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Information and Collective Mindfulness - A Methodological Replication Study

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Abstract:

This paper reinvestigates the cognitive theory of collective mindfulness on organizational Information Systems performance by conducting a methodological replication of Khan, Lederer, and Mirchandani's (2013) study. Collective mindfulness in the context of organizational information systems (IS) has significant effects on effectiveness and performance. We found that upper management concern and support for IS influences organizational performance through collective mindfulness. Upper management concern for typical and atypical situations and their associated repercussions on performance require solutions in real-time and concern for alternative problem-solving methods. Collective mindfulness addresses the notion of a more in-depth and purposeful analysis of potential catalysts negatively affecting performance. Future studies are encouraged to strengthen this study through construct improvement including the addition of relevant dimensions to collective mindfulness.

Keywords: Collective Mindfulness, Information Systems, Organizational Performance, Conceptual Replication

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1 Introduction

Organizations invest in information systems (IS) to improve organizational efficiency, decision making, and innovativeness (Trantopoulos, von Krogh, Wallin, & Woerter, 2017). Top management's concern in achieving these goals requires a continual focus on potential and actual systemic errors, and their resolution (Butler & Gray, 2006). For example, a highly contested hallmark of IS performance is information security. Within the last decade, several high-profile data breaches have occurred against companies like Target, Sony, and Equifax, which have resulted in billions of dollars in damages to both customers and organizations (DeSot, 2015; Peterson, 2014; Target, 2014). The cognitive theory of collective mindfulness addresses the need to assess IS performance and reliability (Butler & Gray, 2006; Brown, Ryan, & Creswell, 2007; Swanson & Ramiller, 2004; Langer, 1989). Further, the notion of collective mindfulness addresses the continual vigilance on performance by addressing the need for organizations to monitor environmental and operational conditions and consider alternate perspectives, and understanding failures as a way to improve organizational performance and reliability (Butler & Gray, 2006, p. 211). Khan, Lederer, and Mirchandani (2013) conducted a test of this theory by operationalizing its dimensions as asserted by Swanson and Ramiller (2004) and Butler and Gray (2006).

We performed a methodological replication process of the Khan et al. (2013) study by using a more extensive sample of respondents. We offer several contributions to this replication study. First, we found support for collective mindfulness to explain the motivations and behaviors of supportive management concerning mindful IS performance. Second, we used a larger sample size to test the model's nomology and found that the explanatory power was improved. Finally, we uncovered the potential to improve the formative collective mindfulness concepts based on the PLS-SEM analysis. We perceived that a closer examination of the formative dimensions could improve with a more in-depth investigatory process by adding and refining the measurement items.

The structure of this paper is as follows. We describe the research method, data collection, and analysis processes, followed by a comparison of our results to Kahn et al. (2013) results. Finally, we close with a discussion of the implications arising from our study and suggestions for future research.

2 Research Hypotheses

The primary objective of the current study was to test the methodological replicability of the Khan et al. (2013) research model, which focuses on understanding top management support and commitment to IS performance. The following are the hypotheses to be tested.

Hypotheses 1: The greater the top management support for information systems, the greater the preoccupation with information systems failure.

Hypotheses 2: The greater the top management support for information systems, the greater the reluctance to simplify information systems interpretations.

Hypotheses 3: The greater the top management support for information systems, the greater the sensitivity to information systems operations.

Hypotheses 4: The greater the top management support for information systems, the greater the commitment to information systems resilience.

Hypotheses 5: The greater the top management support for information systems, the greater the deference to information systems expertise.

Hypotheses 6: The greater the top management preoccupation with IS failure, the greater the IS performance.

Hypotheses 7: The greater the top management reluctance to simplify IS interpretations, the greater the IS performance.

Hypotheses 8: The greater the top management sensitivity to IS operations, the greater the IS performance.

Hypotheses 9: The greater the top management commitment to IS resilience, the greater the information systems performance.

Hypotheses 10: The greater the top management deference to IS expertise, the greater the IS performance.

3 Method

A cross-sectional survey design facilitated by panel data from an organization specializing in Internet-based research serves as our data collection method. The management literature has successfully conducted this type of sampling, particularly when specific participant characteristics are required (Carlson, Ferguson, Hunter, & Whitten, 2012; Judge, Ilies, & Scott, 2006). All measurement items (table 2), scales, and respondent selection criteria were adopted from (Khan et al., 2013). A purposive sampling methodology was necessary to select respondents based on established criteria set by the original study (Mangal & Mangal, 2013). The selection criteria include bounding the survey to the United States, 'for profit' organizations, and individuals in top management positions.

Table 1. Example Constructs, Items, and Descriptive Statistics

		Current Study		Khan et al. (2013)	
Construct	**Item**	**Mean**	**St. Dev**	**Mean**	**St. Dev**
Preoccupation with failure (PF)					
PF1	Top management consistently looks for signals of trouble even during times of smooth operation	4.16	1.31	3.87	0.91
PF2	Top management is always alert for any signs of future problems	4.26	1.17	3.85	0.87
PF3	Top management is preoccupied with the possibility of failure	3.52	1.39	1.95	0.79
Reluctance to simplify interpretations					
RS1	Top management believes complex responses are needed in complex environments	3.71	1.27	2.40	1.08
RS2	Top management believes general interpretations of events or phenomena may not always apply to our organizational situations	3.66	1.17	3.54	0.84
RS3	Top management is open to new ideas even when they come from outside our organization	3.91	1.22	4.26	0.68
RS4	Top management is reluctant to simplify interpretations	3.37	1.41	1.93	0.67
Sensitivity to operations					
SOP1	Top management entertains the possibility of a high degree of unreliability in the current operations	3.61	1.30	2.40	0.96
SOP2	Top management is sensitive to operations	3.96	1.04	3.23	0.65
Commitment to resilience					
CR1	Top management believes it is difficult to identify and develop contingency plans for every possibility	3.63	1.17	3.21	1.06
CR2	Top management favors improvisation over planning	3.57	1.28	2.30	1.06
CR3	Top management favors adaptation over routine	3.87	1.09	3.07	0.90
CR4	Top management favors effectiveness over efficiency	3.99	1.01	3.34	0.82
CR5	Top management believes trade offs between schedule, budget, and delivered functionality need creative adjustment	3.94	0.97	3.48	0.89
CR6	Top management believes inevitable surprises and mistakes in new undertakings are opportunities to learn	4.02	0.92	4.15	0.70
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	4.08	0.93	4.22	0.66
DE2	Top management believes formal structures within the organization may be relaxed so that expertise is given priority over rank or departmental boundaries	3.85	0.99	3.87	0.83
DE3	Top management defers to expertise over rank	3.93	1.05	4.05	0.69
Information Systems Performance					
ISP_1	End-users recognize the benefits of our IS function's services	4.07	0.97	3.89	0.79
ISP_2	Our IS function is perceived as facilitating better decision making	4.06	0.93	3.80	0.78
ISP_3	End-users are generally satisfied with the services of the IS function	4.13	0.89	3.87	0.77
ISP_4	The use of IS services has led to better management of organizational activities	4.18	0.86	4.00	0.66
ISP_5	Our IS function has failed to meet end-user performance expectations	3.49	1.36	2.02	0.88
Top Management Support					
TMS_1	Top management involvement with IS function is strong	4.13	1.00	3.97	0.92
TMS_2	Top management is interested in IS function	4.25	0.81	4.23	0.63
TMS_3	Top management understands the importance of IS	4.12	0.89	4.45	0.65
TMS_4	Top management supports the IS function	4.05	0.85	4.34	0.60
TMS_5	Top management considers IS as a strategic resource	4.04	0.96	4.35	0.57
TMS_6	Top management understands IS opportunities	3.91	1.11	3.98	0.87
TMS_7	Top management keeps the pressure on operating units to work with IS	4.07	0.97	4.37	0.65

4 Findings

One hundred and three participants completed the survey. There were no missing data cases, and thus all data were usable for a 100% response rate. Fifty-five of the participants were male, 45 were female, and three preferred not to disclose their gender. Approximately 96 percent of the respondents achieved education beyond high school with 54 percent attaining a graduate degree. The majority of participants worked in technology (25%), manufacturing (17%), and real estate (10%). The majority of age groups ranged from 20-49 (88%). Thirty-five percent were in the c-suite (CIO, CTO, & COO), 26% were in the president/CEO position, 18% were owners, 16% were in the vice-president position, and 5% were in the role of senior vice-president.

4.1 Reflective Construct Assessment

The research model for the current study was analyzed using partial least squares structural equation modeling (PLS-SEM) techniques via SmartPLS 3 software (Ringle, Wende, & Becker, 2015). PLS-SEM assesses the psychometric properties of the measurement items and in modeling the relationships among the independent and latent dependent variables simultaneously. PLS is a correlational-based parametric method with fewer stringent assumptions on data distribution.

The research model for this study contains both reflective and formative items. We assessed the reflective items first followed by the formative items. The reflective assessment process begins by measuring reliability through Cronbach's alpha (CA), composite reliability (CR), and convergent and discriminant validity. Cronbach's alpha evaluates internal consistency in which measurement items should correlate and consistently measure what they purport to measure (Straub, Boudreau, & Gefen, 2004). Table 3 presents the CA, CR, and average variance extracted (AVE) results. The CA values were within the recommended minimum acceptable value of 0.70 (Nunnally, 1978). A shortfall of Cronbach's alpha is that it tends to underestimate internal consistency because of "its sensitivity to the number of items in the scale" (Hair Jr., Hult, Ringle, & Sarstedt 2017, p.111). Composite reliability addresses this limitation by examining the items' outer loadings (Hair Jr. et al. 2017). The CR values were within the suggested threshold of 0.60 (Bagozzi & Yi, 1988). Convergent validity measures the amount of error-free variance in a set of measurements captured by their assigned construct through average variance extracted (AVE). The AVE results appear to capture at least 50% of the measurement variance (Fornell & Larcker, 1981; Hair Jr. et al. 2017).

Table 3. Reliability Results

Variable	CA	CR	AVE	Sqrt/AVE
IS Performance	0.769	0.851	0.589	0.767
Top Management Support	0.775	0.847	0.527	0.725

CA = Cronbach's Alpha
CR = Composite Reliability
AVE = Average Variance Extracted
Sqrt/AVE = Square root of the Average Variance Extracted

Convergent validity occurs when measurement items thought to theoretically reflect a given construct converge on their assigned factor (Hair Jr. et al. 2017). Table 4 indicates that most of the reflective indicators appeared to load higher on their associated construct and satisfied the minimum recommended value of 0.70 (Gefen, Straub, & Boudreau, 2000). ISP1 appears to load high on the TMT construct (.717). However, ISP1 loads at least 10% less on other constructs thus satisfying the convergent validity requirements (Gefen & Straub, 2005). Items TMS5 and ISP5 loaded well below the recommended minimum of 0.70. As a result, each item was removed independently and the model re-run to note any effects. No significant effects were present.

Discriminant validity assesses the uniqueness of a construct measuring a phenomenon that is uncaptured by other constructs in a given model (Hair, Jr., et al. 2017). Construct measurement items should load higher on their associated construct than with other items. Table 4 shows that items loaded higher on their associated construct than with others.

Table 4. Cross Loadings			
Variable	**TMS**	**ISP**	**VIF**
TMS1	**0.756**	0.524	1.688
TMS2	**0.658**	0.506	1.426
TMS3	**0.676**	0.523	1.362
TMS6	**0.784**	0.506	1.654
TMS7	**0.666**	0.531	1.386
ISP1	0.715	**0.841**	1.326
ISP2	0.459	**0.735**	1.670
ISP3	0.519	**0.749**	1.408
ISP4	0.427	**0.740**	1.643
TMS = Top Management Support ISP = Information Systems Performance VIF = Variance Inflation Factor			

4.2 Formative Construct Validity

The mindfulness constructs for this study are formative, which requires a different methodology for assessing construct validity (Chin, 1998). We begin the formative validity process by assessing multi-collinearity and item significance. Unlike reflective constructs, formative measures are not interchangeable and thus exhibit minimal if any collinearity. High multi-collinearity indicates a conceptual overlap between two or more measurement items (Cenfetelli & Bassellier, 2009). One method to measure multicollinearity involves the variance inflation factor (VIF). Table 5 shows that the VIF value for all formative items was below the recommended 3.33 threshold (Diamantopoulos & Siguaw, 2006). We, therefore, perceived no multi-collinearity issues.

Another measure of construct validity is the assessment of item significance and relevance on their associated formative construct. According to Cenfetelli & Bassellier (2009) and Hair Jr. et al. (2017), the outer weights of each formative measurement signify its relative contribution to its associated construct. We executed the bootstrap procedure using 5000 subsamples with the no sign change option set and the PLS algorithm to measure the outer weights, (Hendeler, Ringle, & Sinkovics, 2009; Hair Jr. et al., 2017). Table 5 shows that measurement item CR6 (.563) contributes most to Commitment to resilience followed by CR5, CR4, and CR3. DE1 (.542) contributes most to Deference to Expertise, followed by DE2, and DE3. PF2 (0.514) contributes most to Preoccupation to Failure, followed by PF3, and PF1. RS3 (0.765) contributes most to Reluctance to Simplify Interpretations followed by RS1 and RS4. SO1 (.628) contributes most to Sensitivity to Operations followed by SO2. Items with a non-significant weight do not necessarily imply that they should be dropped (Hair Jr. et al. 2017). However, items with a non-significant outer weight and a loading value less than .50 are candidates for removal from the model (Hair Jr. et al. 2017). Therefore, formative items CR1 (.381) and RS2 (.421) were removed because of their low loading values and insignificant outer weights. We, therefore, perceive that while the majority of formative items contribute appropriately to the model, measurement items CR1 and RS2 require further examination.

Table 5. Formative Outer Weights and Loadings					
Variables	**Outer Loading**	**Outer Weight**	**t-statistic**	**p-value**	**VIF**
CR2 -> Commitment to IS resilience	0.541	-0.069	0.450	0.652	1.796
CR3 -> Commitment to IS resilience	0.673	0.043	0.215	0.830	2.251
CR4 -> Commitment to IS resilience	0.760	0.337	1.629	0.103	1.582
CR5 -> Commitment to IS resilience	0.781	0.332	1.847	0.065	1.842
CR6 -> Commitment to IS resilience	0.875	0.563	3.470***	0.001	1.624
DE1 -> Deference to IS expertise	0.861	0.542	3.719***	0.000	1.416
DE2 -> Deference to IS expertise	0.855	0.532	3.552***	0.000	1.402
DE3 -> Deference to IS expertise	0.556	0.142	0.940	0.347	1.248
PF1 -> Preoccupation with IS failure	0.780	0.320	1.004	0.316	1.596
PF2 -> Preoccupation with IS failure	0.877	0.514	1.936*	0.053	1.668
PF3 -> Preoccupation with IS failure	0.745	0.403	2.170*	0.030	1.264
RS1 -> Reluctance to simplify IS interpretations	0.697	0.293	1.367	0.172	1.462
RS3 -> Reluctance to simplify IS interpretations	0.937	0.765	4.443***	0.000	1.249
RS4 -> Reluctance to simplify IS interpretations	0.516	0.153	0.848	0.396	1.299
SO1 -> Sensitivity to IS operations	0.864	0.628	3.241***	0.001	1.221
SO2 -> Sensitivity to IS operations	0.823	0.556	2.667**	0.008	1.221
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$ VIF = Variance Inflation Factor					

4.3 Formative Construct

The results of the structural model appear in Figure 1. In accordance with the original design, TMS is the independent variable to PF, RSI, SO, CR, and DE, which are the dependent variables. Based on the test of the hypotheses, TMS positively influences PF (H1, $\beta = .41$, $p < .001$), RSI (H2, $\beta = .50$, $p < .001$), SO (H3, $\beta = .41$, $p < .001$), CR (H4, $\beta = .49$, $p < .001$), and DE (H5, $\beta = .64$, $p < .001$). TMS also explains 17%, 25%, 17%, 25%, and 41% of the variance in its associated dependent variables.

The second test of the structural model involves the formative constructs as independent variables on ISP as the single dependent variable. The results indicate that PF does not influence ISP (H6, $\beta = .24$, ns). RSI does not influence ISP (H7, $\beta = -.03$, ns). SO does not influence ISP (H8, $\beta = -.05$, ns). CR positively influences ISP (H9, $\beta = .30$, $p < .01$), and DE positively influences ISP (H10, $\beta = .36$, $p < .001$). Further, the formative constructs explain 51% of the variance in ISP.

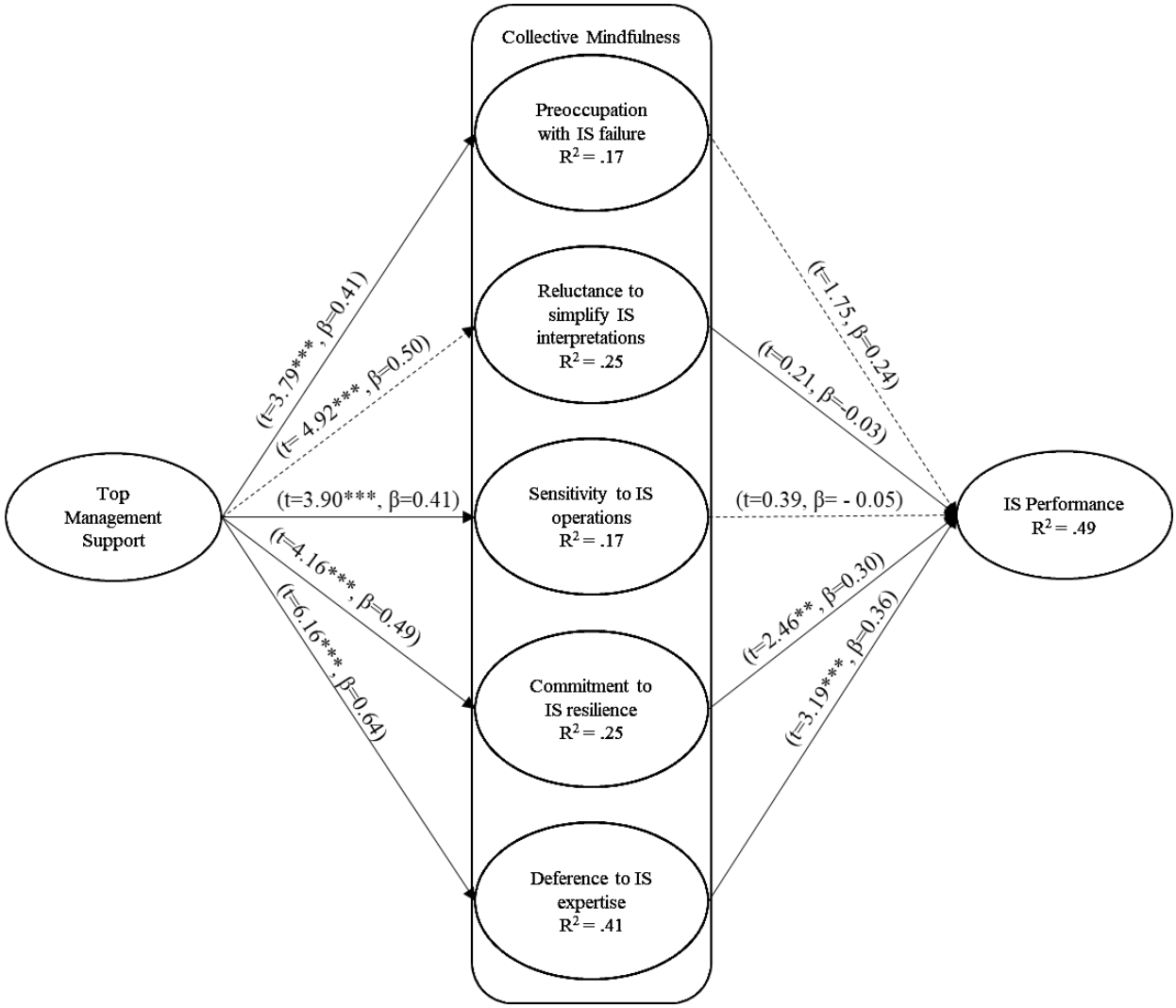

Figure 1. Structural Model Results

5 Discussion and Conclusion

The summarization of the study's findings appears in Table 6. The Khan et al. (2013) study hypothesized that top management support (H1 – H5) leads to collective mindfulness. Further, the higher top management support in collective mindfulness, the greater the IS performance (H6 – H10). While the hypotheses (H1 – H5) appear to support this assertion, it is clear that only a small portion of the collective mindfulness constructs support IS performance. We perceive that our study reasonably replicates Khan et al. (2013) findings with some concessions. First, an appropriate respondent sample should be at least ten times the largest number of paths to any single construct (5 in our model) to ensure appropriate power to detect significant relationships (Hair Jr., Black, Babin, & Anderson, 2010). Regarding the number of paths, a sample size of 55 is the minimum to achieve 80% power with an R^2 of 25% in ISP, at 0.05 significance level (Hair Jr. et al. 2017). Thus, our sample size is sufficient. Khan et al. (2013) conducted their study on a sample of 47 chief executive officers (CEOs) using a model, in the absence of more confirming information, that required a sample size of at least 55 for statistical significance (Hair Jr. et al. 2017).

Table 6. Model Results[1]

			Current Study				Khan et al. (2013)			
H	**Independent Construct**	**Dependent Construct**	R^2	Path	T-value	Result	R^2	Path	T-value	Result
1	Top Management Support	Preoccupation with IS failure	0.17	0.41	3.79***	supported	0.31	0.44	2.70**	supported
2		Reluctance to simplify IS interpretations	0.25	0.50	4.92***	supported	0.31	0.45	2.28*	supported
3		Sensitivity to IS operations	0.17	0.41	3.90***	supported	0.51	0.67	4.65***	supported
4		Commitment to IS resilience	0.25	0.50	4.16***	**supported**	0.38	-0.50	2.34*	**not supported**
5		Deference to IS expertise	0.41	0.64	6.16***	Supported	0.45	0.50	3.02**	supported
6	Preoccupation with IS failure	IS Performance	0.49	0.24	1.75	not supported	0.45	0.09	0.33	not supported
7	Reluctance to simplify IS interpretations		0.49	-0.03	0.21	not supported	0.45	0.20	0.83	not supported
8	Sensitivity to IS operations		0.49	-0.05	0.39	**not supported**	0.45	0.45	2.13*	**Supported**
9	Commitment to IS resilience		0.49	0.30	2.46**	**supported**	0.45	-0.11	0.58	**not supported**
10	Deference to IS expertise		0.49	0.36	3.19***	**supported**	0.45	-0.03	0.13	**not supported**
*p ≤ .05, **p ≤ .01, ***p ≤ .001			N = 103				N = 47			
			Online survey/panel data				Online and Written survey			
			Partial Least Squares				Partial Least Squares			
			SmartPLS V3.2.7				PLS-Graph v.3.00			

A second interesting finding involved the content of the formative measurement items. We performed a literature review to ascertain the operationalization of the mindfulness concepts and related topics. In concordance with Khan et al.'s (2013), we found no operationalized instruments for the mindfulness constructs in the literature review, which potentially explains the need for their development. Since formative items *cause* the construct and are not interchangeable (Hair Jr. et al. 2017), establishing content validity may partly explain some of the differences between studies. Content validity involves determining if the measurement items truly and unequivocally represent the construct (Straub, Boudreau, & Gefen 2004). While the original study documented the methodology used to create the constructs, it is likely that additional investigation is necessary to account for previously undiscovered dimensions.

Another interesting finding was the support of three hypotheses that were unsupported in the original study. Hypothesis 4 asserted that the greater the top management support for information systems, the greater the commitment to information systems resilience. Our results show that hypothesis 4 was supported (t=4.16, β=.50, p < .001). While it is possible that the increased sample size supported the hypothesis, the formative measurement items require focus. The original study did not incorporate a global reflective measure for the formative construct thus negating the ability to conduct a redundancy analysis (Chin, 1998; Hair Jr. et al., 2017). Except for CR1, the outer loadings for the remaining CR items were above the minimum threshold of .50. However, only one item was statistically significant (CR6 t = 3.470, p ≤ .001). Further, CR2's outer weight (-0.069) suggested a suppressor effect indicating possible collinearity with other items (Cenfetelli & Bassellier, 2009). However, the VIF results suggest no multicollinearity issues thus supporting the items retention.

[1] The bolded items represent the differences between the hypotheses of our study and Khan et al., 2013).

Hypothesis 8 asserted that the greater the top management sensitivity to IS operations, the greater the IS performance (t=.19, β=.02, ns). Sensitivity to Operations (SO) refers to the ability of an organization to focus on small details during day-to-day operations. It is the concern that significant problems usually appear from overlooking small issues (Swanson & Ramiller 2004). The results for the SO items (c.f. Table 5), appear to exhibit statistical issues. However, an examination of the literature appears to refer to this dimension globally, which is evident in the SO items. A critical point Swanson and Ramiller (2004) suggest that SO applies to situations requiring "extreme time pressure" (p. 560). Therefore, it is likely that the SO construct lacks specificity. Further research should examine this dimension by focusing on organizations that deal with time-sensitive decisions.

Finally, we confirmed support for hypotheses 9 (t=2.46, β=.30, $p < .05$), which asserts that the greater the top management commitment to IS resilience, the greater the information systems performance. Hypothesis 10 is supported (t=3.19, β=.36, $p < .05$), which asserts that the greater the top management deference to IS expertise, the greater the IS performance. The CR item issues notwithstanding, DE1 and DE2 appear to be measuring the same condition (1) that only experts with the most knowledge on a particular situation handle the issue and (2) that management should relax its structural boundaries to support the former. However, Swanson and Ramiller (2004) caution that "care must be taken not to conceptualize expertise too narrowly" (p. 561) and it is "about attending to the innovation with reasoning grounded in the firm's own facts and specifics" (p.561). The three items making up the Deference to expertise construct may be devoid of additional dimensions creating a conflicting replication stability issue.

A final note regarding the replication of the Khan et al. (2013) study involves the configuration of the collective mindfulness constructs. While the results of the constructs as formative indicate construct dimensionality (c.f. Table 5) and loadings (> .70), it may be possible to arrange the items as reflective. Therefore, we conducted a post hoc analysis by switching the collective mindfulness constructs to reflective indicators. Table 7 presents a comparison of all three models. The results show that when modeling the collective mindfulness constructs as reflective, the model remains consistent except one hypothesis. Hypothesis 6 posits that the greater the top management preoccupation with IS failure, the greater the IS performance. The results show that with reflective indicators, H6 is supported such that in the original and replicated models, this was not the case.

Table 7. Model Results[2]

			Current Study-Formative				Current Study-Reflective				Khan et al. (2013)			
H	IV	DV	R^2	Path	T-value	Result	R^2	Path	T-value	Result	R^2	Path	T-value	Result
1	TMS	PF	0.17	0.41	3.79***	supported	0.16	0.41	3.70***	supported	0.31	0.44	2.70**	supported
2		RS	0.25	0.50	4.92***	supported	0.23	0.48	4.87***	supported	0.31	0.45	2.28*	supported
3		SO	0.17	0.41	3.90***	supported	0.17	0.41	4.05***	supported	0.51	0.67	4.65***	supported
4		CR	0.25	0.50	4.16***	**supported**	0.19	0.44	3.95***	**supported**	0.38	-0.50	2.34*	**not supported**
5		DE	0.41	0.64	6.16***	Supported	0.39	0.63	5.99***	supported	0.45	0.50	3.02**	supported
6	PF	ISP	0.49	0.24	1.75	not supported	0.49	0.30	1.98*	**supported**	0.45	0.09	0.33	not supported
7	RS		0.49	-0.03	0.21	not supported	0.49	-0.08	0.49	not supported	0.45	0.20	0.83	not supported
8	SO		0.49	-0.05	0.39	**not supported**	0.49	-0.07	0.56	**not supported**	0.45	0.45	2.13*	**supported**
9	CR		0.49	0.30	2.46**	**supported**	0.49	0.30	2.35*	**supported**	0.45	-0.11	0.58	**not supported**
10	DE		0.49	0.36	3.19***	**supported**	0.49	0.37	3.23**	**supported**	0.45	-0.03	0.13	**not supported**
			N = 103				N = 103				N = 47			
			Online survey/panel data				Online survey/panel data				Online and Written survey			
			Partial Least Squares				Partial Least Squares				Partial Least Squares			
			SmartPLS V3.2.7				SmartPLS V3.2.7				PLS-Graph v.3.00			

*p ≤ .05, **p ≤ .01, ***p ≤ .001

IV = Independent Variable
DV = Dependent Variable
H = Hypothesis
TMS = Top Management Support, PF = Preoccupation with IS Failure, RS = Reluctance to Simplify IS Interpretations, SO= Sensitivity to IS Operations, CR = Commitment to IS Resilience, DE = Deference to IS Expertise, ISP = Information Systems Performance

6 Limitations and Future Research

We identified four limitations to consider in interpreting our results. First, applying the current findings to organizations that are concerned with collective mindfulness are tenuous because the real extent to which these respondents are representative of most organizations is unknown. For example, Weick and Sutcliffe (2001) reference high-reliability organizations (HRO) as dealing with potential life and death situations such as naval operations, and healthcare. However, it is likely that E-commerce organizations such as Amazon, E*Trade, and Netflix, though not life affecting, are taxonomically HRO's. While we did not specifically target HRO's in our study, it is probable that organizations that fit this profile might make the findings less generalizable.

[2] The bolded items represent the differences between the hypotheses of our study and Khan et al., 2013).

Second, while Khan et al. (2013) provided information on the research methodology, there appears to be an opportunity to refine the collective mindfulness dimensions. For example, with the exception of the Deference to IS expertise construct, the coefficient of determination results exhibit a weak effect (Hair Jr. et al. 2017). The development of the formative measurement items stems from a somewhat limited literature review and an expert panel. Further, only a single pilot test was conducted to test the items and likely raises a concern for content validity (Straub, Boudreau, & Gefen, 2004).

Third, it is unknown whether the nomology fully captures the representation of each item based on the evidence in the formative assessment tests. Future studies should focus on investigating and improving the dimensions comprising the collective mindfulness formative constructs. It is also likely that additional constructs can further refine the model's cohesiveness. We encourage future research to replicate this study by seeking broader national and international organizations with a more significant impact on the marketplace and society to determine the model's stability.

Finally, care must be observed when interpreting the post hoc results. While it is possible to argue for configuring collective mindfulness as reflective, future research should conduct appropriate construct analyses.

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