# How Organizational Performance Influences Managerial Search? – Towards 'Informating Search' Theory

*Research-in-Progress*

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## Abstract

*Although we expect managers to use the capabilities of business analytics systems to search for solutions and improve firm performance, we do not have a good understanding of the factors that motivate managers to undertake such search. Drawing on attribution and control theories, we propose a theory that explicates the performance conditions under which managers undertake search activities. Specifically, we theorize that managers are motivated to search for knowledge when both, operational performance and overall organizational performance, are declining. Further, we propose that managers' search response to sustained organizational performance failure is faster (low search latency) when the magnitude of sustained failure is larger. We tested our hypotheses with longitudinal data collected monthly over a period of four years from seven hospitals. Distributed lag model analysis of the data supports our hypotheses. We conclude with implications for research and practice, and plans for future research.*

**Keywords:** Business Analytics, Managerial Search, IS Use, Performance Feedback, Longitudinal Analysis

# Introduction

Managers' use of the informating capability[1] of information systems (IS) has been found to contribute to improved organizational performance (Burton-Jones 2014; Zuboff 1988). Two mechanisms underpin that relationship. First, the use of informating capabilities generates valuable knowledge for managers about the cause-effect relationships between performance and the factors affecting performance. By searching through data and analyzing variability in performance, managers identify factors associated with performance variability. Second, managers employ the acquired knowledge to devise strategies and actions to improve future performance (Anand et al. 2016; Chen et al. 2012; Sharma et al. 2010).

How managerial search is influenced by performance variations, however, is a complex phenomenon. While scholars have argued that organizational learning underpinned by search activities leads to improved performance, researchers have also found that managers find it difficult to learn from experience (Baumard and Starbuck 2005). In particular, managers exhibit different search and learning behaviors in response to successes and failures that are pertinent to performance variations (Desai 2010b; Madsen and Desai 2010). Analysis of increasing as well as declining performance offers potentially useful learning for managers. However, prior research has found those effects to be asymmetrical: decision makers are more likely to learn from large failures than from small failures (Desai 2015; Haunschild and Rhee 2004; Haunschild and Sullivan 2002). Specifically, the larger the failures, the greater the likelihood that organizations will engage in search and learning efforts to improve performance. More importantly, prior research finds that success is unlikely to stimulate search and learning behaviors (Baum and Dahlin 2007).

The effort expended on search and the asymmetric effects of performance feedback on search effort are hypothesized as key mechanisms in the findings of previous works relating failures to future performance (Baum and Dahlin 2007; Desai 2015; Madsen and Desai 2010). Although scholars have theorized the above cited mechanisms (failures/success→search→learning→performance), the empirical studies have primarily examined the relationship between failure→performance at the organizational level without examining the effects of failure/success on managerial search. This is acknowledged as a key limitation of that literature (Baum and Dahlin 2007). This missing link (failure/success→search) limits our understanding of how past performance variations influences managers' search effort that is related to subsequent learning and performance improvements.

In this study, we examine that missing link, i.e. the effect of performance feedback on managers' search behavior. We contribute to the discourse on how past performance influences search. In particular, we distinguish between the effects of operational performance and organizational performance on managers' search efforts. In doing so, we also contribute to the IS use literature by theorizing the effects of past performance on managers' use of informating capabilities to search for knowledge. Particularly, our findings contribute to the growing literature on how the use of informating capabilities embedded in business analytics systems can contribute to improved performance (Chen et al. 2012; Sharma et al. 2014). The promise of performance gains from analyzing historical data and devising performance improvement strategies is a key motivation for organizations to invest in systems with informating capabilities (Anand et al. 2016; Anand et al. 2013; LaValle et al. 2011). Those include, for instance, business analytics systems, business intelligence systems, data warehouses, and other systems with capabilities to integrate, analyze and visualize data (Chen et al. 2012; Kohli 2007; Watson 2014). Managers are keen to understand how to exploit those capabilities to create organizational value (Anand et al. 2016). The findings of this research contribute to that understanding.

This paper is set out as follows. Drawing from the tenets of attribution theory (Heider 1958; Kelley 1971; Vaara et al. 2014) and control theory (Anthony et al. 1989; Simons 1991; Simons 2013), we theorize a contingent model of how performance variation affects the use of informating capabilities in subsequent periods. Specifically, we hypothesize that both operational performance and organizational performance exert contingent effects on the use of informating systems in subsequent period. We further hypothesize that the latency of search response is a function of the magnitude of failure in organizational performance. We draw on longitudinal data collected over four years from seven hospitals to test the hypotheses

[1] We advance the notion of IS use and emphasize IS capability use. As various type of IS are integrated into firm wide multi-function systems, they create capabilities such as analytic capability. Therefore, IS capability use is a more relevant construct to examine.

developed in this paper. The longitudinal data is analyzed using distributed lag model to test our hypotheses. The findings provide strong support for the theory developed in this paper. We conclude with a discussion of the implications of our findings for research and practice, and plans for future research.

## Performance Feedback and Managerial Search

Managerial search, defined as the effort spent by managers in acquiring and analyzing information to discover knowledge, is a key predictor of learning and future performance (Cyert and March 1963). Knowledge here refers to managers' understanding of cause-effect relationships between performance and factors that affect performance. The desire to understand and explain performance variation is a key intrinsic motivation that underpins managerial efforts expended in search and learning (Desai 2015; Haunschild and Rhee 2004; Haunschild and Sullivan 2002; March 1991). Indeed, problemistic search, a form of search *"stimulated by a problem … and … directed toward finding a solution to that problem"* is considered to be a key predictor of learning (Cyert and March 1963). In particular, prior research finds that managers learn more effectively from failures than from successes (Greve 2003; Jordan and Audia 2012; Salge et al. 2015). Researchers speculate that this is due to the asymmetric effects of performance feedback on managerial search. Managers are more motivated to search for explanations of failures than of successes (Baum and Dahlin 2007; Desai 2015; Madsen and Desai 2010).

The failure-search-learning-performance sequence has been examined in prior literature. For instance, Lant and Montgomery (1987) report that decision-makers' choices and engagements in more/less innovative actions was a function of their attainment discrepancy and perceived failure/success in past performances. Similarly, Haunschild and Sullivan (2002) examined the effect of prior organizational accident experience on future accident rates among large U.S. airlines and found that prior accident experience was associated with reduced rates of future accidents. Lapré and Tsikriktsis (2006) report a similar pattern in improving customer satisfaction in a study of the airlines industry. Madsen and Desai (2010) report further evidence of the link between failure and search, drawing on NASA's immediate response in forming an accident investigation unit to learn the causes behind the failure of the Columbia Space Shuttle. They also found that learning was more effective following failure periods rather than after success periods and that the knowledge accumulated from failures depreciated more slowly than knowledge accumulated during success periods. Similarly, Darr et al. (1995) report that organizations acquired significantly more knowledge after experiencing an operational failure, such as increasing unit cost of production. Similar findings are reported in the gas (Desai 2010a), railroad industries (Baum and Dahlin 2007; Desai 2010b) and hospitals (Desai 2015). The above-cited literature provides compelling evidence in support of the proposition that organizational performance improves following failures, but not following successes.

A key criticism of the above body of literature is that it has focused on investigating the relationship between failure experiences and future performance primarily at the organizational level (Baumard and Starbuck 2005). That has resulted in two important theoretical gaps in our understanding of the processes underpinning that relationship. First, past studies implicitly assume that managerial search is an automatic response to failure, but has not empirically examined that relationship. Indeed, it is generally the failure-learning/performance sequence that has been empirically investigated in prior literature, while the *failure-search* sequence remains the missing link that needs to be investigated. Second, though the literature theorizes asymmetrical effects of performance on learning, it does not investigate whether search responds differently to success than to failures (Madsen and Desai 2010).

Another important limitation of the above literature is that it is ambivalent about the effect of the locus of failure on managerial search behavior. Specifically, it is unclear whether managers' search behavior is affected by failure in the performance of the unit they are managing or by overall organizational failure. Prior literature, while articulating the effects of performance on search behaviors, has not distinguished between the effects of the performance of the unit that a manager is responsible for and the aggregate performance of the organization within which that unit is embedded. The individual performances of all managerial units within an organization, while likely to be correlated to some extent, are also likely to be influenced by unique factors as they each operate in different competitive spaces. As a result, at any given point in time some managerial units may be experiencing success and some may be experiencing failure. Consequently, aggregate performance is not likely to be perfectly correlated with the performance of individual units at all points in time. Hence, it is important to investigate the effect of aggregate

organizational performance too on the search behaviors of managers of individual organizational units as that is one of the key loci of organizational learning. The key question is whether managers engage in search in response to their own failures only or in response to organizational failures, or both. Extending prior literature, we theorize that while managers' search behavior is expected to be asymmetrical under success and failure conditions with respect to the performance of their own unit, it is likely to be influenced by trends in overall organizational performance too.

The above literature has an important bearing on our understanding of how organizations are likely to use informating capabilities embedded in analytics systems and how that use is likely to be affected by various contextual contingencies, in particular, the patterns in the performance of organizational units and overall organizational performance. Building on our understanding of informating capabilities use as a form of managerial search, we argue that managerial search behaviors in response to failure periods are different than those in response to success periods. Therefore, understanding how managers' search for knowledge in response to failures and success is important as this would add to our understanding of how analytics capabilities are used and appropriated in the overall learning process.

## *Organizational Performance, Operational Performance and Managerial Search*

Managers' search efforts reflect enactments of the control systems under which they operate (Anthony et al. 1989; Simons 1991; Simons 2013). Organizations employ various control systems to align the extrinsic motivations of managers with the interests and goals of the organization (Eisenhardt 1985; Flamholtz et al. 1985; Snell 1992). In particular, organizations employ output controls such as management by objectives, including financial metrics and non-financial metrics such as customer satisfaction, product sales, capabilities of internal process, innovation and employee skills, to create such alignment (Chenhall 2003; Gomez-Mejia et al. 2014). Output controls involve setting performance goals for multiple operational metrics for managers to achieve, and offering rewards contingent on operational performance exceeding target levels. For instance, sales managers may be rewarded for exceeding targets for new product sales, production managers may be rewarded for not exceeding targets for days lost due to machine breakdown, and accounts managers may be rewarded for not exceeding targets for the number of days of accounts receivables outstanding (Langfield-Smith 2009; O'Connor et al. 2006). Since managers' rewards are contingent on operational performance exceeding target goals, they are extrinsically motivated to search for causes of poor operational performance and develop strategies to improve operational performance of their unit in the next period (Chenhall 2003; Eisenhardt 1985; Flamholtz et al. 1985). However, output controls do not create the same level of extrinsic motivation for managers to search for knowledge when performance is exceeding target levels (Anthony et al. 1989; Simons 1991; Simons 2013).

Attribution theory adds to the above discourse by also proposing that managers are intrinsically motivated to search for causes of failures, rather than successes (Heider 1958; Kelley 1971). Attribution theory posits that managers have an ingrained need to understand their environment and develop causal explanations for significant events (Vaara et al. 2014). It further postulates that managers have a general tendency to attribute failures to external causes over which they have little or no control. This is an effort on the part of managers to protect their self-esteem, to show and maintain their sense of mastery over their environment, and to reduce cognitive dissonance (Bettman and Weitz 1983; Staw et al. 1983). In contrast, managers attribute success to their own abilities and actions over which they can exert control. Hence, there is an enhanced intrinsic motivation to search for causes of failure than for causes of success.

One possible explanation for the above attributions comes from the cognitive biases literature, particularly recall bias (Clapham and Schwenk 1991). There are differences in cognitive processes when managers recall events that occurred prior to positive outcomes versus those that occurred prior to negative outcomes. When managers focus on improving performance, they plan a set of actions to attain objectives. If outcomes are as intended and managers are asked to explain the reasons for successful outcomes, the explanation that they can most readily recall lies in the actions they took. However, if the outcomes are not as intended, it is not likely that they will attribute failure to their own actions. Rather, they rely on identifying external causes that might have undermined or mitigated the intended effects of their actions (Clapham and Schwenk 1991; Schwenk 1984; Schwenk 1985).

Attributional effects are also found in managerial explanations of successes and failures. For instance, Vaara's (2002) study of the post-integration outcomes of eight Finnish-Swedish mergers and acquisitions

found that managers adopted a number of discursive strategies to provide justification/legitimization of their own actions when dealing with the sociopsychological pressures related to success and failure. While managers emphasized their own actions behind successful outcomes, they employed the same discursive frameworks to reframe and reconstruct the actions of failed outcomes to environmental factors such as cultural differences. A similar study by Vaara et al. (2014) also found that managers use cultural differences as a convenient attribution to explain failure. However, they also found that managers attributed extreme cases of failures to their own actions while cases of non-extreme failure were attributed to external causes. One reason behind that was the need to project the sense of control and also to maintain their political image and trustworthiness by accepting blame. Similar findings relating performance to managerial attributions have been reported in a number of other studies too (Billett and Qian 2008; Hayward 2002; Hayward et al. 2004; Lee and Tiedens 2001; Schlenker et al. 2001).

Extending prior research, we propose that the attention that line managers pay to variations in a specific operational performance metric is likely to be a function of the attention that top management is paying to that specific operational metric. Recall that organizations develop multiple operational metrics as a way to manage overall organizational performance. Further, top management is likely to be paying close attention to overall organizational performance, rather than to each specific operational metric. When overall organizational performance is unsatisfactory, top management is more likely to scrutinize each operational metric and push line managers returning unsatisfactory operational metrics to explain and reverse declining operational performance. In contrast, when organizational performance is satisfactory, we expect that the top management is less likely to scrutinize operational performance metrics closely. It follows that the responsiveness of line managers to declines in specific operational metrics is likely to be contingent on the level of overall organizational performance. In other words, managerial search following decline in operational performance is likely to be contingent on overall organizational performance.

The control and attribution effects that are responsible for the asymmetric managerial responses to success and failure operate not only for unit managers, but for their senior managers as well. Just as unit managers have their own goals and targets to perform against, so do senior managers, as do CEOs. Similarly, just as unit managers exhibit attribution effects, so do their managers and CEOs. Following on from this structure of goal and attribution effects, we argue that unit managers are more likely to pay greater attention to their declining operational performance when overall organizational performance is experiencing a sustained decline (failures), i.e. managerial search effort increases when both operational performance and organizational performance decline. However, when organizational performance is stable or increasing, declining unit performance is not likely to have an effect on the managerial search intensity.

Lastly, attribution effects also suggest that top management is unlikely to demand analysis of operational performance when overall organizational performance is stable or increasing. Managers interpret stable and increasing organizational performance as evidence of their own success and that further search of knowledge is deemed unnecessary, inducing managers to ignore any contrary information (Hayward et al. 2004; Lant 1992; Yadav et al. 2007). Hence, under that condition, line managers are not likely to increase their search efforts in response to declines in operational performance. Formally,

*H1: A decline in operational performance is likely to lead to increased search effort in subsequent periods* ***only*** *when organizations are experiencing sustained failures in organizational performance, but not when they are experiencing episodic failure or episodic or sustained success.*

We have proposed above that the extent of managerial search is contingent on the magnitude of operational and organizational failures. We further propose that when organizations experience sustained failures in organizational performance, the latency between decline in operational performance and managerial search efforts is a function of the magnitude of the speed of failure in organizational performance. Sustained failures indicate an existence of knowledge gaps and reveal a need to search for the source from where those problems are arising (Levinthal and March 1981). Organizational control systems are sensitive to large disruptions and react more quickly to avoid further declines and damage control mechanism are quickly activated: the larger the magnitude and speed of failure, the faster the response. Performance control systems are commonly employed to assign accountability for failures. Operational managers understand this and calibrate their responses to the magnitude and speed of failure. Specifically, the greater the magnitude and faster the failure, the greater is the sense of urgency to search for causes and responses (Cameron 1984; Sitkin 1992). In contrast, small and episodic operational failures often do not have large negative consequences for organizational performance. In many cases, small operational failures are even

redefined as opportunities for learning and stepping stones of future success (Dillon and Tinsley 2008; Morris and Moore 2000). Hence, they are often excused or overlooked and the urgency to respond to small episodic operational failures is less severe.

Attribution theory also suggests that in order to avoid being perceived as *"deceptive, self-absorbed, and ineffectual…unreliable…"* (Schlenker et al. 2001), managers tend to proactively assume responsibilities for large failures. In order to project that they are in control of the failure situation and that they can turn it around, they engage in substantive and visible search efforts in order to be able to offer plausible explanations for failures and to justify corrective actions (Lee and Robinson 2000). Formally,

*H2: In organizations experiencing sustained failures in organizational performance, the speed of decline in organizational performance influences the latency between decline in operational performance and increased search efforts.*

# Research Methodology, Operationalization and Analyses

## *Research Setting and Data Collection*

To empirically test our theory, we examined the operational level and firm level financial performance of seven hospitals in United States over a period of 49 months. All seven hospitals belong to one corporate entity and utilize the same analytics system introduced by the corporate entity over the same time period. The system was developed by the corporation and is employed by managers in each hospital to monitor organizational and operational performance. Like other organizations, hospitals rely on IT capabilities, develop strategies to improve their performance and closely monitor financial performance as a critical indicator of their overall performance (Anand and Fosso Wamba 2013; Clement et al. 1997; Kohli and Kettinger 2004; Salge 2011). We collected monthly data for the *ad hoc* use of a custom-built business analytics system utilized by managers for analyzing contracts, comparing costs of expected services and expected payments from insurers, and for evaluating strategies for improving performance. It maintains a log tracking performance measures, including net patient revenue per day, net income, and usage of the informating capabilities. Data are aggregated and reported on a monthly basis.

## *Operationalization of Constructs*

**Managerial Search Effort**: Managerial search effort reflects the extent to which managers use informating capabilities embedded in business analytics systems to monitor and diagnose operational and organizational performance. Managerial search effort is operationalized based on three system captured measures of the use of analytics functionalities by managers: the number of ad hoc reports generated by managers (mean=280.14, max=2438, min=9), the CPU time consumed in generating the reports (mean=8183.19, max=71365, min=80), and the number of Disk Input/Output cycles consumed in generating the reports (mean=216447.23, max=1468907, min=6339). Similar measures of use have been employed and validated in prior research (Devaraj and Kohli 2003). While the first measure captures the extent of search, the latter two measures capture the depth of complexity of search. Given the disparities in the scales of the three measures, we normalized the measures by rank ordering the responses on each of the three scales and summing the ranks to create a composite measure of managerial search effort (Cronbach's $\alpha = .782$).

**Operational Performance**: Consistent with previous studies (Devaraj and Kohli 2003; Gapenski et al. 1992; Langland-Orban et al. 1995), operational performance is operationalized by net patient revenue per day (NPRDAY). It is an important operational metric that is regularly monitored by operational managers and top management in hospitals considered in this study.

**Organizational Performance**: Consistent with previous studies (Baum and Dahlin 2007; Venkatraman and Ramanujam 1987), organizational performance is operationalized by hospitals' monthly net income (NI), a key performance metric monitored by top management. Trends in organizational performance of individual hospitals over the 49-month period of data collection were analyzed based on a time series analysis of monthly net income data to categorize them as facing sustained success or failure, or episodic success or failure.

We categorized hospitals returning a *significant* negative slope in organizational performance over the 49 month period as experiencing *'sustained failures'* (n=2 of 7 hospitals); those returning a non-significant negative slope as experiencing *'episodic failures'* (n=2 of 7 hospitals); those returning a non-significant positive slope as experiencing *'episodic success'* (n=2 of 7 hospitals); and those returning a *significant* positive slope as experiencing a *'sustained success'* (n=1 of 7 hospitals).

To test H2, we further tested the differences in slopes for the two hospitals categorized as facing sustained failure (Hospitals O1 and O2, see Table 1). Specifically, we conducted a difference in slopes test to examine if O1 or O2 faced a significantly faster sustained failure than the other. The test revealed (Table 1) that the slope for O1 was significantly larger than the slope for O2, suggesting that O1 was facing a significantly faster sustained failure than O2.

### *Data Analysis*

To test hypotheses H1 and H2, we employed the finite distributed lag model (DLM). DLM enables us to examine the significance of lagged effects of operational performance on managerial search effort for each hospital individually (Gujarati 2012; Kmenta 1971).

$$Managerial\ Search\ Effort_t = \propto + \sum_{i=0}^{\infty} \beta_i\ Operational\ Performance_{\ t-i} + u_t,$$

where, $\alpha$ is the intercept, $Managerial\ Search\ Effort_t$ is the value of the informating capabilities use at time period $t$, $Operational\ Performance_t$ is the value of the operational performance at time period $t$, $\beta_i$ is the lag weight placed on the value at the $i^{th}$ period of the operational performance and $u_t$ is the error.

For Hypothesis 1 to be supported, we expect $\beta_i$ to be negative and significant over multiple lags for organizations experiencing sustained failure (Hospitals O1 and O2) and $\beta_i$ to be positive/negative, but non-significant for organizations experiencing episodic failure and success, and also those experiencing sustained success. For Hypothesis 2 to be supported, we expect $\beta_i$ for hospital O1 to be negative and significant in earlier lags when compared to hospital O2.

#### Additional Diagnostics and Robustness Checks

Akaike Information Criteria (AIC) and Final Prediction Error (FPE) tests were conducted to determine the number of the lags for finite DLM analyses. Both tests determined a lag selection of 8, suggesting that 8 lag periods should be included in the finite DLM analysis (Akaike 1974; Gujarati 2012; Kmenta 1971). Granger causality test was conducted to verify our assumptions on the direction of causality between operational performance and managerial search. Robustness checks against validity threats arising from multicollinearity, outliers and influential observations were performed. All the results indicated a good fit for the model. The highest variance inflation factor (VIF) was 8.9, which is below the acceptable levels (<10), suggesting that multicollinearity is not a concern in the model (Hair et al. 2006; Kennedy 2003).

## Results

Table 1 shows the results of the finite DLM analyses for the individual hospitals.

Hypothesis 1, *a decline in operational performance is likely to lead to increased search effort in subsequent periods **only** when organizations are experiencing sustained failures in organizational performance, but not when they are experiencing episodic failure or episodic or sustained success*, is supported. The lag coefficients (Table 1) are negative and significant only for the two hospitals (O1 and O2) experiencing sustained failures. In contrast, there are no significant negative lags in the other hospitals experiencing episodic failure and episodic or sustained success.

Hypothesis 2, *in organizations experiencing sustained failures in organizational performance, the speed of decline in organizational performance influences the latency between decline in operational performance and increased search efforts*, is supported. Consistent with our theory, O1 returns significant lags between performance decline and search for Lags 2 to 8, while O2 returns significant lags for Lags 6 to 8, i.e. O1, which is experiencing a faster sustained organizational performance failure than O2 is responding much faster to operational performance decline than O2.

| **Table 1: Results from Finite Distributed Lag Models** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Hosp** | **O1** | **O2** | **O3** | **O4** | **O5** | **O6** | **O7** |
| Lags | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. |
| 0 | -0.00131 | 0.00053 | -0.0005979 | 0.001883 | -0.00104 | 0.0007524 | 0.0000761 |
| 1 | -0.00116 | -0.00088 | -0.0003922 | 0.000267 | -0.00063 | 0.0004813 | 0.0005393 |
| 2 | *-0.00214** | -0.0003 | -0.0000641 | -0.00101 | -0.00049 | 0.0003164 | -0.0000889 |
| 3 | *-0.00255**** | 0.00026 | -0.0003561 | 0.000887 | -0.00076 | -0.0001005 | 0.0006548 |
| 4 | *-0.00262**** | -0.00229 | 0.0000942 | 0.000792 | 0.000591 | -0.0000356 | -0.0002928 |
| 5 | *-0.00274**** | -0.00588 | -0.0002806 | -0.00048 | 0.000253 | 0.0009339 | -0.0002295 |
| 6 | *-0.00277**** | *-0.00696** | -0.0005704 | -0.00032 | -0.00123 | 0.0004344 | 0.0000593 |
| 7 | *-0.00323**** | *-0.00995**** | 0.0001813 | 0.001052 | -0.00234 | -0.0000903 | -0.0006901 |
| 8 | *-0.0032**** | *-0.00695** | 0.0001545 | 0.000866 | -0.00245 | 0.0001782 | 0.001282 |
| Org Perf Trend | Sustained Failure (B = -28650, p = .00) | Sustained Failure (B = -7060.4, p = .05) | Episodic Failure (B = -1135.3, p = .42) | Episodic Failure (B = -1929.5, p = .60) | Episodic Success (B = 32541, p =.22) | Episodic Success (B = 3246.8, p = .52) | Sustained Success (B = 17274, p = .02) |
| DST | Std Err: 7145.35, T: -3.074 Sig: 0.002 *O1 is experiencing a 'faster' sustained failure than O2* | | | | | | |

Note: p-values: *<.05 **<.01 ***<.001, DST: Difference in Slope Test

## Discussion and Implications

Prior literature has implicitly assumed that the effects of failure on future performance are mediated through search and learning. The causal sequence hypothesized in that literature is failure→search→learning→performance. However, scholars have also noted that *"…existing evidence that failure is more important than success for…learning is entirely anecdotal… no direct empirical examination of the relative efficacy of… learning from success and failure exists in the organizational learning literature*" (Madsen and Desai 2010, p.452). We note that the same holds for the effects of failure on search. Our study extends the literature by examining that missing link.

Our proposed theory contributes to the search and learning literature by theorizing managerial search effort as a joint function of operational performance and organizational performance. In doing so, it extends the earlier failure-performance theory by including the specific effects of operational performance and organizational performance. Distinguishing between the effects of operational performance and organizational performance, we find that managerial search effort in response to declining operational performance is contingent on the failures/success in the overall organizational performance. Specifically, we find that managerial search in response to declining operational performance occurs only when organizations experience sustained failures in organizational performance. Further, we also find that the *'time to react'* by managers in their search efforts is also contingent on the magnitude of the sustained failure in organizational performance.

The proposed theory and findings has important implications for IS research. Specifically, we find that the patterns of use of informating capabilities are contingent on performance. Such contingencies have not been hypothesized in prior IS literature, particularly studies that examined the use of informating capabilities (Belcher and Watson 1993; Devaraj and Kohli 2003; Easley et al. 2003; Poston and Speier 2005; Szajna 1993). Extending earlier theorizations and consensus that has predominantly hypothesized use as a driver of performance (Use→Performance) (DeLone and McLean 1992; DeLone and McLean 2003), we theorize that operational performance can also drive use (Performance→Use), and that the causal relationship varies over time and is contingent on overall organizational performance (Anand et al. 2014; Anand et al. 2015).

To understand the phenomenon at a more granular level and for the purpose of completeness, we tested the conventional hypothesis that IS use in one period leads to a positive effect on operational performance in subsequent periods using DLM analysis. The findings reported no support for the conventional hypothesis in six of the seven hospitals. Only in one of the seven hospitals (O6) that was experiencing episodic success supported the conventional hypothesis. Extending previous studies (Anand et al. 2014; Anand et al. 2015), Table 2 provides a more granular understanding of the use-performance relationship to

show that use influences performance *only* under certain organizational conditions, particularly when organizations are experiencing success conditions. Future studies that examine the use-performance relationship need to account for the contextual contingences that the Use → Performance hypothesis may need to be extended by the inclusion of contextual moderators that may better explain the relationship between use and subsequent performance.

**Table 2: Results from Finite DLM for Use (Search) to Performance Relationship**

| **Hosp** | **O1** | **O2** | **O3** | **O4** | **O5** | **O6** | **O7** |
|---|---|---|---|---|---|---|---|
| Lags | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. | Unstd Coeff. |
| 0 | -27.8933 | 1.357375 | -107.5165 | 88.62992 | -49.6407 | 24.56666 | 6.509092 |
| 1 | -12.8663 | 0.613035 | -76.90434 | 39.61191 | -83.6969 | 27.52999 | -23.83075 |
| 2 | -22.6752 | -0.90913 | -36.96747 | -64.487 | -103.969 | 43.21574 | 28.04881 |
| 3 | -10.749 | -1.86957 | -136.6745 | -94.8032 | -125.806 | *87.18654**** | 9.763096 |
| 4 | -1.56046 | -14.2197 | -154.9915 | -4.10671 | -124.105 | *49.6303** | -11.25973 |
| 5 | -13.3302 | -9.37113 | -150.1432 | -7.23326 | -132.841 | *46.47291** | -50.83204 |
| 6 | -16.9487 | -4.31909 | -124.7175 | 2.356744 | -155.078 | *53.19832** | 14.2883 |
| 7 | 8.324722 | -10.6579 | -161.1155 | 23.97207 | -135.175 | 28.22538 | 34.76572 |
| 8 | -13.0769 | 1.995939 | -195.3963 | 57.7571 | -128.762 | 42.12162 | 83.19573 |
| GCT | OP→U / U→OP | OP→U | OP→U / U→OP | OP→U / U→OP | OP→U / U→OP | U→OP | U→OP |
| ETS? | No | No | No | No | No | Yes | No |

Note: p-values: *<.05 **<.01 ***<.001, GCT: Granger Causality Test, ETS: Extant Theory Supported?

An emergent insight from our findings for practice is that managers exploit informating capability of analytics systems only under a narrow set of circumstances, viz. when both operational performance and organizational performance are in decline. This indicates that the potential of analytics systems to contribute to managerial learning and performance improvement is not being realized in practice to its full potential. An important implication for practice is to explore how organizations should redesign their control systems in ways that encourage managers to use informating capability to search for knowledge even under conditions of episodic success and failure, as well as under sustained success. For instance, to guard against asymmetric attributional tendencies, organizations could require managers to produce 'success reports', just as many organizations require managers to produce 'failure reports'. Scrutinizing success with as much rigor as organizations employ in scrutinizing failure could help managers draw more valid and valuable lessons for learning and as well as for improving performance.

A limitation of our study is that the measure of use employed for managerial search efforts is not dimensionally as rich as the measure of effective use (Burton-Jones and Grange 2012). However, our use measure is robust because it is based on archival records that capture the *actual use* of informating capabilities. Further, use data are collected longitudinally spanning more than 4 years of system use. Despite their acknowledged desirability over self-report measures, archival use data and longitudinal data have not been widely employed in prior IS research. Another limitation of this study is that the sample consists of hospitals only, and limits the potential generalizability of our findings. Against that criticism, the hospitals are not-for-profit organizations and employ control systems and performance management strategies that are similar to for-profit organizations in other sectors.

## Future Research and Conclusion

This paper presents initial results from this program of research. Further research is underway to extend and test the proposed 'informating search' theory. Specifically, by examining the contingent effects of managerial social and historical aspirational levels on managerial search, we extend and test a more comprehensive theoretical model. To provide further generalizability for the theory proposed in this study, the findings from the DLM analyses will be complimented with panel models to test for within and between effects of the relationships.

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