



# E-Business Innovation and Firm Performance

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## ABSTRACT

Companies develop e-business initiatives to improve communications with customers and suppliers. However, one of the challenges for information systems managers is to determine whether such investment generates any value with respect to firm performance. By extending previous research done by Shin (2004), this research empirically examines the relationship between e-business innovation and firm performance. It employs the Information Week's annual data set on innovative users of IT for two years: 2000 and 2001. The measure of e-business innovation is constructed by combining the categories of e-business strategy and customer knowledge available from the data set. This study attempts to show how firms can improve their performance with e-business innovation by providing empirical evidence for the economic payoffs generated from e-business innovation.

## INTRODUCTION

E-business initiatives are developed to improve communications with customers and suppliers. Companies invest in e-business technologies for customer relationship management (CRM) and supply chain management (SCM) in order to facilitate information sharing, transactions, customer service, and inventory management. However, one of the challenges for information systems (IS) managers is to determine whether such investment generates any value with respect to firm performance (Zhu 2004).

While the value created by e-business investment has been an issue in both academic and business worlds, there has been little research examining e-business value empirically. Previous research on information technology (IT) value generally emphasizes the organizational changes in business processes and strategies coupled with IT investment (Clemons and Row 1991; Hitt and Brynjolfsson 1996; Malone 2001; Rangan and Adner 2001). For example, a company can create value by using IT to streamline its business processes and transform the way it does business. Likewise, IT can deliver much benefit by leveraging a firm's current strategic positioning or by fostering new strategic opportunities.

By applying the same reasoning to the creation of e-business value, this research empirically examines the relationship between e-business innovation and firm performance. The study employs the Information Week's annual data set on innovative users of IT for two years: 2000 and 2001. The data set includes four categories of IT innovations for each firm based on the early adoption and creative use of technologies and business practices, which indicates the quality of IT innovations, not the quantity of IT investments. The four IT innovation categories are technology strategy, e-business strategy, business practices, and customer knowledge. The measure of e-business innovation is constructed by combining the e-business strategy and customer knowledge categories. Applying the definition of IT innovation provided by Information Week, e-business innovation refers to the early adoption and creative use of e-business and customer management technologies and practices (for example, e-marketplaces, enterprise portals, extranets, CRM, and SCM).

## PREVIOUS RESEARCH ON E-BUSINESS VALUE

Previous IS research has used the resource-based view (RBV) of the firm to analyze IT business value and explain the leverage effect of organizational resources on IT investment (Clemons and Row 1991; Bharadwaj 2000). The theory posits that firms create value by combining heterogeneous resources that are economically valuable, rare, costly to imitate, or not substitutable (Barney 1991). Using the RBV as a theoretical basis, Zhu and Kraemer (2005) examine the value created by actual e-business use. They argue that IT-enhanced capabilities that integrate various business resources are tailored to a firm's strategic context and cannot be easily copied by other firms. Thus, such IT capabilities can deliver the potential to create business value. Focusing on the actual way e-business is used, not simply on its adoption, Zhu and Kraemer (2005) show that actual e-business use and its capabilities contribute to performance improvement in companies in the retail industry. In their earlier study (2002), Zhu and Kraemer also demonstrated a significant relationship between e-commerce capability and firm performance measured by inventory turnover and cost of goods sold (COGS).

Using the publicly available Information Week 500 data set for the two years from 1999 to 2000, Shin (2004) empirically examined the contribution of e-business initiatives to firm performance by constructing a measure of e-business initiatives by combining e-business and CRM innovations. His findings showed that the contribution of e-business initiatives is significant for gross margin, revenue per employee, and return on equity (ROE).

The present research extends Shin's study (2004) by employing a more recent data set and a different methodology that minimizes the potential influence of a firm's prior performance.

## ECONOMETRIC APPROACH

### Data Sources and Variable Construction

The study uses two data sources: the Information Week 500 data set on innovative users of IT for 2000 and 2001 and the Compustat database. The IT innovation data were collected annually through a survey of senior IT executives on their organizational priorities and spending plans. Information Week rated various categories of IT innovations for each firm by the quality of IT innovations (how companies used IT in their organizations), not by the size of IT spending (how much companies spent on IT). The data set for 2000 and 2001 includes four IT innovation categories, scored at three levels (gold, silver, and bronze) for each firm based on its early adoption and creative use of technologies and business practices. The four IT innovation categories are technology strategy, e-business strategy, business practices, and customer knowledge.

The measure of e-business innovation is constructed by combining the categories of e-business strategy and customer knowledge. The following process is used to construct the e-business innovation measure: The numbers, 3, 2, and 1 are assigned to gold, silver, and bronze respectively. Then an e-business innovation index is created by adding the numeric

values of both e-business strategy and customer knowledge. This procedure transforms the nominal variables of the two innovation categories into a continuous composite measure. This helps to alleviate potential statistical issues associated with using a number of nominal variables as independent variables in the regression models (Zhu and Kraemer 2002).

Data items such as sales, COGS, return on asset (ROA), and ROE, and the number of employees are also obtained from the Compustat database for the same firms included in the Information Week 500 data set. Multiple performance ratios such as Tobin's q, gross margin, revenue per employee, ROA, ROE, and the ratio of COGS to sales (a cost measure) are employed as measures of firm performance.

### Validity of the IT Innovation Variables

The Information Week 500 data set has been partially validated by Shin (2004). Observing the weaknesses of using the qualitative (perceptual) IT innovation variables, he shows their nomological validity. When the predicted relationship specified by theory is found to be significant, despite variations in measurement, then the instrument may be considered as nomologically valid. Since the hypotheses developed allow him to examine the predicted relationships, the discovery of positive and significant relationships demonstrate the nomological validity of the IT innovation variables employed in his study. He also provides qualitative evidence of IT innovations by using case examples to corroborate the validity of the constructs.

Shin (2004) further states that although the survey instrument might lack academic rigor, it is probably relevant practically since the editing team of Information Week 500 has had experience in designing the instrument and collecting the data annually for over a decade.

### Methodology

To analyze the relationship between e-business innovation and firm performance, an analysis of the combined data set for two years is performed by using the two-stage least-squares (TSLS) regression, which uses one-year lagged e-business innovation as an instrument variable. This method is employed to minimize the potential bias caused by the simultaneity problem. Possible lag effects will be also examined.

Even though the performance ratio variables and qualitative e-business innovation variable avoid the possible problem of heteroscedasticity, the total number of employees is used to control for differences in firm size. In order to control for industry- and year-specific effects, dummy variables for each industry categorized by the North American Industry Classification System (NAICS) code and for each year are included.

### The Model

The model measures the relationship between e-business innovation and firm performance while controlling for firm size, industry and year.

$$V_{it} = \beta_0 + \beta_1 EI_{it} + \beta_2 EMP_{it} + \beta_3 INDUSTRY_{it} + \beta_4 YEAR_{it} + \varepsilon$$

$EI_{it}$  stands for e-business innovation.  $EMP_{it}$  denotes the total number of employees.  $V_{it}$  represents firm performance measures that will be replaced in turn by each of the six performance variables: Tobin's q,

gross margin, revenue per employee, ROA, ROE, and the ratio of COGS to sales.  $INDUSTRY_{it}$  and  $YEAR_{it}$  denote dummy variables for industry and year, which control for differences in industry characteristics and market trends respectively.  $\varepsilon$  is the residual term with zero mean, which captures the net effect of all unspecified factors.

### EXPECTED CONTRIBUTIONS

This study empirically analyzes the contribution of e-business innovation to firm performance. E-business innovation is measured by a combination of the IT innovation categories of e-business strategy and customer knowledge, which indicates the early adoption and creative use of e-business and customer management technologies and practices.

This study attempts to demonstrate how firms can improve their performance with e-business innovation by providing empirical evidence for the economic payoffs generated from e-business innovation. By extending the previous research done by Shin (2004), this study corroborates the importance of the complementarity of e-business technologies and innovative e-business practices, a subject that has received attention in recent e-business value research.

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