFs) utilizing the LVS of

each underlying construct. The estimated VIFs of the four sub-constructs were all below the critical value of 3.3 (ranging from 1.140 to 1.743) indicating no serious concern of multicollinearity (Diamantopoulos & Siguaaw 2006). Moreover, all weights exceeded the proposed (+/-) 0.2 threshold and were significant at a two-tailed 0.05 level except for MNS that was insignificant ($t=1.074$, $p>.10$). However, we retained the indicator to avoid the danger of affecting the content validity of the formative construct (Jarvis et al. 2003, Petter et al. 2007).

Since all self-reported data can potentially be affected by common method bias arising from different sources, such as social desirability and consistency motif (Podsakoff et al. 2003), we conducted an additional common method bias analysis (Liang et al. 2007, Podsakoff et al. 2003). First, the results from a Harman's one-factor test revealed that the most variance explained by one factor is 27.09 percent. Thus, the presence of common method bias is not likely in our study. Despite this, we included a common method factor in our PLS model whose indicators included all the principal constructs' indicators and calculated each indicator's variances substantively explained by the principal construct and by the method. The results show that the average substantively explained variance of the indicators is 0.690 while the average method variance is 0.043 resulting in a ratio of about 16:1. In addition, most method factor loadings are not significant. Based on both of these results, we concluded that there is unlikely to be a serious concern of common method bias for this study.

4.2 Hypotheses Testing and Discussion

The research model was operationalized as a structural equation model (SEM) and analyzed using the Partial Least Squares (PLS) approach (Chin 1998b) 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 1998b), and the data set of 221 responses, we deemed a component-based approach instead of covariance-based approach as appropriate for the complexity and design of the research model. Figure 1 depicts the estimates obtained from PLS analysis.

Overall, four (H1, H2, H3, H4b) of the seven hypotheses are supported by the results. The estimated explained variance (R^2) for the endogenous latent variables adjusted R^2 values of 0.215 for USE and 0.301 for BPO, indicating a moderate amount of explained variance (Chin 1998b).

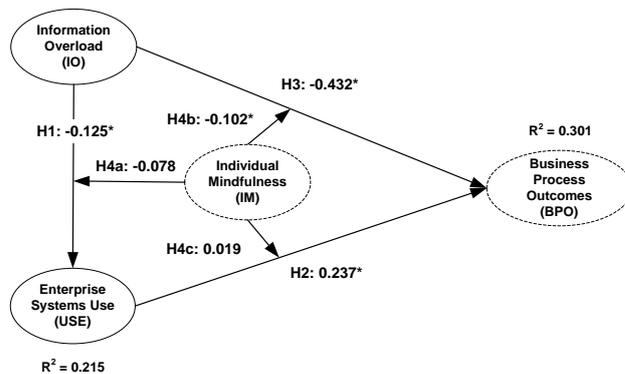


Figure 1. PLS estimates for the research model; * $p < .05$ (two-tailed)

Our results indicate that the use of the CRM system positively influences the realization of business process outcomes (H2, $\beta=0.237$, $p<.05$). Here, information overload negatively impacts on the use of the CRM system (H1, $\beta=-0.125$, $p<.05$) and also decreases the business process outcomes realized from CRM use (H3, $\beta=-0.432$, $p<.05$). Mindfulness among IT users mitigates the negative consequences of information overload in that sense that it negatively moderates the relationship between information overload and business process outcomes (H4b, $\beta = -0.102$, $p<.05$). According to Chin et al. (2003), we standardized the given indicator values before estimating the interaction terms. Surprisingly, individual mindfulness has no significant moderating impact ($p>.10$) on the relationship

between information overload and use (H4a) as well as the relationship between use and business process outcomes (H4c). This can be potentially attributed to two reasons: first, the consequences of individual mindfulness might only manifest indirectly and therefore cannot clearly be delineated from concurrent influences such as information overload (e.g., H3, H4b). Second, the utilized individual mindfulness construct is based upon Bodner and Langers' measurement scale and therefore might be too broadly specified for the context of enterprise systems use.

The results of our study extend prevalent theorizing by shedding light on the micro-level perspective of IT-based business value generation. In this context, our results indicate that the use of enterprise IT systems generates business value on the process level (H2), which strengthens prior research that by means of analyzing the process level changes, ambiguous results with regard to IT value research can be overcome (Davamanirajan et al. 2006). In addition to this, the results of our study suggest that information overload is a crucial state that directly negatively affects IT business value generation at the process level (H3) and increases user resistance to use the system (H1). Thus, in essence, the use of enterprise IT systems leads to two opposing effects: first, it generates business value (H2) but concurrently levels of higher information load might lead to situations of information overload that jeopardize potential value realized from IT use (H3).

Here, we find that the prevalent assumption of stable cognitive processing capacities among users seems to misguide further theorizing. By explicating variations in cognitive capabilities, such as the extent of individual mindfulness, we can indirectly depict how negative consequences of information overload with regard to business value generation can be mitigated (H4b). Individual mindfulness empowers users of enterprise IT systems to effectively extract the digitized information from the IT system that is context-relevant and thus helps to prevent vicious cycles arising from IT systems use.

5 Conclusion and Limitations

Our results inform prevalent theorizing on IT business value generation by further explicating its micro-structure mechanisms, such as the interplay between systems use, information overload, individual mindfulness, and business process outcomes. Especially, the interdependence between information overload and individual mindfulness might serve as an additional starting point to account for the partly contradictory findings with regard to IT value realization. Our results depict how information overload negatively influences both the use of IT systems as well as the business value realized from it. As a consequence, further effort should be spent to double-check the necessity of all provided information and to optimize its representation to decrease the information load of users. On the user side, individual mindfulness is one means to mitigate negative consequences potentially arising from scenarios of information overload. A higher degree of individual mindfulness fosters the effective and efficient identification and selection of context-relevant information. Furthermore, our results suggest that the cognitive capabilities among users partly account for variations in the use of enterprise IT systems and its consequences against the background of arising information overload. Here, the depicted results are intended to be a starting point for further research and a related ethical debate with regard to the extent of acceptable information overload. However, the focus of this article was not to answer the ethical question whether people have to adapt to a given extent of information load or if the set of provided information should rather follow the available cognitive capabilities of the employees. For practitioners, the study results emphasize that the design of enterprise IT systems with regard to their data provisioning and information representation is crucial to facilitate its sustained use and the realization of IT business value. Besides these technically-related means, individual mindfulness training sessions that empower employees to focus on the present and actively consider new ideas might serve as an effective means to prepare them for the use of complex enterprise IT systems. As with all research, there are several limitations to consider that concurrently represent venues for further research: first, our sample consists only of respondents from one large financial services provider, thus potentially limiting the generalizability of the results due to the

idiosyncratic characteristics of the industry (e.g., high volatility). Also, the responses of our survey represent the users of a specialized enterprise IT system within the sales department.

References

- Bock, G.-W., Mahmood, M., Sharma, S. and Kang, Y. J. (2010). The Impact of Information Overload and Contribution Overload on Continued Usage of Electronic Knowledge Repositories. *Journal of Organizational Computing and Electronic Commerce*, 20(3), 257-278.
- Bodner, T. E. and Langer, E. J. (2001). Individual Differences in Mindfulness: The Mindfulness/Mindlessness Scale. 13th Annual Psychological Society Conference.
- Brown, K. W. and Ryan, R. M. (2003). The Benefits of Being Present: Mindfulness and its Role in Psychological Well Being. *Journal of Personality and Social Psychology*, 84(4), 822-848.
- Brynjolfsson, E. (1993). The Productivity Paradox of Information Technology. *Communications of the ACM*, 36(12), 67-77.
- Burpee, L. C. and Langer, E. J. (2005). Mindfulness and Martial Satisfaction. *Journal of Adult Development*, 12(1), 43-51.
- Burton, G. F. and Tuttle, B. (2002). Market Behavior Under Information Overload Conditions: Evidence from the Laboratory. Working paper, University of Nebraska, Lincoln, Nebraska.
- Chau, P. Y. K., Kuan, K. K. Y. and Liang, T.-P. (2007). Research on IT value: What we have done in Asia and Europe. *European Journal of Information Systems*, 16(3), 196-201.
- Chin, W. W. (1998a). Issues and Opinion Structural Equation Modeling. *MIS Quarterly*, 22(1), vii-xvi.
- Chin, W. W. (1998b). *The Partial Least Squares Approach to Structural Equation Modeling*. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Chin, W. W., Marcolin, B. L. and Newsted, P. R. (2003). A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. *Information Systems Research*, 14(2), 189-217.
- Cook, G. (1993). An Empirical Investigation of Information Search Strategies with Implications for Decision Support System Design. *Decision Sciences*, 24(3), 683-697.
- Dane, E. (2010). Paying Attention to Mindfulness and Its Effects on Task Performance in the Workplace. *Journal of Management*, forthcoming.
- Davamanirajan, P., Kauffman, R. J., Kriebel, C. H. and Mukhopadhyay, T. (2006). Systems Design, Process Performance, and Economic Outcomes in International Banking. *Journal of Management Information Systems*, 23(2), 65-90.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.
- Diamantopoulos, A. and Siguaw, J. A. (2006). Formative versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. *British Journal of Management*, 17(4), 263-282.
- Edmunds, A. and Morris, A. (2000). The Problem of Information Overload in Business Organizations: A Review of the Literature. *International Journal of Information Management*, 20(1), 17-28.
- Eppler, M. and Mengis, J. (2004). The Concept of Information Overload: A Review of Literature from Organization Science, Accounting, Marketing, MIS, and Related Disciplines. *Information Society*, 20(5), 325-344.
- Farhoomand, A. F. and Drury, D. H. (2002). Managerial Information Overload. *Communications of the ACM*, 45(10), 127-131.
- Fichman, R. G. (2004). Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods. *Journal of the Association for Information Systems*, 5(8), 314-355.
- Fornell, C. and Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18(1), 382-388.
- IDC (2010). Worldwide IT Spending to Grow 3% in 2010, According to IDC's Worldwide Black Book <http://www.idc.com/getdoc.jsp?containerId=prUS22192510>.
- Jarvis, C. B., MacKenzie, S. B. and Podsakoff, N. P. (2003). A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research. *Journal of Consumer Research*, 30(2), 199-218.
- Jasperson, J. S., Carter, P. E. and Zmud, R. W. (2005). A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems. *MIS Quarterly*, 29(3), 525-557.

- Karimi, J., Somers, T. M. and Bhattacharjee, A. (2007). The Impact of ERP Implementation on Business Process Outcomes: A Factor-Based Study. *Journal of Management Information Systems*, 24(1), 101-134.
- Kohli, R. and Grover, V. (2008). Business Value of IT: An Essay on Expanding Research Directions to Keep up the Times. *Journal of the Association for Information Systems*, 9(1), 23-39.
- Langer, E. J. (1989). *Minding Matters: The Consequences of Mindlessness - Mindfulness*. Academic Press, Inc., San Diego.
- Langer, E. J. (1997). *The Power of Mindful Learning*. Addison-Wesley, Reading.
- Langer, E. J. and Moldoveanu, M. (2000). The Construct of Mindfulness. *Journal of Social Issues*, 56(1), 1-9.
- Liang, H., Nilesh, S., Hu, Q. and Xue, Y. (2007). Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management. *MIS Quarterly*, 31(1), 59-87.
- Miller, H. (1972). Environmental Complexity and Financial Reports. *The Accounting Review*, 47(1), 31-37.
- O'Reilly, C. A. (1980). Individuals and Information Overload in Organizations: Is More Necessarily Better? *Academy of Management Journal*, 23(4), 684-696.
- Petter, S., DeLone, W. H. and McLean, E. R. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, 17, 236-263.
- Petter, S., Straub, D. and Rai, A. (2007). Specifying Formative Constructs in Information Systems Research. *MIS Quarterly*, 31(4), 623-656.
- Podsakoff, P. M., MacKenzie, S. B., Jeong-Yeon, L. and Podsakoff, N. P. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology*, 88(5), 879-903.
- San Miguel, J. G. (1976). Human Information Processing and its Relevance to Accounting: A Laboratory Study. *Accounting, Organizations and Society*, 1(4), 357-373.
- Schroder, H. M., Driver, M. J. and Streufert, S. (1967). *Human Information Processing - Individuals and Groups Functioning in Complex Social Situations*. Holt, Rinehart & Winston, New York.
- Schröder, R. G. and Benbasat, I. (1975). An Experimental Evaluation of the Relationship of Uncertainty in the Environment to Information Used by Decision Makers. *Decision Science*, 6(3), 556-567.
- Schultze, U. and Vandenbosch, B. (1998). Information Overload in a Groupware Environment: Now you see it, Now you don't. *Journal of Organizational Computing and Electronic Commerce*, 8(2), 127-148.
- Sternberg, R. J. (2000). Images of Mindfulness. *Journal of Social Issues*, 56(1), 11-26.
- Swanson, E. B. (1992). Information Accessibility Reconsidered. *Accounting, Management and Information Technologies*, 2(3), 183-196.
- Swanson, E. B. and Ramiller, N. C. (2004). Innovating Mindfully with Information Technology. *MIS Quarterly*, 28(4), 553-583.
- Venkatesh, V. and Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 39(2), 273-315.
- Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425-478.
- Weick, K. E., Sutcliffe, K. M. and Obstfeld, D. (1999). Organizing for High Reliability: Processes of Collective Mindfulness. *Research in Organizational Behavior*, 21, 81-123.
- Westrum, R. (1988). Organizational and Inter-Organizational Thought. World Bank Conference on Safety Control and Risk Management.
- Wetzels, M., Odekerken-Schröder, G. and van Oppen, C. (2009). Using PLS Path Modeling for Assessing Hierarchical Construct Models: Guidelines and Empirical Illustration. *MIS Quarterly*, 33(1), 177-195.
- Wolf, M., Beck, R. and Vykoukal, J. (2010). An Integrated Perspective on IT Project Alignment in Highly Dynamic Environments – A Multi-Level Analysis Proceedings of the 31st International Conference on Information Systems (ICIS 2010).
- Zhu, K., Kraemer, K. L., Xu, S. and Dedrick, J. (2004). Information Technology Payoff in E-Business Environments: An International Perspective on Value Creation of E-Business in the Financial Services Industry. *Journal of Management Information Systems*, 21(1), 17-54.