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The impact of ERP implementation on organizational capabilities and firm performance

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Abstract

Purpose – The purpose of this paper is to examine whether the implementation of ERP impacts both business strategy and organizational capabilities which in turn enhance firm performance. Specifically, the paper investigates the mediating effect of business strategy and organizational capabilities on the relationship between ERP implementation and firm performance.

Design/methodology/approach – Using secondary data collected from more than 400 firms, this study tests the relationships among these variables.

Findings – ERP implementation has a positive impact when a firm employs a prospector business strategy. A prospector business strategy enhances the firm's ability to achieve organizational capabilities and enables the firm to achieve higher levels of financial performance.

Practical implications – ERP implementation encourages and supports a prospector strategy. ERP not only supports cost control, but also supports new product development and introductions. The prospector firm seeks better information to support decision making, develop new and innovative products that drive revenue growth, and build efficient and effective operations that enhance return on assets.

Originality/value – This paper reports the mediating effect of business strategy and organizational capabilities on the relationship between ERP implementation and firm performance. This study uses cybernetic control, resource-based view of firm, and dynamic capabilities theories to develop and integrate this research.

Keywords ERP implementation, Business strategy, Organizational capabilities, Organizational performance, Performance management, Management strategy

Paper type Research paper

1. Introduction

In a highly competitive global business environment, firms seek to improve or maintain their competitiveness by using information systems to improve customer service, shorten cycle times, and reduce cost. Enterprise resource planning (ERP) systems provide many benefits to companies so they can meet changing expectations by providing accurate, timely, and integrated information to improve decision making (Trott and Hoecht, 2004).

Research findings on the performance of ERP systems are equivocal. One study suggests that firm may achieve significantly higher stock returns upon announcing the implementation of an ERP system (Hayes *et al.*, 2001). Another indicates significantly greater long-term return on assets (ROA) for ERP adopters relative to non-adopters (Hunton *et al.*, 2003). Wier *et al.* (2007) find positive and significant relationship between ERP adoption and non-financial performance, which have a positive impact on both current and long-term ROA and stock return. Even though ERP implementation becomes a focal point of business and technology planning (Sweat, 1998), implementing

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ERP systems is expensive and time consuming with many projects taking longer, costing more, and delivering less than expected.

Drawing upon the resource-based view of the firm, dynamic capabilities theory, and agency theory, this paper examines whether the implementation of ERP impacts both business strategy and organizational capabilities which in turn enhance firm performance. Specifically, the paper investigates the mediating effect of business strategy and organizational capabilities on the relationship between ERP implementation and firm performance.

One contribution of the current study is the reporting of the mediating effect of business strategy and organizational capabilities on the relationship between ERP implementation and firm performance. By focusing on business strategy and organizational capabilities, this study sheds light on the mixed results in prior studies that focused only on the direct relation between the ERP implementation and firm performance. For example, while Hayes *et al.* (2001) and Hunton *et al.* (2002) find an overall positive stock market reaction to ERP implementation announcements moderated by the relative size and health of the firm, Hunton *et al.* (2003) and Wier *et al.* (2007) do not find a significant difference in firm performance between adopters when examining pre-to-post ERP implementation effects over a three-year period. A plausible explanation for the lack of findings in Hunton *et al.* (2003) and Wier *et al.* (2007) is that they do not control for mediating role of business strategy and organizational capabilities between ERP implementation and firm performance.

Another contribution of this study is the use of three theoretical perspectives to tie together this research. Cybernetic control theory explains how ERP systems offer a means by which managers can effectively develop their business strategy and organization capabilities (Vancouver, 1996), the resource-based view of a firm and dynamic capabilities theory which discuss assets as important factor in improving performance (Barney, 1991; Teece *et al.*, 1997), and agency theory which describes how performance measures provide the motive and opportunity for managers to attend to key financial and non-financial performance indicators (Feltham and Xie, 1994).

The study also develops instruments to measure each construct: ERP implementation, business strategy, organizational capabilities, and performance measures. Investors and managers can learn about the relative contribution of ERP in improving performance. The successful implementation of ERP allows firms to more effectively transform their business strategy and organizational capabilities into higher levels of firm performance.

2. Related literature and research hypotheses

Successful ERP implementation and redesigned processes impact business strategy and organizational capabilities. Through fast and accurate information sharing, process improvement, and production and financial flexibility, firms can respond to the market quickly and proactively thereby having a positive impact on financial and non-financial performance measures. Figure 1 shows these relations, and Table I describes these important variables.

2.1 ERP implementation and business strategy

From a theoretical standpoint, the implementation of ERP systems may affect the firm business strategy by offering new opportunities for the firm that did not enjoy previously.

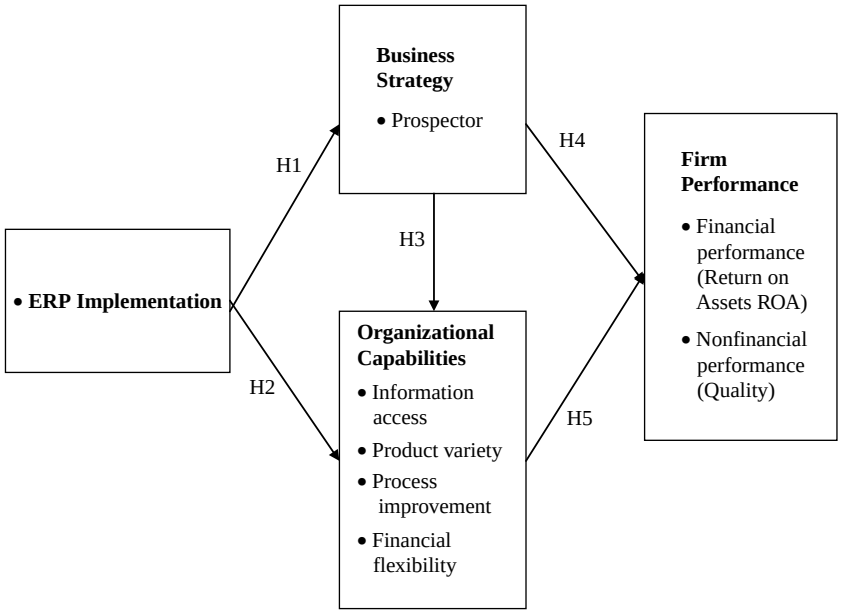

Figure 1.
Impact of ERP implementation on firm performance

ERP implementation. It is the firm's ability to adapt, configure, and integrate information flows and business processes. Even though a firm may implement ERP, it needs to adapt, reconfigure, and integrate its information flow and business processes on a continuing basis because markets change and new technology are created (Teece *et al.*, 1997; Hong *et al.*, 2010). Successful ERP implementation involves redesigning business processes from an inflexible, mass-transaction orientation to an agile, lean, and knowledge-based process (Law and Ngai, 2007; Tsai *et al.*, 2010). During business process transformation efforts, firms must incorporate corresponding training programs, operating procedures, and information technologies to support the emerging infrastructure. The result of appropriately implementing ERP is to improve firm performance primarily caused by redesigned business processes, integrated managerial functions, accelerated reporting cycles, and expanded information capabilities (Chung *et al.*, 2007; Wier *et al.*, 2007).

Business strategy. Miles and Snow (1978) classify business strategy firms into four categories: defenders, prospectors, analyzers, and reactors. Each type has a unique configuration of contextual and structural factors (Lo and Wang, 2007). The Miles and Snow (1978) typology is useful because it is based on a firm's product-market orientation that is responsive to environmental challenges. Following recent research (Desarbo *et al.*, 2005), this study focuses on prospector who tends to reside at opposite end of the strategic continuum from defenders (Miles and Snow, 1978).

Defender firms follow a cost-leader orientation in which they concentrate on established products and markets. They take strategic advantage by minimizing costs through improved operating efficiencies. This focus leads defender firms to employ short-term financial strategy and performance (Said *et al.*, 2003).

Conversely, prospectors seek to exploit emerging market opportunities by emphasizing market research and responding to anticipated market changes.

Variable	Definition
Independent variables	
ERP	The ERP impact score
Mediating variables	
BUSTRTGY	The composite for organization strategy measured using RD_SALES and MB where: RD_SALES = the ratio of research and development (COMPUSTAT ADI # 46) to sales (COMPUSTAT ADI # 12) MB = natural log of the market-to-book ratio measured as ((COMPUSTAT ADI # 6 − COMPUSTAT ADI # 199 × COMPUSTAT ADI #25 + COMPUSTAT ADI # 60)/ COMPUSTAT ADI #6)
PROSPCT	Dummy variable that takes on the value of 1 if the firm BUSTRTGY variable value is equal to or greater than the median value of the sample, 0 otherwise
ORG_CAP	The composite for organization capability measured using INFO, PVARIETY, FINFLEXIBILY (FREE_CASH and CASH_DEBT_COV), and PROCESS_IMPROV where INFO = information index measured as the average of information accuracy and timely PVARIETY = product variety measured as the number of products from Merchant database FINFLEXIBILY = financial flexibility is a composite for organization capability and measured using FREE_CASH and CASH_DEBT_COV; where FREE_CASH = free cash flow measured as net cash from operations (COMPUSTAT ADI #308) − capital expenditure (COMPUSTAT ADI #128) − dividends (COMPUSTAT ADI #) CASH_DEBT_COV = cash debt coverage ratio measured as net cash from operations (COMPUSTAT ADI #308)/average total liabilities (COMPUSTAT ADI #181)
Dependent variables-organization performance (FRM_PERF)	
ROA	Return on assets measured as earnings before extraordinary items (COMPUSAT ADI #) plus interest expense (COMPUSTAT ADI # 15) divided by average total assets (COMPUSTAT ADI #6)
QLTY	Dummy variable for quality that takes on the value of 1 if the firm is a major quality award winner, 0 otherwise

Table I.
Variable descriptions

Prospectors consider new products their primary source of revenue growth. A critical aspect of product innovation is efficiently managing the flow of ideas from across the organization and turning them into reality. Prospectors need a system to improve the management and execution of product innovation by identifying opportunities, generating ideas and concepts, and selecting the most promising projects to pursue.

Impact of ERP implementation on business strategy. Management information systems such as ERP affect business strategy (Langfield-Smith, 1997). Business strategy involves long-term planning that may include mergers and acquisitions, market segmentation, capital formation, products sourcing, supplier and customer relationship management, and product innovation (Porter and Millar, 1985). A firm's ability to have information readily available helps them achieve competitive advantage and strategic initiatives. The concept of receiving timely feedback, analyzing deviations from expectations and taking necessary decisions to correct deviations is rooted in cybernetic control theory (Green and Welsh, 1988; Vancouver, 1996). While the adoption of ERP systems offer the means by which firms can survive and adapt, managers need to implement processes, procedures, systems, and metrics that will facilitate their business

strategy (Wier *et al.*, 2007). Because ERP systems can rapidly deliver a comprehensive set of interrelated data and information to decision makers, firms can achieve competitive advantage and strategic initiatives such as cost leadership and market differentiation. These are characteristics of a firm that would be defined as a prospector. An ERP system allows a firm to pursue strategic options such as mergers and alliances, product innovation, cost leadership, and market differentiation. Implementing an ERP system has a positive impact on the adoption of prospector-type business strategy because it effectively facilitates this approach. Therefore, the following hypothesis is proposed:

H1. ERP implementation positively affects a firm's prospector-type business strategy.

2.2 ERP implementation and organizational capabilities

To cope with a rapidly changing environment, firm need to have capabilities to integrate, build, and reconfigure internal competencies. Firms develop their capabilities to create competitive advantage by leveraging organizational resources such as information system to develop unique and change-oriented capabilities that enable them to meet customer needs and respond to challenges from competitors (Teece *et al.*, 1997).

Organizational capabilities. They are a firm's abilities to perform a set of tasks using company resources. Firms develop and manage organizational capabilities in order to gain competitive advantage by creating organizational-specific competencies. Through continued use, capabilities become stronger and more difficult for competitors to imitate. Investment in information technology (IT) enables a firm to make its processes more efficient, and it enables the firm to achieve operational and financial outcomes by increasing information access, developing new products quickly and effectively, improving operations, and taking effective actions to alter the amounts and timing of cash flows (Shang and Seddon, 2002). The ERP system automates business processes and enables process changes, which offers benefits in terms of information access, product variety, process improvement, and financial flexibility.

Information access is the degree to which a firm supports organizational production through fast data gathering and processing (Klein, 2007). Existing knowledge and information stimulate new ideas and become a source of efficiency for existing processes (Moorman and Miner, 1997). Knowledge reduces variability in the time required to accomplish tasks and in the quality of task performance; work is therefore more reliable (Brockman and Morgan, 2003). Effective information access will have a substantial impact on business performance.

Product variety is the degree to which a firm introduces new goods and/or services with additional features and improved performance with a wide offering (mix). Broadening product lines has a positive impact on competitiveness and for many firms (Kekre and Srinivasan, 1990).

Process improvement is the degree to which a firm enhances existing programs and procedures within its organization. In some cases, they want to improve specific processes, such as procurements, production scheduling, or customer service. In other cases, management focuses more on process standardization to assure the quality and predictability of global business processes.

Financial flexibility is the degree to which a firm takes advantage of unforeseen opportunities or deals with unexpected events depending on the firm's financial

policies and structure. Financially flexible firms have the ability to use financial resources to respond to new information about the company and its environment. The Financial Accounting Standards Board defines financial flexibility as "the ability of an entity to take effective actions to alter amounts and timing of cash flows so that it can respond to unexpected needs and opportunities."

Impact of ERP implementation on organizational capabilities. ERP systems have significant impact on organizational capabilities (Masini and van Wassenhove, 2009). Shang and Seddon (2002) indicate that ERP systems are beneficial to achieve strategic, organizational, management, operational, and IT infrastructure goals. ERP systems enable more accurate and timely information coordination, which reduces inventory and administrative costs and increases responsiveness to market demands (Horvath, 2001). Reducing buffer inventory and lead times increase the efficiency and flexibility of the firm (Suwardy *et al.*, 2003). Therefore, in both theoretical and practical perspective, it is important to know the impact of ERP systems on the firm.

Researchers have studied various organizational capabilities which can be enhanced by information systems (Sethi and King, 1994). Accurate and fast information accessibility helps employees work together across functions. They can share resources, ideas, and data, informally work together as a team, and achieve goals collectively with other employees from different departments. Implementation of an ERP system also nurtures the establishment of backbone data warehouses so that management can have fast access to accurate information for decision making and control. Process improvement is enhanced by the implementation of ERP systems. ERP integrates business processes and information technologies into a synchronized suite of procedures, applications, and metrics that span intra- and inter-firm boundaries (Wier *et al.*, 2007). Management of product variety is not only a production issue, but a challenge for sales as well. Through support of an ERP system, firms can configure products efficiently and produce greater variety efficiently. A majority of the firms expect their new ERP-based systems should enable process improvements (Peng *et al.*, 2008). The ERP system improves the management and execution of the entire new product innovation process through helping companies more readily identify market opportunities, generate ideas and concepts, and select the most promising projects to pursue. Recent research finds some evidence that ERP systems impact a firm's financial performance (Poston and Grabski, 2001; Wier *et al.*, 2007). The adoption of ERP systems leads to sustained operational efficiencies and improved overall liquidity (Hunton *et al.*, 2003).

According to cybernetic control theory, if an organization is to adapt and survive in its environment, decision makers need to receive feedback on key performance indicators in sufficient time to notice unexpected deviations, take appropriate action and observe system responses (Vancouver, 1996). Consistent with this theory, ERP systems provide the means by which organizations can capture, process, and deliver a wide array of key performance indicators in (near) real-time (Markus and Robey, 1998), and through which managers can coordinate and control their decisions across the enterprise (Dechow and Mouritsen, 2005). Thus, a successfully implemented ERP system enhances organizational capabilities including information access, product variety, process improvement, and financial flexibility. Therefore, it is expected that:

H2. ERP implementation positively affects the firm's organizational capabilities.

2.3 Business strategy and organizational capabilities

In strategic management, organizational capabilities are important organizational resources that help a firm build competitive advantage. It is essential to develop and maintain these capabilities based on the firms strategies and information systems so it can develop sustainable competitive advantages. Based on the theory of Miles and Snow (1978) and Snow and Hrebiniak (1980) established theoretically the causal relationship between strategy and functional capabilities. There are tendencies for the firms with different strategies to develop different functional capabilities (Hambrick, 1983). A firm which is characterized as prospector firm emphasized product and market effectiveness (Leung and Lee, 2004). These firms focus on product research to develop innovative products. A firm that emphasizes the prospector strategy shares information, increases product variety, and enhances financial flexibility. Therefore, it is expected that:

H3. A prospector-type business strategy impacts the types of organizational capabilities the firm achieves.

2.4 Business strategy and firm performance

Financial performance is the degree to which a firm is able to achieve strong ROA and profitability. Financial metrics are tools for comparing organizations and evaluating a firm's behavior over time (Holmberg, 2000). The purpose of judging firm performance by financial and non-financial indicators is to better align incentives with a firm's strategic objectives (Luft, 2004). The theoretical basis underlying non-financial performance measures is rooted in agency theory (Feltham and Xie, 1994). Agency theory suggests that non-financial performance measures provide incrementally valuable information, regarding all dimensions of managerial actions that are of concern to investors (Ittner *et al.*, 1997).

In innovative industry with high risk and uncertainty, prospector firms perform better than defender firms (Lo and Wang, 2007). Compared to defenders firms with prospector strategies have wide and varied markets and must cope with change and innovation. They keep developing new products and markets. Their management structures are flexible, while defender firms' management structures are stable. Prospectors are more innovative and can influence their actions and competitiveness in order to react to change. Prospector firms search for new opportunities. Therefore, it is expected that:

H4. Firms with a high level of prospector-type business strategy have high firm performance.

2.5 Organizational capabilities and firm performance

In the management literature, the resource-based view of a firm claims that firms compete on the basis of "unique" corporate resources that are valuable, rare, difficult to imitate, and non-substitutable by competitors (Barney, 1991). These unique resources enable firms to achieve competitive advantage and superior long-term performance. The advantage can be sustained to the extent that the firm is able to protect against resource imitation, transfer, or substitution. In the resource-based view of a firm, many researchers mention that not only a firm's resources but also its capabilities are important to get a competitive advantage. Barney (1991) suggested that organizational resources and capabilities are key factors for competitive advantage and its sustainability.

In this study, four capabilities, which developed through ERP system implementation are examined: information access, product variety, process improvement, and financial flexibility. These capabilities contribute to performance outcomes because they embody dynamic routines that can be manipulated into unique configurations to drive product and service differences (Teece *et al.*, 1997). In the uncertain and turbulent business environment, acquiring useful information for product development with a minimum expenditure of energy, time, or resources improves organizational efficiency. In considering efficiencies, effective information access will have a great impact on business performance. The information systems allow firms to have better performance with new customized products that have unique features and better quality. Organizational responsiveness to the market is the important attribute or ability that firms need to operate effectively in competitive environments. Accordingly, information access, production variety, process improvements, and financial flexibility are unique capabilities that contribute to a firm's competitiveness and market success. Subsequently, this paper proposes that these manufacturers' capabilities enhance performance outcomes. In a word, increased organization capabilities through higher levels of information-sharing practices can lead to increases in financial and non-financial performance. Therefore, it is expected that:

H5. Organizational capabilities positively affect firm performance.

3. Research methods

3.1 Sample selection procedures

The sample consists of firms announcing the implementation of ERP systems for the first time during the period 2003-2007. To identify the sample, an automated search was conducted of Securities and Exchange Commission filings (10-Qs, 10-Ks, and 8-Ks) text files and companies news via Lexis/Nexis using a series of keywords (e.g. "enterprise," "resource," "planning," and "systems") likely to identify firms that implemented ERP. This procedure yields an initial sample of 548 firms. It was not possible to obtain financial data for 47 firms because COMPUSTAT did not include the ticker symbols. After omitting 32 firms with missing data, the usable sample was 469 firms.

As for the industry statistics (not tabulated), approximately 35 percent of the ERP firms come from the durable goods (162 firm), 20 percent come from mining and construction (93 firms), 14 percent from transportation and utilities (66 firms), and 11 percent from non-durable goods (51 firms). In contrast, <6 percent of the ERP firms come from the consumer and business services. Overall, manufacturing firms represent the highest proportion of the sample (45 percent). Years 2006 and 2007 (distribution by year not tabulated) show the highest percentage of implementing ERP; 24 and 29 percent, respectively.

3.2 Dependent variables

We use two performance measures, ROA and Quality (QLTY). ROA is measured by earning before extraordinary items plus interest expense divided by average total assets. QLTY is a non-financial performance measure that on the value of 1 if the firm has won or been a finalist in a major quality award competition, and 0 otherwise. The logic behind this measure is that the quality award criteria require firms to demonstrate how quality programs fit into the firm's overall business strategy and it is determined in large measure by the organization's capabilities. To identify those

quality-oriented firms, an extensive keyword search of publications in Factiva and Lexis/Nexis, was completed.

3.3 Independent variables

ERP metric. To measure ERP implementation, the extent to which a company has implemented its ERP system and redesigned its business processes commensurate with the ERP concept was used (Markus and Robey, 1998). This research followed the study by Wier *et al.* (2007). ERP impact score is created by multiplying the telephone call responses to the following questions:

- To what extent has your company implemented all of the available modules and features of the ERP system?
- In conjunction with implementing of the ERP system, to what extent did you company redesign its related business processes to best utilize the ERP systems' inherent capabilities?

These questions capture the concepts of the extent to which a company has implemented the full capability of its ERP system and the degree to which a company has properly aligned its business processes with the ERP system's capabilities. The IT manager and either the vice president of operations or general manager of all ERP firms were contacted and asked to respond to these two questions (responses could range from 0 to 100 percent in 10 percent increments). Based on the advice of the focus group, an "ERP impact" score was created by multiplying the responses to each question. For instance, if the IT manager claimed that the firm had implemented 50 percent of the ERP system's functionality and redesigned 40 percent of its related business processes to accommodate the ERP system, the resulting ERP impact score would be 0.20 (50×40 percent). The opinions of IT and operational/general managers were solicited to gain two different perspectives – a technical orientation and business orientation.

The authors recognize the imperfection of the ERP impact score. This score does not consider the brand name of the ERP system or count the number of available applications implemented, whether the entire ERP system is purchased off-the-shelf or developed in house, and it was and it is based on self-reports. However, the authors contend that it is more reliable than a 0-1 dummy variable approach used in prior ERP studies. To test whether the impact score explains more of the variation in performance than the ERP dummy variable, Vuong (1989) procedure is used to further explore this issue, which is a likelihood ratio test for competing non-nested model selection. A significantly positive Z-statistic indicates that the ERP dummy variable is rejected in favor of the impact score (two-way p-values < 0.10). Overall, the Vuong results indicate that the ERP impact score, while imperfect, explains significantly more variation in both ROA and QLTY. Pearson correlation (not reported) between the business manager and IT manager impact scores was 0.84 ($p < 0.001$), suggesting relatively high convergent validity between the two managerial viewpoints. Thus, the ERP impact score reflects the average of both perspectives.

Business strategy. Factor analysis is used to develop a composite measure of business strategy (BUSTRTGY) using principal component analysis. Two indicators for competitive strategy were used:

(1) the ratio of research and development to sales; and

(2) the market-to-book ratio[1].

The first principal components explain 54.25 percent of the variation in the data with eigenvalues = 1.085. Following Stevens (1992) for our sample size, loadings > 0.54 can be considered significant. BUSTRTGY index score is computed using the average equal-weighted sum of the standardized indicators associated with each factor (Grice and Harris, 1998). Higher BUSTRTGY scores reflect the prospector end of the strategy continuum. Because prospector firms are involved in more innovative actions, they should have a higher ratio of R&D to sales than other firms. Likewise, because prospectors are expected to have higher growth opportunities compared to defenders, prospectors are expected to have higher market-to-book ratios. The previous two variables were measured as the average of the respective yearly ratios over the five years preceding the proxy date, and then a dummy variable was created to reflect prospectors. PROSPCT dummy variable equals 1 when high levels of these attributes are found and it equals 0 when low levels of this attributes are present.

Organizational capabilities. To measure organizational capabilities, we use four sub-variables; information access, product variety, process improvement, and financial flexibilities. We use an index to measure the information access. The information index is created by averaging the telephone call responses to the following questions:

- Post ERP system implementation, to what extent do you get accurate information needed to make a decision? (Responses could range from 0 to 100 percent, in 10 percent increments; where 100 percent is to great extent).
- Post ERP system implementation, how fast do you get the information needed to make a decision? (Responses could range from 0 to 100 percent, in 10 percent increments; where 100 percent is to extremely fast).

These two questions capture the impact of the ERP implementation in increasing the accuracy and the speed of delivering information. Accuracy and speed are necessary conditions for relevant and timely information. If the implementation of ERP significantly improved one aspect of the information while it did not improve the other aspect then it is hard to claim that ERP improved information relevancy or index. Therefore, the average of the two responses deems appropriate[2].

Product variety is measured by the number of products. The intuition behind this measure is that the higher the number of products, the more flexible is the firm in responding to markets needs. While it could be argued that product variety is not a perfect surrogate measure of a firm's flexibility, the authors believe that it is an appropriate and reasonable surrogate because firms with more products tend to have greater flexibility throughout the organization. Process improvement is measured as the ratio of employees to sales. This ratio reflects the firm's ability to produce and distribute goods and services efficiently (Thomas *et al.*, 1991). ERP implementation increases a firm's efficiency in terms of a reduction in employee numbers and in the ratio of employees to revenues for each year (Poston and Grabski, 2001). Financial flexibility is measured as free cash flow (= net cash from operations-capital expenditure-dividends) and cash debt coverage ratio (= net cash from operations/average total liabilities).

To ensure reliability of the measurement instruments, reliability of the constructs was computed using Cronbach's alpha for indicators associated with organizational capabilities and performance measures (results not tabulated). The mean (median) coefficient alpha is 0.702 (0.742). As for the indictors of the business strategy, the

Cronbach's mean alpha is 0.528. Although the level of reliability for business strategy is somewhat lower than the 0.70 benchmark suggested by Nunnally (1967), low levels of reliability are common in the early stages of measurement development and considering the sample size (Larcker *et al.*, 2007).

4. Results

The results are provided in three parts that include descriptive statistics for each variable in Table I, pair-wise correlations both Pearson and Spearman, and the path coefficients and the *t*-statistics for each hypothesis.

4.1 Descriptive statistics

For each variable in the model in Figure 1, except for QLTY, the mean, standard deviation, median, the first quartile, and the third quartile were calculated and displayed in Table II. How these variables were defined and measured is discussed earlier?

4.2 Correlation

The correlation data in Table III are interesting. The outcome variables, ROA and QLTY, are correlated with nearly all of the variables in the model.

Variables [a]	Mean	Q1	Median	Q3	Standard deviation
ERP	0.159	0.03	0.06	0.205	0.193
BUSTRTGY					
MV	2.95	2.426	2.974	3.535	0.916
RD	0.185	0.037	0.098	0.215	0.32
ORG_CAP					
INFO	0.35	0.20	0.35	0.50	0.17
PVARIETY	20.99	3	8	19	45.61
FREE_CASH	82.83	−5.14	7.56	55.74	305.77
CASH_DEBT_COV	0.19	0.05	0.16	0.34	0.44
FRM_PERF					
ROA	0.017	−0.018	0.035	0.089	0.22
QLTY	0.165				0.371

Table II.
Descriptive statistics

Note: [a]Variables are defined in Table I

Variables[a, b]	ERP	BUSTRTGY	ORG_CAP	ROA	QLTY
ERP		0.091*	0.097*	0.090*	0.145**
BUSTRTGY	0.043		0.407**	0.160**	0.196**
ORG_CAP	0.071	0.409**		0.214**	0.097*
ROA	0.053	0.222**	0.419**		0.133**
QLTY	0.016	0.206**	0.115**	0.148**	

Table III.
Correlation matrix

Notes: Significance at: $^{*}p < 0.05$ and $^{**}p < 0.01$ levels, respectively, one-tailed; [a]variables are defined in Table I; [b]Pearson (Spearman) correlations are above (below) the diagonal

4.3 Structural model results

To test the model in Figure 1, structural equation modeling was applied twice to assess the relative strength for each path using in one case ROA and in the other case QLTY as the performance variable (see Table IV for the results). We use partial least squares (PLS), which does not provide fit statistics. PLS was selected because it does not assume that the variables are normally distributed.

The results from these two tests are very similar except for the relationship between ORG_CAP and FRM_PER. For *H1*, which examined the impact of ERP on PROSPCT, the relationships are significant at $p < 0.10$ in both versions. This implies that ERP implementation has an impact on the firm's ability to be a prospector, but the relationship is weak. For *H2*, which examined the impact of ERP on ORG_CAP, the relationships are not significant. This implies that ERP implementation has no direct impact on the firm's ability to achieve these organizational capabilities. However, as illustrated by the results from *H3*, it is likely that there is an indirect effect between ERP and ORG_CAP through PROSPCT.

For *H3*, which examined the impact of PROSPCT on ORG_CAP, the path coefficients are significant at $p < 0.01$ in both versions. This implies that having a prospector strategy has a very significant impact on the firm's ability to achieve the ORG_CAP that are listed in Figure 1. For *H4*, which examined the impact of PROSPCT on FRM_PER, the path coefficients are different. For the ROA outcome variable, the relationship is significant at $p < 0.05$ while for the QLTY outcome variable, the relationship is significant at $p < 0.01$. This indicates that a prospector business strategy positively impacts the firm's ability to improve both a ROA and QLTY. For *H5*, which examined the impact of ORG_CAP on FRM_PER, the path coefficients are very different. For the ROA outcome variable, the relationship is significant at $p < 0.05$ while for the QLTY outcome variable, the relationship is not significant. This indicates that the organizational capabilities positively impacts the firm's ability to achieve a ROA but do not appear to lead to better quality.

5. Summary and conclusion

The paper examines the relationships among ERP implementation, business strategy (prospector), organizational capabilities, and firm performance. Model testing indicates that ERP implementation has a significant and positive impact when a firm employs a prospector business strategy. While this relationship is weak, it does provide support for the claim that ERP implementation encourages a prospector strategy. ERP not only supports cost control, it also appears to support new product development and introductions, mergers, and other revenue growth opportunities.

Variables[a]	ROA Path-coefficient	ROA *t*-value	QLTY Path-coefficient	QLTY *t*-value
ERP → PROSPCT (*H1*)	0.091	1.31*	0.091	1.36*
ERP → ORG_CAP (*H2*)	0.060	1.19	0.060	1.23
PROSPCT → ORG_CAP (*H3*)	0.402	6.66***	0.402	7.29***
PROSPCT → FRM_PER (*H4*)	0.087	1.67**	0.187	2.52***
ORG_CAP → FRM_PER (*H5*)	0.179	1.75**	0.021	0.26

Notes: Significance at: *$p < 0.10$, **$p < 0.05$ and ***$p < 0.01$ levels, respectively, one-tailed; [a]variables are defined in Table I

Table IV. Path coefficients and *t*-value

A prospector business strategy also influences the firm's ability to achieve organizational capabilities including information access, flexibility through product variety, process improvement, and financial flexibility. The prospector firm seeks better information that supports decision making, new and innovative products that drive revenue growth, efficient and effective operations that enhance ROA, and the ability to invest in working capital, new facilities and equipment, and market exploration as needed. This is natural set of actions for firms with a prospector business strategy, and ERP helps them to achieve this, not directly as implied by *H2* which was not significant, but through the prospector business strategy.

Firms with a prospector business strategy achieve higher levels of financial performance as measured by ROA and highs level of operational performance as measured by quality. These firms are able achieve better returns because they seek new product ideas, acquisitions, and other revenue enhancements while they achieve greater efficiency and effectiveness via improved decisions making using better information and through cost reductions with process improvements. The impacts of these organizational capabilities were more easily seen on improving ROA rather than on quality.

ERP is more than a tool for cost cutting it provides a rich source of information that allows firms to support a business strategy that pursues growth, innovation, and possibly even entrepreneurship. It provides access to customer and market data that allows a firm to investigate and evaluate external opportunities for growth.

6. Limitations and future research

As with any research study there are limitations. Data collection for an organization-level study such as this is problematic. It is difficult to find measures for organizational capabilities such as process improvement and firm flexibility. This paper uses secondary data from a variety of sources to form surrogate measures for key variables. Even though the surrogate measures are appropriate and reasonable, they are less than perfect measures of the underlying variables. This study focused on prospector-type business strategy and does not consider the defender-type, which may produce different results. Also, the study is cross-sectional in nature so it is difficult to examine cause an effect because there is no opportunity to examine time delays between creating capabilities and achieving better performance.

Futures studies could examine both the prospector and defender-type business strategy. Are there differences in ERP implementation, capabilities, and performance for these two types? Are the underlying relationships different? Also future studies could examine longitudinal impact of ERP implementation on firm capabilities and performance.

Notes

1. The α of two indicators of the business strategy (BUSTRTGY) construct was 0.528 indicating that the set of variables does not represent a single unidimensional construct. Nunnally (1978) has indicated that 0.7 may be considered to be an acceptable reliability coefficient. The data appear to be multidimensional. Factor analysis was then applied to the BUSTRTGY data in order to see which items load highest on which dimensions. However, α of the organizational capabilities data indicates that the data represent a single unidimensional constructed therefore factor analysis was not used.
2. Principal component analysis of the two indicators (accuracy and speed) was used and the results are qualitatively similar.

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