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FACTORS AFFECTING INVESTMENT IN IT: A CRITICAL REVIEW

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ABSTRACT

In this paper, we present a review of analytical and empirical research studies that analyze the factors impacting the organizational IT investment. We briefly review research studies conducted in the problem areas of justification of IT investments and contribution of IT to organizational performance. Then we develop a framework that enables us to classify the relevant research and understand the different approaches taken on the subject. Finally, we identify possible future research directions that will be of interest to researchers working in the IS field focusing on IT investment related issues.

INTRODUCTION

Motivation

Information technology (IT) attracts wide spread attention from both managers and researchers as it holds its importance as a critical enabler of competitive advantage for organizations. IT provides firms with competitive edge through improved processes (Prahalad and Hamel 1990) that lead to a decline in operating costs and an increase in quality of products and services. Yet, many firms remain slow in investing in IT. It has been invested at different pace in different firms, different industries and different countries depending on factors including operational and market characteristics and government regulations (Carr 2004). It is not surprising, therefore, that a growing body of research studies deal with these factors that determine IT investment decisions.

Firms invest in IT to improve their business, however not all IT projects are successful despite heavy spending. The debate over the value of IT investment has been going on for many years. Researchers have sought variety of performance measures including market measures (event studies, Tobin's q, market value) and accounting measures (ROA, ROE, ROS, market share) to evaluate the value of IT projects (Dehning and Richardson 2002). These research studies, however, have shown mixed results, giving life to the term "Productivity Paradox" (Brynjolfsson 1993).

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Determining the contribution of IT to organizational performance still remains a major problem for the IS researchers and practitioners, which is even more evident with the collapse of Internet companies and the economic slowdown in the early 2000s.

The primary motivation of this paper is to objectively evaluate the relevant research studies on IT investment factors, justification of IT investment and the value of IT. We also identify the future research opportunities to stimulate further discussions on the subject and guide the researchers who are interested in studying these problems.

Scope

We reviewed 46 studies that focused on IT investment problems. The review evaluates the studies that have appeared in scholarly journals, and conference proceedings such as *Communications of the ACM, Information Systems Research, Journal of Management Information Systems, Management Science, MIS Quarterly, Information Systems Management, Journal of Information Systems, Proceedings of International Conference in Information Systems and Proceedings of Informs Conference on Information Systems and Technology.*

There has been enormous interest on evaluation and organization of the studies that focus on IT contribution to organizational performance and productivity, but there have been few surveys that organize and evaluate the studies that focus on the factors that distinguish firms in terms of their IT investment strategies. Therefore, we briefly review the IS literature on justification of investment decisions and IT value, and mainly focus on papers studying the factors impacting the IT investment decisions.

The remainder of this paper is organized as follows. In the next section we propose a conceptual framework. In the subsequent three sections, we investigate the literature and identify the future research directions within the context of IT investment at three different levels of analysis: 1) factors that impact IT investment decisions, 2) justification of IT investment and 3) impact of IT on organizational performance. Finally, we present concluding remarks.

CONTRIBUTION

To the best of our knowledge, this paper is the first that evaluates the IS literature on IT investment determinants in the context of IT investment decisions. This review is potentially very valuable for IS researchers because it can help researchers identify important research areas as well as future research directions. Further, the paper proposes a framework that would help the researchers and readers understand different aspects of the IT investment studies. Finally and most importantly, the study assists managers in decisions on IT investments in their organizations based on the findings of prior studies.

CONCEPTUAL FRAMEWORK

We present a framework that organizes the related studies in Figure 1. The left portion of the framework represents factors that influence the IT investment strategies. The factors that are studied in this research stream mainly include IT cost decline (Kim, Thatcher and Wooders 2000; and Demirhan, Jacob and Raghunathan 2002), IT efficiency (Barua, Kriebel, and Mukhopadhyay 1991), switching cost (Davamanirajan, Kriebel, and Mukhopadhyay 1991; and Demirhan, Jacob and Raghunathan 2002), competition intensity (Banker, Khosla, and Sinha 1998; and Dewan and Mendelson 1998), and firm characteristics (Gremillion 1984; and Harris and Katz 1991). We can, further, make the distinction that the factors-IT cost decline, switching costs, and competition intensity- are mainly market characteristics. They individually or collectively affect firms' IT investment.

The bottom right portion of the framework presents research studies that analyzed the justification of IT investment. Evaluation of IT investments attracts wide spread attention from academicians as well as practitioners. Several research studies (e.g. Dos Santos 1991; and Benaroch and Kauffman 1999, 2000) discuss the use of capital budgeting and real option pricing approaches in evaluating investments in IT.

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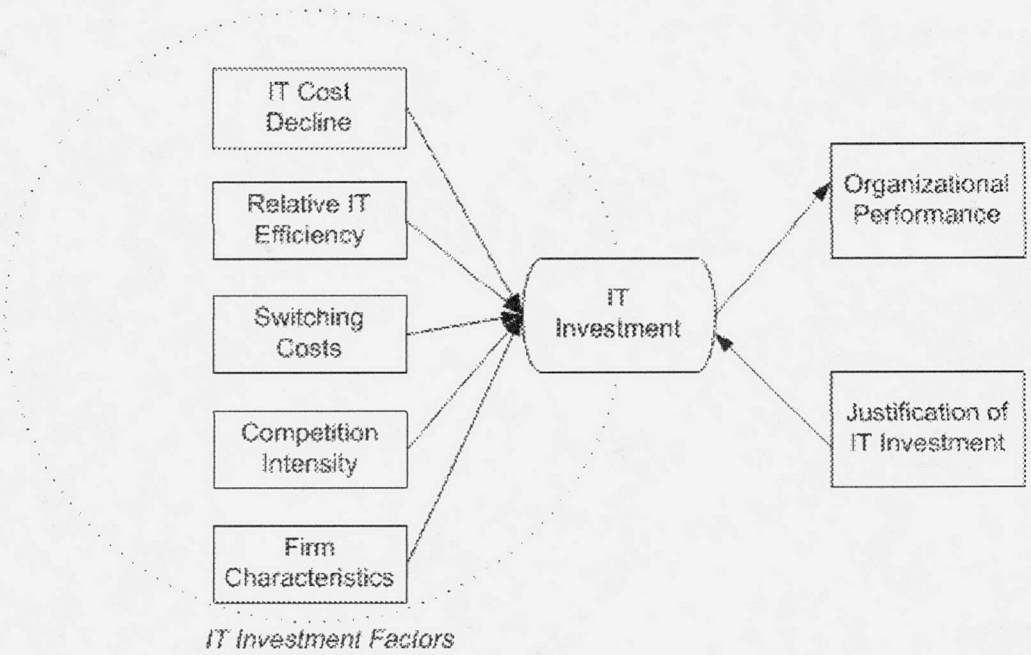

Figure 1. IT Investment-Framework for Literature Review

Finally, the top right portion of the framework categorizes the literature focused on the impact of IT investment on organizational performance. The contribution of IT to organizational performance has been the subject of debate for many years and still remains the major problem area for academicians and practitioners. Several researchers (e.g. Cron and Sobol 1983; Alpar and Kim 1991; Dos Santos, Peffers and Mauer 1993; Dos Santos and Peffers 1995; and Brynjolfsson and Hitt 1996) assess the contribution of IT to organizational performance, using performance measures including profitability, productivity, cost, market value, market share and operative efficiency.

Factors That Impact IT Investment Decisions

While most firms invest in information technologies, the investment pace is different in different firms (Carr 2004). IS researchers discuss that IT investment strategies among organizations differ mainly due to the factors including competition (Clemons 1991; Banker, Khosla, and Sinha 1998; Dewan and Mendelson 1998; Butterfield and Pendegraft 2001), decline in IT cost or vintage effect (Barua, Kriebel, and Mukhopadhyay 1991; Kim, Thatcher and Wooders 2000; Demirhan, Jacob and Raghunathan 2002), switching cost (Barua, Kriebel, and Mukhopadhyay 1991; Demirhan, Jacob and Raghunathan 2002; and Davamanirajan, Kriebel, and Mukhopadhyay 1991), and firm characteristics (Gremillion 1984; Harris and Katz 1991; and Dewan, Michael, and Min 1998).

Decline in IT Costs and Relative IT Efficiency

Technological advances contribute to dramatic price declines along with significant improvements in performance of IT. For instance, the price of computer hardware, adjusted for computing power, decreased at an annual rate of 34% during the second half of 2001 (Mandel 2001). Similarly, in the telecommunications industry, the carrying capacity of fiber doubled every year, and the price of telecommunication equipment declined every year between 1994 and 1998 (Mandel 2000). In the presence of such rapid technological advances that lead to price declines and performance increases, pioneers of the market may incur a cost disadvantage in IT-intensive industries and late entrants accessing improved technology may enjoy lower costs and higher quality compared to the

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pioneers. Even though two firms possess similar technology, it is quite possible that one firm is more efficient employing the technology than the other (Barua, Kriebel, and Mukhopadhyay 1991). In such case, IT efficiency can provide a firm with a cost advantage over its rival. Hence, IT cost decline and relative IT efficiency raise interesting research questions in terms of strategic IT investment. For instance, is IT cost decline enough to offset the late entrant disadvantages? How do the differences in relative IT efficiency among firms affect leadership-followership positions? Table 1 summarizes the research studies attempting to answer these research questions within the context of decline in IT cost and relative IT efficiency.

There are various studies that have investigated the relation of cost decline and IT investments in a competitive scenario using analytical models (Kim, Thatcher and Wooders 2000; Bohlmann, Golder and Mitra 2002; and Demirhan, Jacob and Raghunathan 2002). Game theory is the dominant analytical tool used in most of these papers. With this modeling technique, investments are considered to be motivated by competitive necessity (Butterfield and Pendegraft 2001). Using game theory, researchers model IT investment decision as a game where actions taken by one rational player influence the responses of the others and future decisions.

Declining technology prices lead to an improvement in quality together with an increase in prices when firms invest in IT simultaneously (Kim, Thatcher and Wooders 2000). Both firms enjoy IT cost decline due to simultaneous investments. However, firms might differ in their timing of investment in new technology because of managerial or cost commitments even though improved technologies are available to all firms. Several research studies on IT investment (Bohlmann, Golder and Mitra 2002; and Demirhan, Jacob and Raghunathan 2002) considered sequential investment models. When firms invest in IT sequentially, later entrant utilizing new technology with lower costs and higher quality (which can be referred as vintage effect) can lower market share and increase failure rate for the pioneer (Bohlmann, Golder and Mitra 2002). Under such conditions where the decline in IT cost along with improvement in IT (the vintage effect) is strong, the late entrants could overtake the pioneers as technology improves. Switching cost, however, can mitigate the adverse effect of declining IT cost in favor of early entrant. Declining IT cost and switching cost have opposing effects on IT investment strategies of pioneers and late entrants (Demirhan, Jacob and Raghunathan 2002). The early entrant, therefore, can enjoy being the leader as long as switching cost is high enough to cancel the negative effect of IT cost decline.

Table 1. Relation of IT Cost Decline or IT Efficiency and IT investment

Study	Issues	Research Questions
Bohlmann, Golder and Mitra (2002)	IT cost decline and performance improvement (Vintage Effects)	What are the conditions under which pioneers are more likely and also less likely to have an advantage?
Demirhan, Jacob and Raghunathan (2002)	IT Cost Decline	What is the impact of IT cost decline on both first entrant's and late entrant's IT investments in the presence of switching cost?
Kim, Thatcher and Wooders (2000)	Price decline	How does the falling cost of technology affect the optimal pricing and investment decisions of firms investing simultaneously?
Barua, Kriebel, and Mukhopadhyay (1991)	IT Efficiency	What are the incentives for sequential investment decisions and for leadership-followership positions when the relative IT efficiency of two firms is different?

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Cost advantage of a firm can be attributed also to the firm's relative IT efficiency compared to its competitors in the market. Firms are not equally effective in using IT for strategic purposes and one firm might have the expertise to develop a strategic application at a lower cost than its competitor do. In such a case, a firm that has a cost disadvantage prefers to be the follower in terms of IT investment, and a firm that has a cost advantage prefers to be the leader only when its cost advantage is significant (Barua, Kriebel, and Mukhopadhyay 1991). The results of this study, however, could be applicable only to the markets where firms do not charge the consumers but enjoy indirect benefits as in search engines of the web.

In most of these sequential order studies, order of investment is considered, but consideration of the time elapsed in between entry of the two firms is not. Consequently, the current research studies don't provide any clear answers to the question of how long the late entrant should wait after the pioneering firm invests in new IT to make its own such investments, in order to maximize the investments' impact on profits. If the second mover invests too soon, it may not have a significant cost advantage over the first mover. If it invests too late, it may get difficult for the firm to attract consumers (Brown and Lattin 1994; and Huff and Robinson 1994) and the firm may have to wait to realize its profit. Cost benefit analysis of delaying investment in IT in the presence of declining IT cost deserves further attention.

Switching Costs

Switching cost, another factor that can be identified as having an impact on IT investment decisions, has attracted wide spread attention from various disciplines. Several types of switching costs including transaction costs, learning costs and artificial or contractual costs (Klemperer 1987) can arise in a marketplace. Such switching costs help early entrants retain their customers and ultimately dominate the market (Robinson and Fornell 1985; Robinson, Kalyanaram, and Urban. 1994; and Urban, Carter, Gaskin, and Mucha 1986) by discouraging its customers from switching to competitors' products. Allowing the incumbent to retain a large fraction of its customers (Shapiro and Varian 1998), switching costs might provide incentives for early entrants to over-invest in IT to establish a large consumer base initially. Hence, it is relevant to study the role of switching costs on IT investment. In Table 2, we summarize the studies that analyze the IT investment in the presence of switching costs.

Game theory is the dominant analytical tool used in most of these papers. This theory helps researchers model firms' decisions to invest in IT based on the actions of their competitors (Butterfield and Pendegraft 2001). In most of these game theoretical papers on switching cost, horizontal product differentiation model setting is applied. This type of modeling captures the process of switching by allowing heterogeneous ideal points under equal prices for all products

Table 2. Relation of Switching Cost and IT Investment

Study	Issues	Research Questions
Demirhan, Jacob and Raghunathan (2002)	Interplay of IT cost decline and switching costs	What is the impact of IT cost decline on firms' IT investments in the presence of switching cost?
Davamanirajan, Kriebel, and Mukhopadhyay (1991)	IT investment and switching costs	In the presence of switching costs, what is the impact of a firm's current market position on its incentive to invest in IT research and development?
Barua, Kriebel, and Mukhopadhyay (1991)	Consumer switching costs and identical quality levels	What is the effect of consumer switching costs on firm profits?

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(Hotelling 1929). Consumers prefer one firm to another over a product characteristic such as customer service and location, in spite of moderate differences in price and quality.

Davamanirajan, Kriebel, and Mukhopadhyay (1991) studied the impact of consumer switching costs on the incentive to invest in new technologies. They found that switching costs provide incentive to the high quality provider to invest more in IT compared to the low quality provider particularly because it would earn higher profits in the presence of switching costs than in the absence of switching costs. Barua, Kriebel, and Mukhopadhyay (1991) addressed the issue of switching costs as well, but their study is limited on the ground that they focused on only the price competition and assumed the quality level as given and identical across firms. Their findings are consistent with the prior research (e.g. Klemperer 1987; and Nilssen 1992) suggesting that consumer switching cost reduces the industry profits as well as consumer welfare.

The presence of switching costs and declining technology costs makes IT investment decision challenging. They have opposing effects on pioneers' and late entrants' IT investment strategies. Switching cost provides incentives to early entrant to over-invest in IT whereas declining technology cost diminishes these incentives to over-invest. The analysis of these two opposing effects- switching cost and IT cost decline- is the focus of few IS researchers. Demirhan, Jacob and Raghunathan (2002) found that the optimal IT investment of the early entrant depends on the extent of switching costs relative to IT cost decline. When the switching cost relative to the IT cost decline is high, then it is in the early entrant's best interest to aggressively compete with the later entrant by increasing its investment in response to the decline in IT cost. It is expected from the firms to create or increase consumer switching costs to deal with the future competition. For instance, online retail brokerage firms have substantial influence over their switching costs, which play substantial role in the industry (Chen and Hitt 2000).

The question of how switching costs influence IT investments is studied by several researchers through analytical models and a positive relationship between switching costs and IT investments of the pioneer is found in those studies. Empirical research is needed to validate the findings of the prior analytical studies. Furthermore, the prior literature (Demirhan, Jacob and Raghunathan 2002; and Barua, Kriebel, and Mukhopadhyay 1991) has considered switching cost as being exogenous. Switching cost is determined outside the model. This model setting assumes that firms do not have any control over switching costs at all. However, firms may engage in activities to create or control switching costs that are imposed on consumers and incur costs consequently. This might be true, for example, for ISPs who bundle basic Internet connection with other value-added services such as proprietary content, e-mail, instant messaging, web hosting, and content filtering to create consumer switching costs. In providing and maintaining these additional features, ISPs need to employ more technology and people, which could be costly. It is important, therefore, to acknowledge these additional costs and endogenize the firms' decisions to engage in activities to impose switching costs on consumers.

COMPETITION INTENSITY

Increasingly, the market has observed investments in IT where the decisions are influenced to a great extent by the actions of competitors. For instance, Merrill Lynch invests in Bloomberg financial system to limit the possibility of future losses from competitors using similar systems (Clemons 1991). Investment decisions on online marketing system as by Barnes and Noble and Borders are to a great extent influenced by the action of their competitor Amazon (Butterfield and Pendegraft 2001). In a highly competitive environment as is today, especially in the IT intensive industries, it is of great concern to researchers and practitioners to understand the impact of competition on firms' IT investment decisions. Some of the studies use game theoretical models while others employ empirical data models to analyze this impact.

The research studies on competition (Banker, Khosla, and Sinha 1998) discuss mostly three different measures of competition intensity: (i) number of firms, (ii) the existence

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of cooperation, and (iii) the degree of substitutability between competing products. Dewan and Mendelson (1998) measured competition intensity with the number of traders in imperfect securities market and found that competition intensity negatively affects the IT investment decisions of each trader. By contrast, Iacovou, Benbasat, Dexter (1995) found that firms facing more intense competition, measured as the number of competitors adopting EDI, tend to invest more in IT investments. A recent study (Zhu, Kraemer, Xu, and Dedrick 2004), however, has not found any relationship between competition intensity and the value attributed to IT investments in finance sector adopting e-business model.

From a different perspective, in operations management and economics context, various studies analyzed investments in quality. Since information technology investments often result in an improvement in the quality of the products/services of the firm, the findings of those studies that deal with investments in quality interest us in this review. In one such study, Banker, Khosla, and Sinha (1998) showed how the product quality levels are affected by the competition intensity. They have suggested that the quality increases with the competition only when certain conditions such as sufficient decrease at fixed costs of quality improvement are met. Their results are consistent with the findings of Dewan and Mendelson (1998) as long as the reduction in fixed cost of investment is low.

More studies need to be undertaken to determine whether competition intensity forces firms to invest in new IT or to keep their existing technologies. Especially IT vendors would benefit from such research studies. For instance, if they know that competition intensity forces firms to abandon their existing technologies before the end of their life cycles and invest in advanced IT to avoid the competition decline, they can tailor their marketing and promotion strategies to aggressively attract the firms serving in a highly competitive environment. However, not all the industries might react the same to competition intensity. The empirical studies on competition intensity, so far, focused mostly on finance sector. We simply do not know the answers to such questions as: Is the impact of competition intensity on IT investment consistent among various industries or is it more apparent in particular industries? The answer to these questions might help the IT vendors identify the sectors in which they can pursue aggressive marketing strategies.

FIRM CHARACTERISTICS

Some firms adopt IT earlier and invest more heavily on IT than others. IS researchers (Gremillion 1984; Yap 1990; Harris and Katz 1991; and Dewan, Michael and Min 1998) have examined the relationship between IT investment and firm characteristics including size, degree of centralization of decision-making, organizational maturity, industry type, growth, diversification, and vertical integration to understand the IT investment differences among firms. Table 3 summarizes a sample of key research papers on the subject.

Firm size as a potential indicator of IT investment intensity attracts wide attention from researchers in MIS field. Harris and Katz's (1991) analysis of life insurance firms found a negative correlation between IT investment intensity, defined as the ratio of IT expenses to total operating expenses, and firm size. They argued that small firms spend a larger proportion of their operating expenses on IT than do large firms. Contrary to the expectations, small firms are the aggressive IT investors. Findings of this study may not be applicable to other industries, other than life insurance industry, which is information intensive. Organizations in different sectors have different information processing requirements. Information intensive firms invest heavily in IT for the support of their core activities (Kearns and Lederer 2004). In less information intensive sectors such as oil refining and construction (Porter and Millar 1985), small firms might not feel the pressure to invest aggressively in IT. The impact of industry differences does not go unnoticed in some other studies. Yap (1990) focused on the impact of firm size in accordance with the industry type, but only the ones in the service sector, on IT investment. He found that large organizations, especially the ones in the financial sector, are more likely to invest in advanced IT than small and medium firms. A study of manufacturing firms in Los Angeles (DeLone 1981) suggests similar findings implying that large firms are more likely to be

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the early adopters of IT than smaller firms. A few other studies (Gremillion 1984) that have been conducted to explain the relationship between firm size and the extent of computerization were, on the contrary, not able to show that firm size is a significant predicator of IT intensity. The mixed results can be attributed to the conflicting measurements of the variable, firm size, in these empirical studies.

Growth, diversification, vertical integration, and maturity level are also studied as possible firm characteristics that affect the extent of IT investment. Firms that are more diversified, firms that are less vertically integrated and firms that have low growth options (access to free cash flow) are more inclined to make excessive investments in IT (Dewan, Michael and Min 1998). Yap (1990) found that mature organizations are more likely to invest in IT, but he was not able to obtain conclusive results for the degree of centralization of decision making as a predicator of IT investment. The inclusive results might be attributed to the fact that organizations are employing IT to facilitate the decentralization of responsibility and decision-making.

It is not well understood whether firms, small or large, in particular industries appear to be more adapt than others in investing in IT. Few researchers (Yap 1990; and Kearns and Lederer 2004) have attempted to study the impact of the industry type on IT investment but they have failed to provide a comprehensive classification scheme on industry types and firm sizes. Research studies in this area would especially benefit the IT vendors in identification of the target market segments. Firm size and industry type would serve as guidelines for the successful promotion of these technologies. The general question to be answered is: Does the relationship between firm characteristics including size and the extent of IT investment vary for different industries or is it witnessed across a large number of industries?

JUSTIFICATION OF IT INVESTMENT

Investment in IT is a strategic decision for managers in many organizations. IT has long been considered a critical factor that provides companies with many opportunities for sustainable competitive advantage (Barney 1991). However, not all IT investment projects succeed. A study conducted by Standish group in 1998 revealed that only 26 % of IT projects were successful (Carr 2004). Before spending thousands of dollars in IT projects, firms should carefully assess the value of their projects and justify the investments. However, justification of IS projects is not an easy task due to the nature of IT including the rapid pace of change, relatively shorter life expectancy compared to manufacturing systems, and user-oriented benefits (Dos Santos 1991; and Laudon and Laudon 2003). Therefore, the assessment and justification of IT investments remains an important issue for managers and researchers.

Table 3. Relation of Firm Characteristics and IT Investment

Study	Firm Characteristics	Research questions
Dewan, Michael and Min (1998)	Diversification Growth Vertical integration	How do diversification and vertical integration affect the demand for IT? Do firms with more growth option require more or less IT?
Harris and Katz (1991)	Firm size	Do small insurance companies exhibit a higher degree of IT investment intensity?
Yap (1990)	Firm size Sector Structure People	What are the characteristics that distinguish organizations using computers from those that do not?
Gremillion (1984)	Firm size	What is the relationship between firm size and IS use?

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Cost benefit analysis including net present value, internal rate of return, and payback period has been widely used to assess IT investment decisions. However, there are problems associated with these methods such as difficulties assigning costs and benefits, failure to identify all alternatives, failure to identify critical characteristics demanded of the system (King and Schrems 1978) and failure to account for the benefits of future projects (Dos Santos 1991). These problems are even more evident for new IT projects that are unstable and untested. Traditional capital budgeting approaches are not recommended to be used in justification of IT investments (Dos Santos 1991; and Benaroch and Kauffman 1999, 2000).

Analytical models, such as real options pricing model, have become popular among IS researchers to justify IT investments. Studies (Dos Santos 1991; Kumar 1996; and Benaroch and Kauffman 1999, 2000) have showed that option pricing models can be applied to analyze non-traded assets, particularly, IT. A major portion of the benefits of an IT project accrues from the experiences gained during the initial project, which would be valuable in future projects (Dos Santos 1991). Real option pricing model takes into account the value of these future investments in justification of current IT investments. Without these useful insights in evaluation of IT projects, managers might make wrong choices in their investments, which might be disastrous for the organizations.

Impact Of It On Organizational Performance

It is of great concern to business executives to know whether their IT investments are paying off. Understanding the value of IT investment to an organization is a focus of a large and growing body of research. Researchers in IS field have studied the impact of IT on organizational performance, using various performance measures including profitability (Cron and Sobol 1983; Bender 1986; and Dos Santos 1991), productivity (Roach 1991; Weill 1992; Brynjolfsson and Hitt 1996; and Dewan and Min 1997), costs (Alpar and Kim 1991; West 1994; and Mitra and Chaya 1996), market value (Dos Santos, Peffers and Mauer 1993; and Subramani, and Walden 2001), and market share (Dos Santos and Peffers 1995; and Sircar, Turnbow, and Bordoloi 2000). However, these studies on impact of IT on organizational performance have shown mixed results.

The early studies conducted in 1980's showed that the U.S. economy had experienced a productivity slowdown since 1973, despite massive IT investments during this period. Comparing the output per production to output to per information worker between the mid-70's and 1986, Roach (1991) supported low office productivity. The negative relationship between IT and productivity found in these early studies was explained to be the possible result of the mismeasurement of inputs and outputs in the productivity measures used (Brynjolfsson 1993). This study highlights the importance of accurate measurement of productivity with increased quality, variety, and customer service, speed and responsiveness.

While early studies were unable to show positive results, more recent studies (Brynjolfsson and Hitt 1996; and Dos Santos, Peffers and Mauer 1993) starting in the mid-90's show that IT investments contribute substantially to productivity. IT investments continue to contribute to productivity even after the collapse of Internet companies and the economic slowdown in the early 2000s (Oliner and Sichel 2002).

Conclusions

The review provides different perspectives on how IS researchers address the issue of IT investment. Our primary objective is to illustrate the important problems and opportunities for the researchers on the subject. In this paper, we review sample of papers that study firm and market specific factors affecting IT investment, justification of the IT investment decision and the IT value to organization. Since there has been considerable amount of research conducted in the area of IT value and justification, our main interest is directed to the papers that attempt to understand how firm specific or market specific factors influence IT investment decisions.

In an attempt to organize the IT investment literature, we propose a conceptual

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framework. It would, ultimately, help the researchers understand the different aspects of IT investment studies. Further, this review can be a very valuable resource for the IS researchers to identify the important research areas as well as the future research directions. Based on the presented findings of papers outlined, the review has also the potential to assist the managers in their decisions on IT investments.

Several fundamental conclusions emerge from this review in terms of the limitations of the existing research and the possible research directions. Table 4 summarizes these research opportunities. First, there are several analytical papers that study various factors impacting firms' IT investment decisions. Most of these studies have provided useful insights into the problem, but empirical studies that can validate and support the findings of these analytical studies are needed. Second, current analytical research studies consider switching cost as being exogenous, i.e., outside the control of the firm. However, pioneers and late entrants may deliberately take strategic actions and use IT to create or reduce consumer switching costs and thus incur costs. More studies need to be conducted to determine the impact of endogenous switching cost on IT investment. Third, current research studies don't provide clear answers for the question of when to invest in IT in the presence of declining IT cost. Waiting to invest in advanced IT might cost a firm in terms of forgone profits but it might save money on the cost of technology. Hence, cost benefit analysis of delaying investment in IT in the presence of decline in IT cost deserves further attention in an attempt to understand the timing of the investment. Fourth, the question of whether competition intensity forces firms to abandon their existing technologies and invest in advanced IT more frequently than they need to still remains unanswered. Finally, most of the empirical studies focusing on competition intensity and firm characteristics in the context of IT investment are industry specific. It is not yet clear whether the findings can be applicable to organizations in different industries. Understanding these questions is important for IT vendors as they can use the knowledge to identify the market segments to tailor their marketing strategies.

Table 4. Future Research Questions

Issue	Goal for Practice	Research questions
Investment Timing	Maximizing the return on IT investment	How long the late entrant needs to wait to invest in IT in order to earn the maximum profit after the pioneering firm invests in new IT?
Endogenous Switching Cost	Retaining and attracting customers	What should be the early and late entrants' investment strategies to increase or reduce consumer switching costs?
Competition Intensity	Identifying sectors in which IT vendors pursue aggressive marketing strategies	Are firms forced to abandon their existing technologies before the end of their life cycles and invest in advanced IT as the competition intensifies? Is it more apparent in particular industries?
Validating Switching Cost effect	Understand the impact of switching cost on competitor's IT investment strategies	Can prior analytical studies be empirically validated to further explain the impact of switching cost on IT investments?
Firm Characteristics	Developing a classification scheme on industry types and firm sizes to identify the market segments for promoting IT.	Does the relationship between firm characteristics including size and the extent of IT investment vary for different industries or is it witnessed across a large number of industries?

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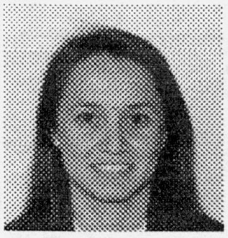

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