

The effect of information technology investment on firm-level performance in the health care industry

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Thouin, M., Hoffman, J. J., and Ford, E. W. (2008). The Effect of Information Technology (IT) Investments on Firm-Level Performance in the Healthcare Industry. *Health Care Management Review*. 33(1), pp. 60-69.

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Abstract:

Background: The return on investment for information technology (IT) has been the subject of much debate throughout the history of management information systems research. Often referred to as the productivity paradox, increased IT investments have not been consistently associated with increased productivity. Understand individual IT factors that directly contribute to business value should provide insight into the productivity paradox.

Purpose: The effects of 3 different firm-level IT characteristics on financial performance in the health care industry are studied. Specifically, the effects of IT budget, IT outsourcing, and the relative number of IT personnel on firm-level financial performance are analyzed.

Methods: Regression analysis of archival survey data for 914 Integrated Healthcare Delivery Systems is performed.

Results: IT budgetary expenditures and the number of IT services outsourced are associated with increases in the profitability of Integrated Healthcare Delivery Systems, whereas increases in IT personnel are not significantly associated with increased profitability. Each one tenth of a percentage increase in IT expenditures is associated with approximately \$950,000 in increased profit for an average-sized Integrated Healthcare Delivery System.

Implications: To increase profitability, IT administrators should increase IT budgetary expenditures along with IT outsourcing levels. IT administrators in the health care industry can use such findings during budgeting cycles to justify increased investments in IT personnel as being budget neutral while increasing organizational capacity.

Key words: health care, IT outsourcing, IT payoff, outsourcing, productivity, return on investment

Article:

Information management is fundamental to the health care delivery system. Given the large volume of transactions, the fragmented communication between providers, and the need to integrate new scientific evidence into practice, the limitations of paper-based information systems are substantial. Information technology (IT) usage in the health care industry has the potential to improve quality of care and dramatically reduce the cost of providing health-care-related services (Hillestad et al. 2005; Barlow, Johnson, & Steck, 2004; Wang, Mitchell, Cumming, & Smith, 2003). IT can improve health care quality by facilitating clinical decision making, reducing the cognitive burden of practitioners, and automating patient safety practices. In addition, IT has the potential to dramatically reduce the cost of providing health care by streamlining back office operations. Researchers at the Boston University School of Public Health estimated that \$1.9 trillion was spent on health care in the United States in 2005, an increase of 48% since the year 2000 ("Report Estimates Health Care Cost Increase at \$621 Billion Since 2000," 2005). The cost of health care places a significant burden on the U.S. economy. Increasing health care providers' performance through technological innovation has the potential to decrease the burden on purchasers and increase the accessibility of health care to a larger segment of society.

The benefits associated with the use of IT in an organizational environment are well established (Bharadwaj, 2000; Mitra, 2005). IT enables organizations to manage organizational knowledge, improve decision making,

and increase the effectiveness and efficiency of many crucial organizational processes (Barua, Konana, Whinston, & Yin, 2004; Garud & Kumaraswamy, 2005; Todd & Benbasat, 2000). Despite these organizational benefits, the ability of IT to generate competitive advantage has been questioned as the IT capabilities shift from unique and rare resources to ubiquitous commodities (Carr, 2003). Similarly, significant ambiguity persists surrounding the gain in productivity associated with the increased use of IT. Referred to as the productivity paradox, gains in productivity have not been consistently linked to increased use of IT. From a research perspective, the benefits of IT investment have been difficult to verify due to the measurement ambiguity with respect to IT inputs and outputs, long time lags associated with IT payoff, the role of IT in redistributing wealth among firms in an industry, and mismanagement of IT (Brynjolfsson, 1993). Understanding how various IT investment allocations impact productivity is particularly important in the U.S. health care sector because there are several national efforts to significantly increase the use of such systems in patient care processes (Ford & Scanlon, 2007). For instance, the often-cited Institute of Medicine (2001) report *Crossing the Quality Chasm* emphasized the critical role of IT in improving care through safety, efficiency, patient centeredness, effectiveness, timeliness, and equity.

The purpose of this article is to examine how different levels of IT investment in the overall IT budget, along with the investment in IT personnel and IT outsourcing, relate to firm-level performance in the health care industry. Data on the use of IT for 914 Integrated Healthcare Delivery Systems (IHDSs) are analyzed in relationship to performance. Using such a data set provides the statistical power to detect the indirect impacts of IT spending on overall return on investment (ROI). Furthermore, disaggregating the type of investment (i.e., equipment vs. personnel) also improves the model's specification to more closely approximate the actual phenomenon.

Quantifying the impact of different IT investment strategies on overall performance represents an important contribution to the management literature and is of practical significance for health care financial officers and IT managers. Both types of managers can use the ROI estimates made herein to build and evaluate their IT budgets. For policymakers, one of the major barriers identified by potential IT adopters has been the low or negative ROI (Poon et al. 2004). This article contributes to the empirical base for discussing that barrier's impact on policy.

The remainder of the article will proceed as follows. First, we review the health IT investment literature and outline the research hypotheses. Next, the method used to test the conceptual model is provided, followed by a discussion of the results. Finally, a summary of the major findings, along with the managerial and theoretical implications, is provided.

Literature Review and Theory Development

A variety of research designs and methods have been used to assess the value of IT to organizations. Examining changes in productivity, business profitability, and consumer surplus are three techniques commonly employed to assess the value of IT (Hitt & Brynjolfsson, 1996). Furthermore, the complementary relationship between IT and other firm resources have led some to posit that the relationship between IT and business value may, in large part, be indirect and difficult to measure. The major contribution of IT is that it complements existing firm-level resources to increase their value in a moderating fashion (Barua & Mukhopadhyay, 2000). The concept of complementarities is often used to explain the productivity paradox and the wide variation observed between IT usage and its business value.

The productivity paradox refers to the contradictory evidence surrounding changes in firm-level productivity associated with IT investments. Productivity measures the ratio of outputs, such as the number of manufactured units, to one or more inputs, such as labor and cost of raw materials. If IT has a positive effect on productivity, then more output should be generated for the same level of input. If IT has a negative effect on productivity, then less output would be expected for the same level of input. IT usage has the potential to lower the costs of raw material transformation and to increase output per dollar of labor. However, productivity gains associated with IT investment have been difficult to disaggregate from other firm-level effects.

An analysis of a large number of firms found that, on average, a positive correlation exists between increased IT investments and productivity levels. However, a wide amount of variation in productivity changes across firms was observed such that investments in IT were not always associated with productivity gains (Brynjolfsson & Hitt, 1998). One explanation of the variation is the greater ability of some firms to adapt and integrate new technologies into their business processes. For instance, an analysis of firm-level productivity in the banking industry revealed that investments in IT are directly associated with increased productivity (Shi, Kunnathur, & Ragu-Nathan, 2005). Whenever productivity is measured, accurate assessments of changes in productivity associated with IT investment remain troublesome because the inputs and outputs associated with IT's impact on productivity are difficult to disaggregate and measure (Oz, 2005). Alternative approaches for assessing the value of IT investments were developed to explicitly look at changes in financial performance associated with investments in IT.

Organizations invest significant sums of money when developing and implementing new information systems, and the potential for a negative ROI or out-and-out implementation failure is a worrisome possibility. A dramatic and often cited case involves the Cedar-Sinai failure in implementing a clinical IT system that resulted in Cedar-Sinai shelving a \$34-million system (Connolly, 2005). The cost of IT failures is relatively easy to detect, whereas success is elusive.

Investment in IT has not been found to affect business performance when assessed in the aggregate. Rather, different types of IT had different effects, with strategic IT having a negative effect on performance, informational IT having a neutral effect on performance, and transactional IT having a positive effect (Weill, 1992). By comparison, some studies have found the effects of IT on business performance to be significant and positive. Literature reviews and meta-analyses confirm the ability of IT to positively affect business performance (Kauffman, & Weill, 1989; Kohli, & Devaraj, 2003; Lim, Richardson, & Roberts, 2004). In a study by Barua, Whinston, and Yin (2004), 12 of the 13 hypotheses tested pertaining to net-enabled business value were supported. Prior studies have also noted a firm's level of IT capability to be directly related to superior financial performance when compared to a sample group and industry averages (Bharadwaj, 2000; Oz, 2005). Within a health care context, Menachemi, Burkhardt, Shewchuk, Burke, and Brooks (2006) found a higher level of outcome ratios based on revenues, income, and cash flow but noted that higher IT use was also associated with higher expense ratios.

As U.S. hospitals and health care organizations become more competitive, strategic investment in IT is becoming a critical success factor. Great efforts have gone into formal technology assessment processes in an attempt to control costs while improving patient outcomes and organizational performance (Li & Collier, 1999). The use of IT in health care has been linked to a number of benefits, such as patient safety (Bates et al., 1998), clinical decision support (Bates et al., 1999), and efficient management of patient information (Mitchell & Sullivan, 2001). However, many have noted a significant delay in IT adoption in the health care industry (cf. Chin, 2004), often citing privacy concerns and resistance by health care professionals as reasons for the delay. One way to offset concerns in this area is to demonstrate empirically the relationship between IT adoption and improved financial performance within health care organizations.

Hypothesis Development

The industry being examined has important consequences for the study of the generation of IT business value because the payoff on IT investment has been shown to be industry dependent. Kohli and Devaraj (2003) found that government and nonprofit sectors demonstrated a higher level of positive outcomes than did the manufacturing and financial sectors. Industry differences were also found between the manufacturing and services industries. Services-based industries were shown to exhibit greater payoff from IT investment than did firms in the manufacturing industry due to the role that IT has in increasing the value of services offered and the increased involvement of IT in the development and implementation of services industry firms' strategy (Sohal, Moss, & Ng, 2001). In the manufacturing sector, Weill (1992) found no significant effect of IT investment on the financial performance of the firm when measured in the aggregate. Hence, it is important to understand the unique characteristics of IT payoff within the health care industry.

It has been predicted that within the health care industry, IT investments will have an increasingly important effect on firm-level performance. For example, Gronroos (1990) notes that service organizations measure ROI differently than do manufacturing sectors. The customers' evaluation of performance drives the analyses and is based on two separate components: (1) technical quality (the outcome of the service system) and (2) process quality (how the service is delivered). Often, customers cannot distinguish between these constructs, so they are collapsed into overall "quality" or "patient satisfaction" measures. In service industries, positive customer perception of quality leads to higher customer satisfaction and loyalty (Anderson, Fornell, & Rust, 1997). Many studies have demonstrated that higher customer loyalty leads to higher firm productivity, by securing future revenues, decreasing the costs of future transactions and increasing firm reputational effects (Fornell, 1992; Rust & Keiningham, 1994). For health care organizations, competitive advantage is closely tied to improved productivity in these areas. Accordingly, it is hypothesized that:

Hypothesis 1: Increased IT expenditures lead to increased financial performance in health care firms.

Once a decision is made to increase IT expenditures, a key question is whether an investment should be made internally in IT capacity (i.e., hiring more IT personnel) or the investment should be made to increase the number of IT services that are outsourced. In this study, we examine both the effect of internal IT investment on the financial performance of health care firms and the effect of increased IT outsourcing on the financial performance of health care firms.

As mentioned above, one option for investing IT dollars is to increase the number of IT personnel within the firm. An argument can be made that the capabilities of the IT staff employed by the IHDS should affect firm-level financial performance. This is because IT personnel have the potential to significantly increase the financial performance of the firm by providing technical expertise and business knowledge to develop integrative solutions that are unique to the firm. Furthermore, it is expected that IT staff will enable others in the organization to perform their jobs more effectively, leading to increased financial performance. In addition, higher levels of IT staff employed by the IHDS will have greater knowledge of the systems and system configurations used by the IHDS, potentially leading to better integration of systems. Because systems integration has the potential to lead to competitive advantage and improved financial performance, it is expected that increased levels of IT staff will lead to increased levels of financial performance. IT personnel have the potential to be inimitable, heterogeneous resources that can be a source of competitive advantage—and competitive advantage is potentially a source for superior financial performance (Barney, 1991).

An alternative to hiring more IT personnel is to invest IT dollars in outsourcing. Several studies have examined organizational management practices for outsourcing (e.g., Briggs, Walden, & Hoffman, 2006; Shi et al., 2005), and few have considered the effect of the number of IT services outsourced on firm-level financial performance. The level of outsourcing for IT refers to an organization transferring all or part of its IT operations to a third party. In exchange for a fee, the third party provides a level of IT service to the organization, enabling the IHDS to focus on patient care. IT outsourcing has increased dramatically in the past 5 years and offers several potential benefits to organizations within a health care context. First, it enables an organization to focus on core competencies. Managing a data center and providing IT services to employees in the organization typically are not a core competency of a health care facility. Outsourcing such functions enables the organization to focus on managing and providing better health care to its patients and improve organizational efficiency. Second, economies of scale enable the same level of service to be provided at a reduced cost. IT-related services can be shifted to regions of the world where labor costs are significantly lower than in the United States. It is predicted that the health care industry's IT outsourcing will rise from \$6.2 billion in 2005 to \$7.7 billion by 2008, with offshore outsourcing contributing \$321.7 million in spending (McDougall, 2006). Allied health care services, such as medical records transcription and radiology, are commonly outsourced to countries such as India, where transcription outsourcing generates nearly \$200 million in revenues for that country each year (ValueNotes, 2001). The use of Indian radiologists to interpret x-rays and CT scans has allowed these services to be provided 24 hours a day, an otherwise impracticable suggestion given the current critical shortage of radiologists in the United States. Thus, increased operational and financial efficiency is a strong potential benefit of outsourcing. It should be noted that outsourcing may also have negative organizational consequences. For example, time,

distance, and communication issues may result in lower levels of service. Another drawback is the potential decrease in organizational control with respect to the IT services that are outsourced. IT outsourcing typically requires explicit delineation of the services to be provided up front, and any deviations from the agreed upon services can add significant cost to the contractual agreement. The combined loss of control and the decrease in in-house expertise may lead to a decreased level of integration in IT for an IHDS. Integration of IT is one of the key enablers of IT productivity and has been cited as a source of sustained competitive advantage. Therefore, outsourcing IT may result in unintended consequences such as a decrease in informational integration. Menachemi, Burkhardt, Shewchuk, Burke, and Brooks (2007) examined the effect of low and high levels of outsourcing on various measures of financial performance for 83 Florida hospitals and found no significant difference in financial performance between the low-outsourcing group and the high-outsourcing group. Although the effect of IT outsourcing on organizational performance is somewhat ambiguous, it is expected that the benefits will outweigh the costs and that firms that have higher levels of IT outsourcing will be more productive than firms that have low levels of IT outsourcing. Based on the discussion above, it can be theorized that health care firms will benefit financially more from investing in IT outsourcing than from investing in additional IT personnel. Specifically, it is hypothesized that:

Hypothesis 2: Increased IT outsourcing leads to increased financial performance in health care firms.

Hypothesis 3: Increased investment in IT personnel does not lead to increased financial performance in health care firms.

Methods

Data

Our hypotheses were tested using a database that contains IT information for more than 30,000 health care facilities. In the health care industry, it is fairly uncommon for individual health care facilities, such as a hospital or a nursing home, to operate independently; rather, the dominant organizational form in the health care industry is that of an IHDS. An IHDS is a collection of one or more health care facilities combined to achieve economies of scale and economies of scope. Economies of scale enable an IHDS to lower the overall cost of providing health care services by allocating common overhead, such as investments in an IT billing system, over a larger number of patients, thereby reducing the cost of overhead for each patient. Economies of scope enable an IHDS to better serve its customers by offering a broader array of health care services so that a customer does not have to go to multiple health care providers to receive treatment. The IHDS was the primary level of analysis for this research project because it is the organizational and managerial level where decisions regarding investments in IT reside and is the legal entity that most closely corresponds to an organization. The data for this study were obtained from the Dorenfest Institute for Health Information Research and Education. The Dorenfest Institute conducts an annual survey of IT usage in the U.S. health care industry and is under the management of the Healthcare Information and Management Systems Society Foundation. The survey results are stored in a market intelligence database that contains a detailed profile of each IHDS along with information regarding software and hardware IT usage and adoption. The database contains information for 1,444 independent health care delivery systems operating in excess of 30,000 health care facilities.* The large sample size should result in a test with high power that is capable of detecting small effect sizes. All the data analyzed were for the calendar year 2003.

Measurement of Variables

The dependent variable examined in this study is the financial performance of an IHDS. Because investments in IT have the potential to increase revenue and decrease costs, a measure that included both cost and revenue was used. Specifically, firm-level financial performance was measured as the ratio of total annual revenue to total annual cost for an IHDS.

One independent variable examined in this study is the total IT budget. Total IT budget was measured using the budgeted amount that an IHDS spends on IT in a given year as a percentage of total operating costs. This type

of measure provides an accurate indication of the level of IT expenditures for an IHDS and readily permits comparison between large and small IHDSs.

A second independent variable examined in this study is the level of IT outsourcing. Each IHDS reported the number of different IT services outsourced, and the total number of IT services outsourced by an IHDS was used to measure the level of IT outsourcing.

The third independent variable examined in this study is investment in IT personnel. IT personnel were measured by using the ratio of IT personnel employed by the IHDS to the total number of employees directly employed by the IHDS.

Analysis

The primary research model analyzed the effect of three different independent IT variables on IHDS productivity. Specifically, the level of expenditures on IT, the level of IT outsourcing, and the level of IT staff were used as the primary predictors of IT productivity. Regression analysis was used to test the model.

Results

Of the 1,444 integrated health care delivery systems contained in the database, 914 observations were retained for the analysis of the proposed regression model, whereas 530 observations were omitted due to missing values. Given the nature of the survey and the process used to collect the data, it was expected that the variables of interest would not be significantly different for the group containing all values and the group containing missing values. To verify this result and to test for nonresponse bias, a two-sample t test for differences between means was performed for all variables used in the regression analysis (log of the ratio of revenue to cost, IT budget, number of services outsourced, and log of the ratio of IT FTE to total FTE). No statistically significant differences were found for the variables of interest at the $p = .05$ level. Therefore, the findings for the group of 914 integrated health care delivery systems analyzed should readily extend to the entire population of 1,444 integrated health care delivery systems.

Descriptive statistics for the untransformed baseline variables of interest are presented in Table 1. After preliminary analysis of the scatter plots of the ratio variables and the identification of significant outliers, the ratio variables were log transformed. Table 2 shows the correlation matrix for the log-transformed variables of interest. As shown in Table 2, the correlation between independent variables is within acceptable ranges, indicating that multicollinearity should not be a factor in the analysis.

Table 1

Descriptive statistics for baseline variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Minimum	Maximum
Profit (\$)	1,228	10,523,766	105,401,748	-400,000,000	2.54×10^9
Annual net revenue (\$)	1,255	332,504,224	913,203,547	1,010,000	1.97×10^{10}
Annual operating cost (\$)	1,237	319,925,930	868,100,993	606,700	1.91×10^{10}
Total no. of employees	1,383	3,357	9,370.97	25	185,000
Total no. of IT employees	1,399	62.975	325.010	0.25	8,500
IT budget (\$)	1,110	2.253	1.149	0.5	6.5
No. of services outsourced	1,444	1.255	1.431	0	17

Note. IT = information technology.

Results from the regression analysis show that the R² for the model is .0070, indicating that a fairly small amount of the variation in the log of the ratio of total revenue to total cost is explained by IT budget, IT services outsourced, and the ratio of IT staff to employees. Although the R² is fairly low, it is important to note that the response variable is the log of the ratio of total revenue to total cost and that many other factors apart from IT influence financial performance. A detailed analysis of the individual effect of each parameter on the response variable is warranted.

Table 3 shows the results from the regression analysis and summarizes the parameter estimates for the model along with the significance of each parameter estimate. Maximum likelihood estimation was used as opposed to ordinary least squares to better account for the presence of extreme outliers.

As shown in Table 3, the parameter estimates for IT budget and the number of IT services outsourced are highly significant, whereas IT staff ratio was not found to be significant. These results support Hypothesis 1, which states that increased IT expenditures lead to increased financial performance in health care firms. The results also support Hypothesis 2, which states that increased IT outsourcing leads to increased financial performance in health care firms. In addition, Hypothesis 3, which states that increased investment in IT personnel does not lead to increased financial performance in health care firms, is also supported.

The estimated size of the effect of each parameter is also listed in Table 3. Although the estimates for the significant parameters appear to be fairly small, it is important to note that they are predicting the log of the ratio of total annual revenue to total annual cost and that differences associated with changes in the significant parameters have managerially significant consequences for an organization. Specifically, the level of IT budget has a significant and positive effect on financial performance such that each one tenth of a percentage increase in IT budgetary expenditures results in an increase in profit of between \$73,895 and \$152,413 for an average-sized IHDS. Similarly, the relationship between the total number of IT services outsourced and financial performance is positive and significant such that IHDSs with more IT services outsourced have better financial performance. Specifically, each additional IT service outsourced is associated with an increase of between \$646,959 and \$1,334,389 in profit for an average-sized IHDS.

Table 2

Correlation matrix

	Ratio of total revenue to total cost	IT budget	IT services outsourced	IT staff ratio
Ratio of total revenue to total cost	1.000 (1,193)			
IT budget	.089** (920)	1.000 (1,110)		
IT services outsourced	.0511 (193)	.105** (1,110)	1.000 (1,444)	
IT staff ratio	.070* (1,160)	.283** (1,058)	-.031 (1,342)	1.000 (1,342)

Note. Values are presented as Pearson correlation (n). IT = information technology.

*Significant at the .05 level.

**Significant at the .01 level.

Table 3**Maximum likelihood parameter estimates for predictors of the log of the ratio of total revenue to total cost**

Parameter	Estimate	Approximate SE	Approximate t value	Pr > t
Intercept	0.009	0.011	0.82	.410
IT budget**	0.003	0.001	2.75	.006
IT services outsourced**	0.003	0.001	3.10	.002
Log of IT staff ratio	0.002	0.002	0.79	.427
Error term SD	0.028	0.001	18.97	<.001
Error term df	1.498	0.112	13.36	<.001

Note. IT = information technology.

*Significant at the .05 level.

**Significant at the .01 level.

Implications

Findings from this study indicate that increased IT expenditures lead to increased financial performance in health care firms. Although increased IT outsourcing had a positive impact on financial performance measures, increased investment in IT personnel did not lead to increased financial performance in health care firms. From a theoretical perspective, these results have three implications for researchers. Prior to the current study, researchers had limited views of the business value of IT in the health care industry. Our study, unlike prior research, theorizes and finds empirical support that demonstrates the value of IT investment and, specifically, IT outsourcing in the health care industry. Going beyond previous work, the current analysis takes a more direct investigation into the determinants of the business value of IT.

In addition, findings from our study extend the health care literature by showing how IT outsourcing has the potential to improve health care firms' financial performance. Distinguishing between internal investments in IT versus outsourcing IT has the potential to dramatically alter the direction of future investments. Furthermore, the results provide one possible explanation for the productivity paradox, as it appears that internal IT has a greater likelihood of mismanagement than IT that is outsourced. Hence, outsourced IT may be an enabler of competitive advantage in health care organizations.

Managerial Implications

These findings have important managerial implications for IHDSs in the health care industry. Specifically, increases in IT budgetary expenditures and the number of IT services outsourced are associated with increases in profit. For example, consider two large populations of IHDSs: One has an IT budget of 3%, and the other has an IT budget of 3.1%, both on a \$335-million base. Holding IT services outsourced and the IT staff ratio fixed at their mean values, one would expect profit (revenue while holding costs fixed) to be \$106,403 higher for the IHDS with an IT budget of 3.1% than for its comparator.

A second managerial implication concerns organizational "make-or-buy" decisions and optimal strategies for procuring IT efficiently. Specifically, IT outsourcing is cost efficient such that higher levels of IT outsourcing

are associated with increased firm-level financial performance. Each additional IT service outsourced is associated with approximately \$950,000 in increased profit. By comparison, investments in IT personnel do not significantly affect firm-level financial performance; rather, investments in IT personnel are cost neutral. Thus, these findings guide managers in determining an appropriate IT budget, selecting a suitable level of IT outsourcing, and choosing appropriate investments in IT personnel.

A third managerial consequence concerns the adoption of IT in the health care industry. Adoption of IT in the health care industry is problematic, and these findings provide clear, tangible evidence of the efficiency associated with investments in IT and outsourcing IT. Espousing the benefits of technology will enhance perceptions in the industry, leading to higher levels of IT adoption.

Policymaker Implications

One of the major barriers to the expanded use of IT in health care has been concerns over the ROI on such investments being negative. This study indicates that IT investments are associated with positive ROIs, although not necessarily higher than the next best use. Nevertheless, any budget-neutral IT investment that potentially improves the quality of care is an important option in a health care facility's strategic plan.

A second major policy implication of the current finding is that outsourcing is an effective strategy. Another major barrier to adoption has revolved around the interoperability of systems. Typically, outsourcing serves to increase the use of standards and accelerate the adoption of interoperable frameworks. Therefore, promoting outsourcing may increase the diffusion of health IT and standards simultaneously, but this phenomenon needs to be studied.

Future Research Directions

As with any study, this study has certain limitations on the generalizability of the results, but this also provides opportunities for future research. One limitation of this study is the use of a single industry sample. Future studies may want to add other industries to the analysis for comparative purposes. Furthermore, the data being analyzed are cross-sectional and represent only 1 year, that is, January 1, 2003, through December 31, 2003. The business value associated with investments in IT infrastructure and IT personnel may not be present in the cross-sectional data due to a lag effect whereby improved financial performance associated with IT investments is not realized until a significant time has elapsed from the initial investment (Goh & Kauffman, 2005). If the return on IT investments lags significantly behind the initial investment, the research model may not be adequately tested by a cross-sectional analysis, and a longitudinal study may be required. Given these limitations, our study demonstrates that in the short run, IT investment in outsourcing has a positive impact on financial performance.

Conclusions

The primary objective of this study was to investigate whether investments in specific types of IT can be used to predict firm-level financial performance in the health care industry. By analyzing IT budgetary expenditures, IT services outsourced, and the ratio of IT staff to total number of employees, IT budgetary expenditures and IT services outsourced were found to significantly affect firm-level financial performance.

Results from this study show how increased numbers of IT services outsourced are associated with firm-level financial performance, such that each additional IT service outsourced is associated with approximately \$950,000 in increased profit. Furthermore, the findings suggest that the number of IT services outsourced and the level of IT budget positively affect performance, whereas the level of IT personnel does not affect performance. These findings have important managerial implications, such that health care organizations should look to expand their level of IT outsourcing and reduce their level of investment in internally owned and operated IT. It is hoped that these findings will aid managers of health care organizations in restoring their firms to financial health. It is also hoped that the findings from this study will serve as a foundation for future research in the area of the business value of IT outsourcing.

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