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Shaji A. Khan

Albert L. Lederer

Dinesh A. Mirchandani

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Top Management Support, Collective Mindfulness, and Information Systems Performance

Shaji A. Khan
Bradley University
USA

Albert L. Lederer
University of Kentucky
USA

Dinesh A. Mirchandani
University of Missouri - St. Louis
USA

ABSTRACT

Mindfulness is a cognitive process that facilitates the discovery and correction of errors that might escalate. This study applies mindfulness theory to examine the impact of top management support for information systems on collective mindfulness, and that of collective mindfulness on IS performance. It treated such mindfulness in five dimensions, and top management support and IS performance as uni-dimensional. Forty-seven chief executive officers responded to a survey asking their perceptions of the constructs. Top management support predicted four of the dimensions with the strongest effect on sensitivity to IS operations. A negative path from support to commitment to IS resilience suggests a management predilection for planning over improvisation and adaptation. Sensitivity to IS operations alone predicted performance.

INTRODUCTION

Greater top management support for information systems results in better design, use, and management of such systems, and thus in improved organizational performance. Considerable research has therefore been conducted concerning the impact of top management support on the contribution of information systems to performance (Choe, 1996; Igarria et al., 1995; Jarvenpaa and Ives, 1991; Ragu-Nathan et al., 2004; Sabherwal et al., 2006). For example, continuous involvement from top management has been shown to resolve problems when crises and conflicts arise in uncertain environments (Pinto & Slevin, 1987).

However, little is known about how the cognitive processes of a supportive top management facilitate performance (Meindl et al., 1994). Recently, the concept of mindfulness has been introduced to IS research to help explain innovation and the achievement of information systems reliability in organizations (Swanson & Ramiller, 2004; Butler & Gray, 2006). Mindfulness is a cognitive process that facilitates the discovery and correction of errors that might escalate (Weick et al., 1999).

Swanson and Ramiller (2004) call for an examination of top management support in the mindfulness context and remark that strategic mindfulness is needed to deal with the disruptive

effects of IT initiatives. Such mindfulness includes a concern for the firm’s long-term viability, and thus is the responsibility of top management. Without mindfulness, the use of such resources as money and people might not be sufficient to permit the new IT to be successfully implemented and adopted.

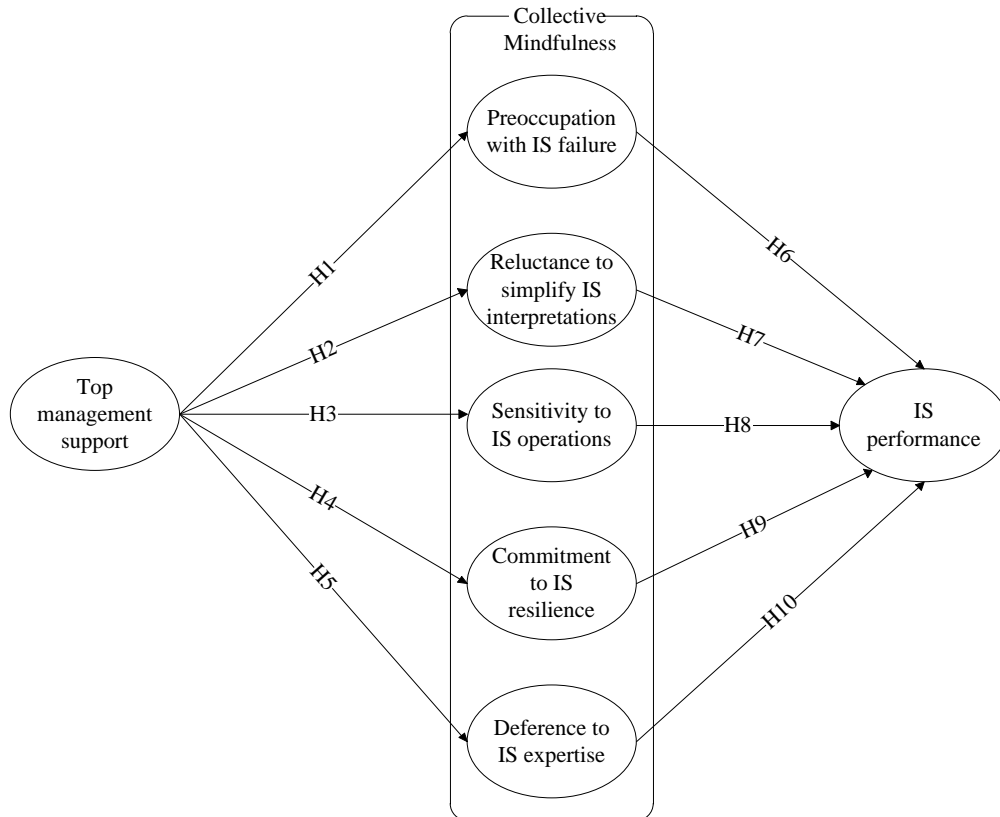
The purpose of this study is to apply mindfulness theory to understand how top management support can enhance IS performance. The study tests the effect of top management support (i.e., top management understanding and involvement) on the collective mindfulness of top management (i.e., attentiveness to five specific factors described below), and the effect of such mindfulness on IS performance.

The next sections explain the constructs, define hypotheses, and elucidate the methodology and analysis. After a discussion of the findings, implications for research and practice follow.

LITERATURE

The research model contains five constructs: top management support; collective mindfulness comprising five dimensions of preoccupation with IS failure, reluctance to simplify IS, sensitivity to IS operations; commitment to IS resilience and deference to IS expertise; and IS performance. The model appears in Figure 1.

Figure 1: The Research Model.



TOP MANAGEMENT SUPPORT

Top management support is the degree to which senior executives understand the importance of the IS function and are involved in IS activities (Ragu-Nathan et al., 2004). Under such circumstances, the executives are interested in the IS function and encourage operating units to collaborate with information systems professionals (Boynton et al., 1992). The executives consider such systems as a strategic resource and understand the opportunities offered by them (Clemons et al., 2009).

Research has considered the impact of top management support. It has shown, for example, such support to be a critical success factor for IS disaster recovery planning (Chow & Ha, 2009) and for successful alignment of IS plans with business plans (Teo & Ang, 1999). Top management support leads to the improved quality of shared information in interorganizational systems usage (Hartono et al., 2010), and to successful software process improvement (Ngwenyama & Nørbjerg, 2010). Top management support influences both perceived ERP system usefulness and usage (Lin, 2010), leads to successful SAP and business process management systems implementation (Becerra-Fernandez et al., 2005; Ravesteyn & Batenburg, 2010), and is a characteristic of successful e-commerce (Epstein, 2005). At the same time, lack of top management support leads to failed projects and lost opportunities (Andriole, 2009).

COLLECTIVE MINDFULNESS

Mindfulness refers to a flexible mental state of highly focused attentiveness. It means openness to novelty, alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, and orientation in the present (Butler & Gray, 2006; Langer, 1997; Langer, 2000; Sternberg, 2000). In contrast, mindlessness means acting automatically on a routine basis using preexisting categories of the past rather than creating new categories for the present (Langer, 2000). Instead of actively drawing distinctions and noticing new things as in mindfulness, mindlessness means being stuck in a single, rigid perspective without any attention to alternative ways of knowing.

Weick and Sutcliffe (2001, p. 42) further describe as “the combination of ongoing scrutiny of existing expectations, continuous refinement and differentiation of expectations based on newer experiences, willingness and capability to invent new expectations that make sense of unprecedented events, a more nuanced appreciation of new dimensions of context that improve foresight and current functioning.” Collective mindfulness deals with a group’s ability to perceive cues, interpret them, and respond appropriately (Butler & Gray, 2006). However, collective mindfulness is not just a matter of allocation of the group’s scarce attention resources, but also concerns the quality of attention. It is more than merely cognitive alertness, and in addition, includes contextually differentiated reasoning (Swanson & Ramiller, 2004).

A mindful firm may be expected to attend to an IS innovation with reasoning grounded in its own organizational specifics, whereas in a mindless firm such grounding would be absent (Swanson & Ramiller, 2004). A mindful firm may also be expected to focus more on IS operations and have a flexible structure in IS development whereas a mindless one would depend more on abstract plans and strategies (Butler & Gray, 2006).

Five processes represent collective mindfulness. They are 1) preoccupation with failure, 2) reluctance to simplify interpretations, 3) sensitivity to operations, 4) commitment to resilience, and 5) deference to expertise (Butler & Gray, 2006; Swanson & Ramiller, 2004; Weick & Sutcliffe, 2001; Weick et al., 1999).

Preoccupation with Failure

A preoccupation with failure within a mindful organization is not an unhealthy single-minded obsession with failure, but a healthy alertness and lively awareness of the possibilities of errors and failures within the organization. It treats failure and near failure as indicators of the organization's health. A thorough analysis of near failures and a focus on the risks of success characterize the construct (Weick et al., 1999). Near misses, shortcomings, and mismatches are seen as opportunities to learn and improve (Beck et al., 2011).

Problems in one part of the organization are not treated in isolation, no matter how small or trivial they may seem by themselves. Instead, careful attention is paid to their impact on the rest of the organization. This is necessary because one particular problem, compounding in association with other localized problems, could create a chain of events with a much bigger impact on the organization. That impact would not necessarily be readily evident when the problem is treated in isolation (Carroll, 1998).

Quiet periods marked by smooth operations are treated as an indication that perhaps indicators of potential problems are being overlooked (Swanson and Ramiller, 2004). Mindful organizations create and foster an environment of openness which encourages and rewards self-reporting of errors, failures, and near failures. Such organizations realize that it is far more important that errors and possibilities of failure are out in the open than to be able to place responsibility of such errors for merely punishment purpose. This is so because visible errors enable corrective action and avoidance of future occurrences (Rochlin, 1993; Weick et al., 1999). Overall, a focus on errors and failures can help avoid the overconfidence, complacency, and inattention that often creep in when success becomes routine (Butler & Gray, 2006).

Reluctance to Simplify Interpretations

Reluctance to simplify interpretations entails resisting the temptation to rely on the oversimplification of complexities. It means an appreciation of the true complexity of the event at hand, the realization that complex responses are needed in complex situations, and thus the avoidance of routine heuristics such as world views, frameworks, or mindsets (Swanson & Ramiller, 2004; Weick, 1995; Weick et al., 1999). It refers to a collective desire to look at problems and events from novel, diverse and conflicting perspectives; such problem analysis increases the organization's chances of detecting both small and large discrepancies in a context-aware manner so that the discrepancies can be dealt with in a timely and appropriate fashion (Butler & Gray, 2006; Swanson & Ramiller, 2004).

Mindful organizations induce their members to notice more, and in essence focus on what they don't know instead of simply on what they do know (Weick et al., 1999). In essence, such

mindful reluctance to simplify moves an organization away from accepting stock or ready-made interpretations of events prevalent elsewhere and toward a more careful examination of events and phenomena based on and relevant to current organizational conditions, thus reducing complacency and rigidity (Fiol & O'Connor, 2003; Swanson & Ramiller, 2004; Weick et al., 1999).

Sensitivity to Operations

Sensitivity to operations implies that a mindful organization pays vigilant attention to each and every detail, regardless of how seemingly insignificant it may be in day-to-day operations at a given moment (Swanson & Ramiller, 2004). This reflects a realization that problems often arise in the interactions of small deviations and random events across different operational areas, and that such problems present situations which were not readily anticipated in formal planning and daily routines (Butler & Gray, 2006; Swanson & Ramiller, 2004). Sensitivity to operations is achieved through a combination of shared mental representations, collective story building, assessment of situations and continual updates of such assessments, knowledge of interconnectedness of systems, and active diagnosis of the limitations of preplanned procedures (Weick et al., 1999; Roth, 1997). Sensitivity to operations is thus both deeper and more dynamic than the concept of situational awareness (Endsley, 1995).

Commitment to Resilience

Resilience is “a generalized capacity to investigate, to learn, and to act, without knowing in advance what one will be called to act upon” (Wildavski, 1991, p. 70). Commitment to resilience in a mindful organization involves a collective mindset that acknowledges the possibility of surprises despite risk analyses and planned defenses (Swanson & Ramiller, 2004; Weick et al., 1999; Wildavski, 1991, Marchewka, 2010). Resilience, as the capability to bounce back and recover from failures, is essential for coping with the surprises (Weick et al., 1999).

A mindful organization is skeptical or at least ambivalent toward the applicability of past practice to future scenarios. It simultaneously both believes and doubts past experience in order to take the appropriate response to a hazardous situation (Weick et al., 1999). Overall, a mindful organization is committed to resilience in that it favors “improvisation over planning, adaptation over routine, and effectiveness over efficiency” (Swanson & Ramiller, 2004, p. 561). It reassesses existing action options, anticipates project-specific challenges, and responds accordingly (Beck et al., 2011).

Deference to Expertise. Deference to expertise in a mindful organization manifests itself in the underspecification of structures, a relaxation and departure from formal hierarchical decision structures to one that enables the flow of authority to people who possess the required expertise to deal with a particular problem at hand (Butler & Gray, 2006; Weick et al., 1999). This allows for problems to be matched with broader, more pertinent sets of capabilities and solutions, typically not the case in a traditional hierarchical structure. Moreover in a mindful organization, someone who detects a problem and cannot figure it out turns to another who might have the relevant expertise (Weick et al., 1999). This loosening of the filter of hierarchy eventually leads to a decoupling of problems from high ranking decision makers when they lack the required

expertise. It thus allows problems to migrate, thereby providing a wider variety of people to make sense of novel cues.

INFORMATION SYSTEMS PERFORMANCE

Information systems performance is the dependent variable in this study (Costea, 1990; Jiang et al., 2001; Rondeau et al., 2003, 2010). It is reflected by top management's satisfaction that information systems facilitate better decision making and improve the management of organizational activities. It is also indicated by end-user recognition of information systems benefits and end-user satisfaction with the services of the IS function. The failure of the IS function to meet end-user expectations is a contraindication of information systems performance.

Hypothesis justification

This study tested ten hypotheses. The first five consider the effect of top management support (i.e., understanding and involvement) on the dimensions of mindfulness (i.e., attentiveness to each factor).

The effect of top management support on preoccupation with is failure

Greater top management support for information systems means a greater interest in the IS function and a greater understanding of the importance of IS to the organization. It includes an appreciation of information systems in their role as strategic resource with the opportunity to contribute (Ragu-Nathan et al., 2004). As such, it indicates a recognition of the mission criticality of IS to business operations and strategy. Recognition of such criticality carries with it an understanding of the possibility of the failure of current information systems and the failure to achieve the benefits of new information systems (Davenport, 2000).

Top management understands that failure – via runaway, never completed, or poor quality projects – is costly and thus threatening (Keil & Rai, 1997; Keil & Roby, 1999). The possibility of failure produces top management's healthy preoccupation to avoid such failure in order to reap the benefits of IS. Hence:

H1: The greater the top management supports for information systems, the greater the preoccupation with information systems failure.

The effect of top management support on reluctance to simplify is interpretations

Top management support implies an understanding of IS opportunities and a recognition of their strategic value in achieving favorable outcomes for the organization (Ragu-Nathan et al., 2004). Top management is aware that information systems are complex, and that simplistic interpretation of the actions and resources required to plan, design, and implement successful information systems risks failure and the loss of that strategic value (Roberts et al., 2004-2005; Akkermans & van Helden, 2002). Top management is reluctant to simplify its interpretations in order to avoid missing key details that might cause unfavorable outcomes. Instead, it embraces the view that complex responses are needed in complex environments. Moreover, it entertains

novel, diverse and even conflicting perspectives in its interpretation of events in order to reap the greatest benefits from information systems (Weick & Sutcliffe, 2001). Hence:

H2: The greater the top management supports for information systems, the greater the reluctance to simplify information systems interpretations.

The effect of top management support on the sensitivity to is operations

Greater top management support for information systems includes greater understanding of the importance of IS and greater interest in the IS function and opportunities (Ragu-Nathan et al., 2004). Top management would therefore invest more resources, both financial and human, in software applications and data management, leading to greater organizational dependence on IS operations (Hoxmeier, 2000).

Greater dependence would increase top management's concern about the possibility of unreliability in IS operations (Hunter et al., 2006). IT failure – whether brief or lengthy – inconveniences customers, suppliers and other external stakeholders. Interrupted or slow service can cause customers to choose other suppliers. Moreover, IT failure disrupts the efficiency and effectiveness of employees. With greater dependence and the concern about the possible consequences of operations problems, top management would have greater sensitivity to information systems operations. Hence:

H3: The greater the top management supports for information systems, the greater the sensitivity to information systems operations.

The effect of top management support on its commitment to be resilience

The more top management supports information systems, the more it will appreciate their value as a strategic resource, and thus the more it will be involved and interested in the IS function (Ragu-Nathan et al., 2004). More involvement and interest in the function will help top management realize that it is difficult to create detailed plans for every possibility and that surprises and mistakes in the use of systems are inevitable (Pan & Flynn, 2003). Top management's strong support for IS will commit it to being resilient in its planning wherein it encourages adaptation, improvisation, and learning in the organization in order to achieve the desired contribution from IS (Galliers, 2004). Hence:

H4: The greater the top management supports for information systems, the greater the commitment to information systems resilience.

The effect of top management support on deference to is expertise

The more top management supports information systems, the more it will understand the complexity of the systems and the more it will be concerned about their success. With such understanding of the complexity, top management will recognize its inability to make decisions without the additional expertise demanded by the complexity (Buckland & Florian, 1991). With greater concern for information systems success, top management will relax formal structures so

that experts have more responsibility (Swanson & Ramiller, 2004; Hetherington, 1991). By enabling experts to self-organize with less supervision, errors and problems can be found and addressed more quickly, thus preventing their escalation to a high level (McKinney, 2007). Hence:

H5: The greater the top management supports for information systems, the greater the deference to information systems expertise.

The final five hypotheses consider the effect of the dimensions of mindfulness on IS performance.

The effect of top management preoccupation with is failure on is performance

Preoccupation with failure would inspire management to search for signals of trouble both during difficult times and smoother operations (Swanson & Ramiller, 2006). By searching and finding signals of trouble, management would avoid problems and the recurrence of errors (Raghunathan & Raghunathan (1991, 1994). The avoidance of problems and recurrent errors would increase end-user satisfaction with the IS function and lead to better management of organizational activities. Users would recognize the benefits of the IS function and perceive it as facilitating better decision making (Ragu-Nathan et al, 2004). Hence:

H6: The greater the top management preoccupation with IS failure, the greater the IS performance.

The effect of top management reluctance to simplify is interpretations on is performance

By entertaining novel, diverse and conflicting perspectives in the interpretation of events – that is, by being reluctant to simplify interpretations – top management keeps an open mind to complex responses in complex environments. This open-minded approach would lead top management to be aggressive in adopting new information systems and seeking opportunities to apply them (Sabherwal & Chan, 2001; Miles & Snow, 1978). Greater investment in such technology would facilitate better information systems performance (Sircar & Choi, 2009; Benitez-Amado et al., 2010). Hence:

H7: The greater the top management reluctance to simplify IS interpretations, the greater the IS performance.

The effect of top management sensitivity to be operations on is performance.

Greater sensitivity to IS operations suggests that top management entertains a greater likelihood of unreliability in current operations (Swanson and Ramiller, 2006). Senior managers would monitor IS operations more closely to ensure that systems function with fewer disruptions and errors, and thus are more reliable (Edmiston, 2007). More reliable IS would lead to greater end-user satisfaction with the IS function and greater use of IS for the management of organizational activities (Roberts & Wanveer, 1994; Kettinger & Lee, 2005). Hence:

H8: The greater the top management sensitivity to IS operations, the greater the IS performance.

The effect of the top management commitment to is resilience on is performance

Greater top management commitment to IS resilience indicates that senior management considers surprises and mistakes in IS undertakings as inevitable, and views such events as learning opportunities (Garvin, 1993; Pan & Flynn, 2003). Such commitment indicates top managers dislike rigidity and routines, and believe that planning cannot encompass all possible IS challenges (Swanson & Ramiller, 2006). Thus they would encourage improvisation and adaptation as long as IS goals are achieved. Given such flexibility, the IS function would be more responsive to end-user needs, produce better quality software, and hence generate greater end-user satisfaction (Gorla & Lin, 2010; Rondeau et al., 2010). Moreover, without fear of being penalized for mistakes, IS managers would be more willing to adopt new, riskier, innovative, and high-impact IS technologies that lead to strategic advantage for the organization (Altschuller et al., 2010). Hence:

H9: The greater the top management commitment to IS resilience, the greater the information systems performance.

The effect of top management deference to is expertise on is performance

Greater top management deference to IS experts leads to the relaxation of organization structures so that individuals with relevant expertise have authority to take action (Swanson & Ramiller, 2006). Quick and appropriate response by experts to problems helps maintain more reliable information systems which meet end-user performance expectations and increase end-user IS satisfaction (Ragu-Nathan et al., 2004). Hence:

H10: The greater the top management deference to IS expertise, the greater the IS performance.

METHODOLOGY

Instrument

A field survey of CEOs of for-profit firms with at least 100 employees provided the data for this research. The survey contained five-point Likert scale items to measure top management's collective mindfulness, top management support for information systems, and information systems performance. The authors developed the collective mindfulness items based on the definitions from Swanson and Ramiller (2004), and adapted the top management support items from Ragu-nathan et al. (2004), and the IS performance items from Rondeau et al. (2006). Appendix A shows those items with their instructions. The survey also contained demographic questions about the participants and their company.

Pilot study

Before mailing, the researchers identified 16 CEOs through the Executive Leadership Institute of a large university in a major, Midwestern metropolitan area, and emailed them a request to participate in the study. Five responded and agreed to do so. They represented five different industries. Their firms had a range of 1,300 to 30,000 employees and 60 to 1,200 IS employees. The CEOs were asked to complete either a paper or Web-based survey.

One of the authors met with each participant independently at the latter's workplace, and asked the subject to read the sample cover letter, fill out the survey, and make any comments while doing so. After the completion of each survey, the author asked the participant for specific comments regarding the clarity and length of the survey, and the utility of the cover letter in gaining responses. Feedback from these executives revealed that the survey was "just about the right length..." and "...easy to navigate." The pilot testing did suggest some minor revisions to the questions and the cover letter, and they were duly incorporated.

Data collection

The sampling frame was restricted to a large Midwestern state in the United States, home to the researchers' university; because the researchers felt that top management level respondents were more likely to reply to a request from a local university. The researchers developed a list of 2,400 public and private organizations within the state using the *ReferenceUSA* database. Along with mailing addresses and telephone numbers, the database provides names and titles of senior executives, North American Industry Classification System (NAICS) primary codes, and other basic information such as number of employees. To avoid potential confounding effects, the researchers excluded government, not-for-profit, and educational organizations. To ensure accuracy of contact information, they manually removed duplicates and incomplete addresses to the extent possible. These steps resulted in a list of about 1,189 for-profit commercial organizations representing 17 different industry sectors.

A final random sample of 1,000 of these firms received personalized cover letters detailing the research purpose, encouraging participation, and providing instructions. Additionally, the survey and cover letter were incorporated into a Web-based format. The mail survey packet was addressed to the CEO (or equivalent such as president/owner). It contained the personalized cover letter, the survey, and a postage-paid business reply envelope.

Potential respondents were also given the option of completing the survey online using the Web-based version. The web site address appeared prominently in the cover letter. After the survey packets were mailed, 47 responses were received, representing a 5% rate.

Demographics

The major industries of the respondent companies included manufacturing (32%); professional, scientific, and technical services (17.0%); finance and insurance (13%); transportation and warehousing (11%); wholesale trade (6%); and information (6%). Sales revenues of the respondent firms ranged from \$4 million to \$2 billion with a mean of \$193 million and a median

of \$40 million. Number of employees ranged from 17 to 7,600 with a mean of 592 and a median of 200. Number of IS employees ranged from 0 to 275 with a mean of 28 and a median of 7.

The respondents had work experience from 20 to 62 years with both a mean and median of 32. They had been with the company from 1 year to 62 years and a mean of 21 and median of 15 years. Fifty-two percent had a 4-year college degree as highest level of education, 24% had a masters, and 9% had a PhD. Table 1 shows descriptive statistics of the constructs; perhaps interestingly, the mean of deference to expertise was higher than that of each other dimension ($p < .001$, 2-tailed t-test) and no other differences were significant. Appendix B shows the descriptive statistics for the items.

Table 1: Means and Standard Deviations of Constructs.

Constructs	Mean	S.D
Preoccupation with failure	3.24	.60
Reluctance to simplify interpretations	3.06	.47
Sensitivity to operations	3.23	.72
Commitment to resilience	3.26	.47
Deference to expertise	4.04	.58
IS performance	3.90	.56
Top management support	4.23	.57

DATA ANALYSIS

Non-response bias

The returned surveys were examined for non-response bias, a prejudice toward the views of subjects who complete a survey. Treating late respondents as surrogates for non-respondents, multivariate analysis of variance evaluated whether differences between early and late subjects were associated with different responses (Armstrong and Overton, 1977). The analysis indicated no significant differences in the survey items (Wilks' $\Lambda = .19$, $p = .35$). This is consistent with the absence of non-response bias.

Common method variance

The possibility that the subjects provide socially-desirable answers rather than objective ones is a concern when the researcher plans to correlate responses for both independent and dependent variables from the same subject in self-report methodology (Campbell & Fiske, 1959). Harman's single-factor test was used to check for the presence of common method variance (Harman, 1967; Podsakoff & Organ, 1986). All of the survey items were entered into a principal components factor analysis with varimax rotation. According to Harman's technique, if a single factor emerges from the factor analysis or one "general" factor accounts for most of the covariation in the variables, common method variance is present. However, the results of the analysis revealed nine factors with eigenvalues greater than one, and no single factor accounting for more than 29.2 percent of the covariation. These results are consistent with the absence of

common method variance.

Content validity

The mindfulness, top management support, and IS performance scales used in this study were derived from prior research (Swanson & Ramiller, 2004; Raghunathan et al., 2004). They were pilot tested with five CEOs. Such derivation and development attests to the content validity of the items.

Convergent and discriminant validity

The mindfulness constructs were deemed formative because the items defined their constructs and were not interchangeable (Jarvis et al., 2003; Diamantopolous & Winkhofer, 2001; Petter et al., 2007). Validation therefore followed Loch, Straub, and Kamel's (2003) procedure where the item scores for each subject were first multiplied by the PLS item weights to create a weighted measure for each item. The weighted measures were then summed to create a composite score for each construct. Convergent validity was demonstrated because the weighted measures in the same construct correlated significantly with their composite construct scores. Discriminant validity was demonstrated because the correlation of each item with its own composite was higher than with the composite of other constructs. A few such exceptions are acceptable in a large matrix, but there were no exceptions in the current data (Loch et al., 2003; Campbell & Fiske, 1957). Table 2 shows the weighted-measure-to-composite correlations.

Table 2: Convergent and Discriminant Validity of Formative Constructs.

	Item	PF	RSI	SO	CR	DE
Preoccupation with failure (PF)	1	.717**	.190	.268	-.335*	.243
	2	.536**	-.019	.060	-.219	.036
	3	.767**	.469**	.301	-.181	.407**
Reluctance to simplify interpretations (RSI)	1	.194	.466**	-.031	.082	.038
	2	.085	.451**	.277	-.087	.204
	3	.387*	.635**	.479**	-.248	.591**
	4	-.005	.519**	.133	-.341*	.279
Sensitivity to operations (SO)	1	.014	.080	.318*	-.038	.147
	2	.330*	.330*	.904**	-.265	.306*
Commitment to resilience (CR)	1	-.407**	.081	-.255	.409**	.007
	2	-.222	-.449**	-.378*	.453**	-.123
	3	-.223	.021	-.172	.765**	-.091
	4	-.250	-.046	-.101	.522**	-.098
	5	-.009	-.106	-.240	.367*	-.005
	6	-.189	-.327*	-.098	.507**	-.435**
Deference to expertise (DE)	1	.300	.495**	.180	-.213	.832**
	2	.172	.476**	.358*	-.097	.797**
	3	.462**	.323*	.419**	-.263	.739**

* p<.05, **p<.01

The top management support and IS performance constructs were modeled as reflective because the indicators are manifestations of the constructs rather than defining characteristics of them. Prior research has also treated the two constructs as reflective (Raghunathan et al., 2004). As shown in Table 3, convergent validity was demonstrated because Cronbach's α and composite reliability both exceeded the .70 criterion (Nunnally, 1978; Hatcher, 1994). Each item also loaded significantly on its respective construct ($p < .001$) (Hatcher, 1994). Furthermore, eight of the twelve items loaded above .707 on their respective constructs and the other four exceeded .64 (Hair et al., 1998), and the average variance extracted (AVE) exceeded .50 for each construct (Hatcher, 1994). Discriminant validity was demonstrated because the correlation between management commitment and IS performance (.68) was less than the square roots of the average variance extracted of both top management support (.82) and IS performance (.71) (Chin, 1998).

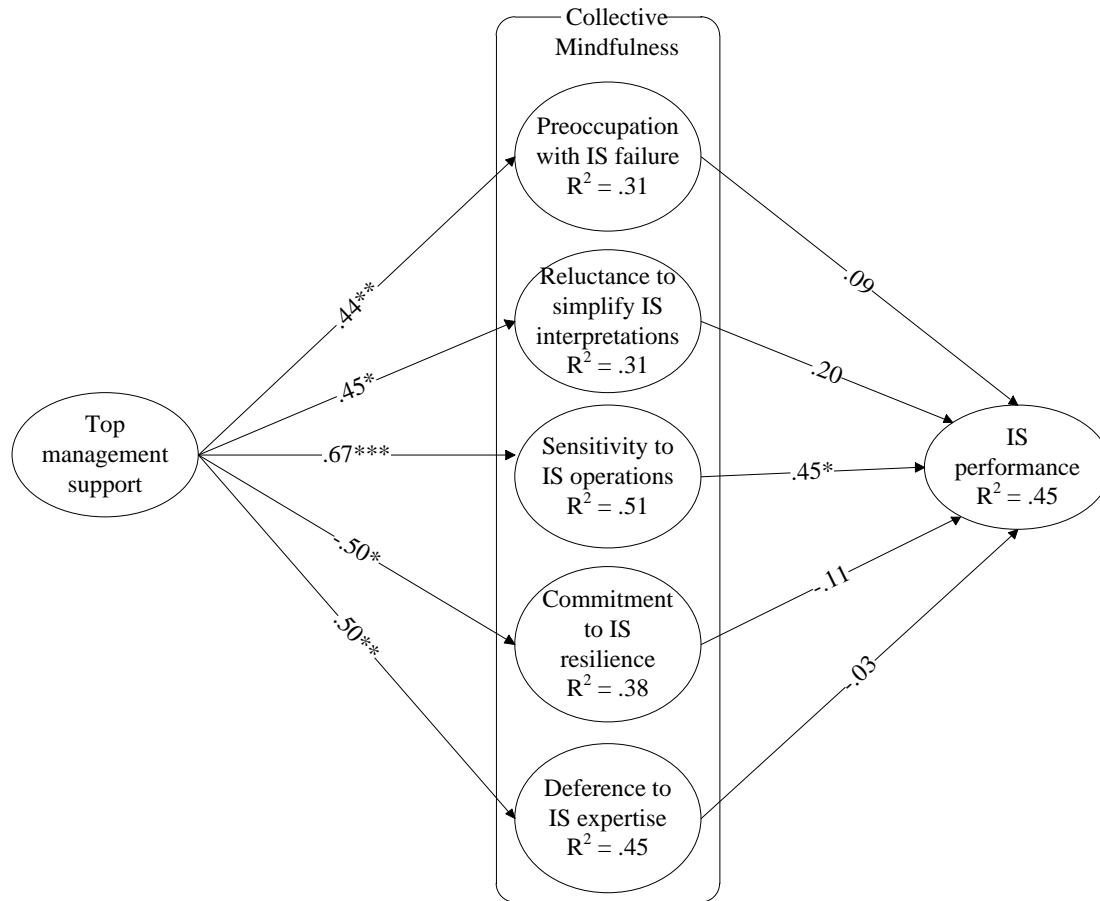
Table 3: Reliability and Convergent Validity.

Construct (Composite Reliability, α , AVE)	Variables	Loadings
Top Management Support (.93, .91, .67)	Top management involvement with IS function is strong	.66
	Top management is interested in IS function	.86
	Top management understands the importance of IS	.82
	Top management supports the IS function	.87
	Top management considers IS as a strategic resource	.79
	Top management understands IS opportunities	.82
	Top management keeps the pressure on operating units to work with IS	.88
IS Performance (.84, .77, .51)	End-users recognize the benefits of our IS function's services	.66
	Our IS function is perceived as facilitating better decision making	.79
	End-users are generally satisfied with the services of the IS function	.67
	The use of IS services has led to better management of organizational activities	.64
	Our IS function has failed to meet end-user performance expectations	.79

FINDINGS

The study confirmed five of the ten hypotheses and contradicted one. Top management support predicted preoccupation with failure (H1, $p < .01$), reluctance to simplify interpretations (H2, $p < .05$), sensitivity to operations (H3, $p < .001$), and deference to expertise (H5, $p < .01$). It contradicted the hypothesis that top management support would lead to commitment to resilience (H4 $p < .05$). Sensitivity to operations predicted IS performance (H8, $p < .05$), but the other four mindfulness constructs did not predict it (i.e., H6, H7, H9, and H10 were not supported). None of the control variables (i.e., years of work experience, years with the organization, level of education, industry, revenue, and number of employees) were significant. The results of the structural model appear in Figure 2 and Table 4. In addition, a post hoc multiple regression power analysis based on G*Power 3.1.3 using the minimum effect size $f^2 = .45$ (i.e., $r^2 = .31$), $\alpha = .05$, and $n = 47$ revealed that the model's power exceeded .99 (Erdfelder et al., 1996). Thus, despite the perhaps seemingly low number of subjects, the sample size was sufficient.

Figure 2: The Structural Model.



*p < .05, **p < .01, ***p < .001

Table 4: Results of the Structural Model.

H	Independent Construct	Dependent Construct	R ²	Path	T-value	Result
1	Top management support	Preoccupation with IS failure	.31	.44	2.70**	Supported
2		Reluctance to simplify IS interpretations	.31	.45	2.28*	Supported
3		Sensitivity to IS operations	.51	.67	4.65***	Supported
4		Commitment to IS resilience	.38	-.50	2.34*	Contra-dicted
5		Deference to IS expertise	.45	.50	3.02**	Supported
6	Preoccupation with IS failure	IS Performance	.45	.09	.33	
7	Reluctance to simplify IS interpretations			.20	.83	
8	Sensitivity to IS operations			.45	2.13*	Supported
9	Commitment to IS resilience			-.11	.58	
10	Deference to IS expertise			-.03	.13	

*p < .05, **p < .01, ***p < .001

DISCUSSION

This study first hypothesized that top management support leads to mindfulness. Top management's greater interest in the IS function and greater understanding of the importance of IS to the organization would inspire a greater appreciation of the value of information systems and of the risks of problems with them. In order to achieve the value and avoid the problems, this appreciation would inspire top management to greater mindfulness through preoccupation with failure (H1), reluctance to simplify interpretations (H2), sensitivity to operations (H3), commitment to resilience (H4), and deference to expertise (H5). Confirmation of four of the hypotheses concerning the impact of top management support on mindfulness, i.e., H1, H2, H3, and H5, lends credence to that reasoning.

Perhaps also interesting, top management support had the greatest impact (i.e., the greatest path coefficient, and the only one significant at $p < .001$) on sensitivity to operations (H3). More supportive top management is thus especially aware of, concerned about, and attentive to the possibility of a high degree of unreliability in the current operations.

The contradiction of H4, i.e., the effect of top management support on commitment to resilience, may suggest a top management predilection for planning over improvisation and adaptation. Perhaps top management feels that the challenges of gaining value from information systems are better overcome with careful, advance deliberation rather than on-the-fly reaction. Senior executives apparently believe that it is better to plan for than react to emerging situations.

This study also hypothesized that mindfulness in all five dimensions leads to IS performance. For example, greater sensitivity to IS operations (H8) would inspire senior managers to monitor IS operations more closely to ensure that information systems function with fewer disruptions and errors. More reliable information systems would lead to greater end-user satisfaction with the IS function and greater use of IS for management of organizational activities. Confirmation of H8 lends credence to that reasoning.

Moreover as Figure 2 shows, the significant path from top management support to sensitivity to IS operations (H3) combined with the significant path from that sensitivity to IS performance (H8) draws attention to the prominence of sensitivity to operations in facilitating the impact of top management support on IS performance. The strong predictive power of top management support on sensitivity to IS operations ($p < .001$ for H3) reinforces that prominence. Moreover, sensitivity to IS operations was the only mindfulness dimension that predicts performance.

H6, for example, had reasoned that preoccupation with failure would inspire management to search for signals of trouble. By finding them, management would avoid problems. The avoidance of problems would increase end-user satisfaction, improve management of organizational activities, and enhance decision making. Perhaps the continuous, unexpected changes in information technology and in organizational information requirements create unforeseeable problems that management cannot reduce despite the anticipatory search for them.

H7 had reasoned that in entertaining novel, diverse and conflicting perspectives in the interpretation of events, top management would keep an open mind to adopting new information

systems which would facilitate increased end-user satisfaction, improved management of organizational activities, and enhanced decision making. Perhaps, however, entertaining novel, diverse and conflicting perspectives in the interpretation of events implies understanding the potential of new information systems, but not necessarily actually investing in them. Perhaps the investment decision for such systems is more difficult.

H9 had reasoned that greater top management commitment to IS resilience would engender greater flexibility which would be more responsive to end-user needs, produce better quality software, and hence generate greater end-user satisfaction. Lack of support for H9 shows that favoring improvisation over planning, adaptation over routine, and effectiveness over efficiency does not result in better IS performance. Perhaps information systems management differs from other organizational endeavors in that such systems need to be better planned with more routine and efficient operations.

In fact, in conjunction with the unexpected inverse effect of top management support on commitment to IS resilience (H4), the H9 lack of support for the effect of commitment to IS resilience on IS performance may make sense. That is, H4 shows that top management believes that planning should be favored over resilience, and the lack of support for H9 may imply that resilience does not necessarily lead to better performance.

H10 had reasoned that greater top management deference to IS experts enables such experts to exercise more responsibility and thus provide information systems that better meet end-user performance expectations and increase end-user satisfaction. Lack of support for H10 suggests that expertise by itself may not be enough without, for example, the organizational rank necessary for championing the systems that can increase IS performance.

IMPLICATIONS

This study confirmed four of five hypotheses that top management support leads to collective mindfulness. These findings were thus generally consistent with the reasoning that greater interest and greater understanding of the importance of IS would inspire greater appreciation of the value of information systems and of risks of problems with them, and that this appreciation would inspire top management to greater mindfulness.

Such confirmation applies mindfulness theory in information systems management. In doing so, the study suggests that other areas of information systems research might likewise apply the theory. For example, researchers might use the theory to better understand the analysis and design of new information systems or the implementation of them.

The study found only very limited support that mindfulness leads to better IS performance. We suggest reasons for that limited support. Future research can test those reasons, or search for others and test them.

The study provided an instrument for measuring mindfulness in the information systems context. Future research could use that instrument or further develop it.

The current study assessed IS performance as a perceptual variable. Future research might use financial measures as dependent variable.

Top management support served as predictor of mindfulness in this study. Future research might study other predictors. Examples include the organizational role of information systems and the industry as well as management competitiveness, style, vision, knowledge, experience, education, and age.

Finally, the study tested hypotheses using the chief executive officer to assess all three constructs. Although the analysis did not detect common method variance, future research might eliminate the potential problem by using different subjects to assess different constructs.

Implications for practice

This study underlined the importance of top management support as a condition for mindfulness. Top management support appears to engender preoccupation with IS failure, reluctance to simplify IS interpretations, sensitivity to IS operations, and deference to IS expertise. This was especially evident in sensitivity to IS operations (H3, $p < .001$). Because sensitivity to operations also appears to facilitate IS performance (H8), top managers might want to be especially cognizant that in their own individual organizations, they are supportive of and mindful about IS operations.

Information systems managers, who want to increase top management mindfulness about operations, might want to take greater action to do so. In other words, they might want to devote more effort to explaining to top management the importance of operations and the risks of unreliable operations.

Ironically, the study found that greater management support led to less commitment to IS resilience (H4) which, in turn, did not influence IS performance. We interpret these findings to be a top management predilection toward planning (as a rebuff of reliance on resilience), in a context where top management commitment to IS resilience does not appear to affect IS performance either favorably or unfavorably.

Both top business and information systems managers may want to acknowledge top management's rebuff of reliance on resilience. IS management may want to try to better explain its view to top business management that resilience is beneficial and merits top management support. Finally, both executives may want to attempt to improve their planning in order to enhance IS performance.

CONCLUSION

The purpose of this study was to apply mindfulness theory to understand how top management support can enhance IS performance. This study investigated the impact of top management support on mindfulness, and the effect of mindfulness on information systems performance. It found that top management support favorably influenced four of five dimensions of mindfulness – preoccupation with IS failure, reluctance to simplify IS interpretations, sensitivity to IS operations, and deference to IS expertise, but that only sensitivity to IS operations influenced IS

performance. The study contributed by extending mindfulness theory to IS research using empirical data, by developing an instrument for measuring collective mindfulness in the information systems context, by showing that top management support generally leads to greater mindfulness, and by showing that top management sensitivity to IS operations leads to improved IS performance. It opened avenues for related future research, and provided suggestions to practicing managers.

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APPENDIX A

All items used a Likert scale with 1 as Strongly Disagree and 5 as Strongly Agree.

Collective Mindfulness

*Instructions: Please answer the following questions based on your perception of the attitude of top management toward the **Information Systems function** in the day-to-day operations of your organization.*

Preoccupation with failure (PF)

1. Top management consistently looks for signals of trouble even during times of smooth operation
2. Top management is always alert for any signs of future problems
3. Top management is preoccupied with the possibility of failure

Reluctance to simplify interpretations (RSI)

1. Top management believes complex responses are needed in complex environments
2. Top management believes general interpretations of events or phenomena may not always apply to our organizational situations
3. Top management is open to new ideas even when they come from outside our organization
4. Top management is reluctant to simplify interpretations

Sensitivity to operations (SO)

1. Top management entertains the possibility of a high degree of unreliability in the current operations
2. Top management is sensitive to operations

Commitment to resilience (CR)

1. Top management believes it is difficult to identify and develop contingency plans for every possibility
2. Top management favors improvisation over planning
3. Top management favors adaptation over routine
4. Top management favors effectiveness over efficiency
5. Top management believes tradeoffs between schedule, budget, and delivered functionality need creative adjustment
6. Top management believes inevitable surprises and mistakes in new undertakings are opportunities to learn

Deference to expertise (DE)

1. Top management believes, in times of crisis, the authority of action should flow to individuals and units with the relevant expertise in the problem at hand
2. Top management believes formal structures within the organization may be relaxed so that expertise is given priority over rank or departmental boundaries
3. Top management defers to expertise over rank

Information Systems Performance

Instructions: The following statements measure typical perceptions about information systems (IS) performance within a firm. Please check the appropriate number which best indicates the strength of your agreement with these statements as they relate to your firm.

1. End-users recognize the benefits of our IS function's services
2. Our IS function is perceived as facilitating better decision making
3. End-users are generally satisfied with the services of the IS function
4. The use of IS services has led to better management of organizational activities
5. Our IS function has failed to meet end-user performance expectations
(This question is reverse coded)

Top Management Support

Instructions: Please check the number which best indicates the strength of your agreement with these statements as they relate to your firm and your perceptions of the relation between top management and Information Systems (IS) function.

1. Top management involvement with IS function is strong
2. Top management is interested in IS function
3. Top management understands the importance of IS
4. Top management supports the IS function
5. Top management considers IS as a strategic resource
6. Top management understands IS opportunities
7. Top management keeps the pressure on operating units to work with IS

APPENDIX B

Table B1: Top Management Support Construct: Item Means and Standard Deviations.

Item#	Item	Mean	S.D.
TMS1	Top management involvement with IS function is strong	3.94	.92
TMS2	Top management is interested in IS function	4.23	.63
TMS3	Top management understands the importance of IS	4.45	.65
TMS4	Top management supports the IS function	4.34	.60
TMS5	Top management considers IS as a strategic resource	4.35	.57
TMS6	Top management understands IS opportunities	3.98	.87
TMS7	Top management keeps the pressure on operating units to work with IS	4.37	.65
	Top management support (average of items)	4.23	.57

Table B2: Mindfulness Constructs: Item Means and Standard Deviations.

Item#	Item	Mean	S.D.
Preoccupation with Failure			
PF1	Top management consistently looks for signals of trouble even during times of smooth operation	3.87	.91
PF2	Top management is always alert for any signs of future problems	3.85	.87
PF3	Top management is preoccupied with the possibility of failure	1.95	.79
	Overall construct	3.24	.60
Reluctance to Simplify Interpretations			
RSI1	Top management believes complex responses are needed in complex environments	2.40	1.08
RSI2	Top management believes general interpretations of events or phenomena may not always apply to our organizational situations	3.54	.84
RSI3	Top management is open to new ideas even when they come from outside our organization	4.26	.68
RSI4	Top management is reluctant to simplify interpretations	1.93	.67
	Overall construct	3.06	.47
Sensitivity to Operations			
SO1	Top management entertains the possibility of a high degree of unreliability in the current operations	2.40	.96
SO2	Top management is sensitive to operations	4.09	.65
	Overall construct	3.23	.72
Commitment to Resilience			
CR1	Top management believes it is difficult to identify and develop contingency plans for every possibility	3.21	1.06
CR2	Top management favors improvisation over planning	2.30	1.06
CR3	Top management favors adaptation over routine	3.07	.90
CR4	Top management favors effectiveness over efficiency	3.34	.82
CR5	Top management believes tradeoffs between schedule, budget, and delivered functionality need creative adjustment	3.48	.89
CR6	Top management believes inevitable surprises and mistakes in new undertakings are opportunities to learn	4.15	.70
	Overall construct	3.26	.47
Deference to Expertise			
DE1	Top management believes, in times of crisis, the authority of action should flow to individuals and units with the relevant expertise in the problem at hand	4.22	.66
DE2	Top management believes formal structures within the organization may be relaxed so that expertise is given priority over rank or departmental boundaries	3.87	.83
DE3	Top management defers to expertise over rank	4.05	.69
	Overall construct	4.04	.58

Table B3: IS Performance Construct: Item Means and Standard Deviations.

Item#	Item	Mean	S.D.
ISP1	End-users recognize the benefits of our IS function's services	3.89	.79
ISP2	Our IS function is perceived as facilitating better decision making	3.80	.78
ISP3	End-users are generally satisfied with the services of the IS function	3.87	.77
ISP4	The use of IS services has led to better management of organizational activities	4.00	.66
ISP5	Our IS function has failed to meet end-user performance expectations (reverse coded)	2.02	.88
	IS performance (average of items)	3.90	.56

COMMUNICATIONS

Shaji A. Khan

Assistant Professor, Foster College of Business Administration

Bradley University, 1501 W. Bradley Ave, Peoria, IL 61625

Phone: 314-516-6267; Fax: 314-516-6827

Email: sakbm9@mail.umsl.edu

Albert L. Lederer

Professor, C.M. Gatton College of Business and Economics

University of Kentucky, Lexington, KY 40506-0034

Phone: 859-257-2536; Fax: 859-257-8031

Email: lederer@uky.edu

Dinesh A. Mirchandani (Contact)

Associate Professor, College of Business Administration

University of Missouri - St. Louis, 1 University Boulevard

St. Louis, MO 63121-4499

Phone: 314-516-7354; Fax: 314-516-6827

Email: mirchandani@umsl.edu