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Evaluating large-scale IT investment decisions

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ABSTRACT

Businesses are becoming increasingly dependent on information and Information Technology. This dependence brings with it both risks and rewards, and managers must decide whether or not to stay averse to the risk, or whether to embrace it in order to achieve the potential rewards. This study explores some of the risks and rewards that integrating Information Technology into a corporation can produce. In this study, a research method that is mainly based on a review of the scientific literature was employed. The final contribution of this study lies in the fact that it identifies and articulates the most important risks and opportunities that must be evaluated carefully and extensively by decision makers before making large-scale IT investment decisions.

1. Introduction

Today's competitive business market requires businesses to understand the risks and rewards of technology especially Information Technology (IT) development and implementation. IT can help a business improve its efficiencies and increase profits. One would agree that various industries require constant IT development to remain competitive and succeed in the growing marketplace. However, companies that engage in large-scale spending must also realize the rewards and risks that come with it. The risks and rewards of IT development must be evaluated extensively by decision makers.

IT departments have seen a large growth in corporations of all sizes over the past several decades. Companies have upgraded from punch cards, to interactive terminals, and finally to personal computing. Each step along the way has allowed the companies to continue to grow into new markets, produce better products and services, and to reduce the costs involved with creating those products and services. These advancements have not come without risks. The risks that companies face include but are not limited to a reliance on technology, the expense of the products and the high fixed costs, the security liabilities that are created, and the need for more skilled workers. However, integrating IT into a company can generate certain benefits such as the ease of scalability, minimal variable costs, the ability to enter into the global market, and the opportunities that can be offered to employees.

While new technology especially IT development is at the top of the agenda in many boardrooms, various decision makers are facing major questions on what the risks and rewards of IT development and implementation are. One question managers must ask is, "How much IT should the company develop and pursue until the reward overcomes the risk?" It is a critical question to address that involves a number of

factors that go into the decision. Overinvestment or underinvestment can have a drastic effect on the future and success of the business. Spending too much on IT can result in lower profits and useless complex information systems. Not spending enough can result in operational inefficiencies and possible security breaches.

This study explores various risks and opportunities that integrating IT into a firm can produce. Although the literature on IT alludes to numerous references pertaining to the benefits of IT, this study makes an attempt to also point out some risks/costs that may come with incorporating IT into a firm. The long range significance of this work is that it provides decision makers with a set of guidelines, ideas, and insights that may be employed when evaluating and comparing IT investment options. Accordingly, the final contribution of this study lies in the fact that it identifies and articulates the most important risks and opportunities that must be evaluated carefully and extensively by decision makers before making large-scale IT investment decisions. This study also performs text analytics on the IT risks and rewards literature to examine the patterns and trends within the literature.

2. Literature review

Investments decisions about IT implementation may have drastic effects on such factors as products, employees, and consumers. Further, managers must evaluate their financial situation when making the decision to invest in IT. A company must evaluate various factors when addressing IT development and decide whether the reward will outweigh the risks. For instance, IT managers should consider key factors such as senior management support, adequate planning, key users' involvement, requirements' management, monitor and control of project execution, and development team management [1]. Once a particular

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product has been identified to be developed, IT managers then may consider additional factors such as various technical features, price, customization requirements, and the costs of switching to an alternative product, and the fit and compatibility with other products [2]. While a number of risks are involved with IT development, a particular company may also realize numerous rewards for investing in the appropriate IT.

While the literature on IT includes frequent references to the benefits associated with developing and implementing IT in an organization, researchers and practitioners have been debating about how IT contributes to organizational performance. As pointed out by Ref. [3]; whether the IT revolution was paying off in higher productivity has been debated for many years.

Lucas [4] argues that studies in the 1980s found no connection between IT investments and productivity in the U.S. economy, a situation referred to as the productivity paradox [5] make a similar observation and suggest that a great deal of controversy exists about the impact of IT on firm performance. Hitt and Brynjolfsson [6] concur and argue that firms have been uncertain about the business value of IT. Brynjolfsson and Yang [7] claim the relationship between IT and productivity has become a source of debate. In the 1980s and early 1990s, empirical research on IT productivity generally did not identify significant productivity improvements. As summarized by Ref. [8]; IT platforms in most organizations are not able to deliver the goods for corporate rebirth, and firms should avoid the fallacy that IT investments are directly responsible for enhancing firm performance [9,10]. Finally, a study conducted by Tarafdar et al. [76], finds that the very qualities that make IT useful may also undermine employee productivity, innovation and well-being and induce technology stress, technology addiction and IT misuse in the workplace.

Although there has been uncertainty about how IT contributes to organizational performance, numerous studies, however, have found a strong positive correlation between investments in IT and organizational performance. For instance [11], and [12] suggest strong firm performance is significantly and consistently associated with heavy use of transactional IT platforms [12] further suggests that there is a strong relationship between firm performance and strategic IT investment. Brynjolfsson and Hitt [13] present some evidence to prove that IT has become a productive investment for a large cross-section of firms. Studies by Ref. [6]; and [14] indicate that IT has increased productivity, the market value of the firm, and created substantial value for consumers. A similar study carried out by Ref. [15] shows that some firms have gained significant advantages by using IT. In their study [16], show how IT is the key enabler of many of today's key innovations and improvements in our lives and society.

IT has evolved from its traditional orientation of administrative support toward a more strategic role within an organization [17], and has been widely applied across many economic sectors in order to increase competitiveness and reduce costs [18]. A study by Ref. [19] indicates that firms with high IT capability outperform firms on a variety of profit and cost-based performance measures. A similar study by Ref. [20] suggests that effective and efficient use of IT is a key factor differentiating successful firms from less successful counterparts. Santhanam and Hartono [21] agree and argue that firms with superior IT capability indeed exhibit superior current and sustained firm performance when compared to average industry performance. Stiroh [22] finds that virtually all of the aggregate productivity acceleration can be traced to the industries that either produce IT or use IT most intensively.

A key issue that needs to be addressed is how to capture benefits and assess investments in IT [23] argues that IT can provide significant benefits, but in many cases these benefits are not captured by the firm that made the investment [24] claims individual benefits occur first, while improvements in organizational effectiveness develop over a longer period of time. A study carried out by Ref. [25] posits that the driver of IT impact is not the investment in the technology, but the

actual usage of the technology. Melville et al. [26] argue that IT is valuable, but the extent and dimensions are dependent upon internal and external factors [27] draws a similar conclusion and claims that the risks and awards afforded by IT may depend on how it's used.

A number of studies explored the link between IT and a few macro level economic indicators and key areas. For instance [28], argue that IT has a positive impact on productivity, employment, creates more efficient markets, allows to produce higher quality goods and services, and innovate new products and services. Stiroh [22] examines the link between investments in IT and the U.S. productivity revival in the late 1990s. The study shows that the most IT-intensive industries experienced significantly larger productivity gains than other industries. The very same study demonstrates that a wide variety of econometric tests show a strong correlation between IT capital accumulation and labor productivity. Atkinson and McKay [28] further found that the integration of IT into the economy and society created a digitally-enabled economy that was responsible for generating growth and prosperity. A study by Ref. [16] shows that in the new global economy IT is the major driver of both economic growth and improved quality of life.

IT has also played other important roles in firms. For instance [29], report that "two newer tools-IT and business process redesign-have the potential to transform businesses." Similarly [30], states IT has revolutionized the management of contemporary organizations and introduced a paradigm shift in the way businesses operate. Atkinson and Castro [16] observe a similar transformation and maintain that IT, since the mid-1990s, has been the principal driver of increased economic growth not only in the United States but also in many other nations.

Several studies examined the impact of IT on firms using non-financial measures. For instance [31], argue companies invest IT to obtain or even sustain a competitive advantage in their respective marketplaces. Dewett and Jones [32] assert that IT plays an important role in moderating the relationship between organizational characteristics and the most strategic outcomes, organizational efficiency and innovation. Sambamurthy et al. [33] focus on how IT capabilities influence firm performance through three significant organizational capabilities: agility, digital options, and entrepreneurial alertness. In addition, IT is also at the core of dramatic improvements in the quality of life for individuals around the world [16], has made substantial improvement in patient safety [34], and revolutionized the management of contemporary organizations and introduced a paradigm shift in the way businesses operate [30].

Along with the risks and rewards afforded by IT, a number of studies investigated some external factors that affect investments in IT and why large-scale IT projects fail. For instance, a study by Ref. [35] examines the impact of market structure on investment in the large scale mobile industry. Desouza and Smith [75] suggest even though managers and leaders are familiar with past failures, they still continue investment in IT projects while failing to understand the causes of failures [36] maintains that large scale IT projects fail due to common problems related to system design and implementation, project management and governance, and contract management.

The risks of investing in IT can also be affected by poor economic conditions. In general, companies will invest so much on technology, but when the economy is downgraded, they scramble for an increased cash flow. Right before the financial crisis of 2008, a reputable forecasting company, Forrester, downgraded its previous estimate of a growth saying, "Information-technology spending is now expected to grow by 6.1 percent next year, down from the firm's prior forecast of a 9.4 percent increase." [37]. As important as technology is, some companies are not risking as much profits to spend on IT.

The above studies suggest that while some studies have reported positive impacts of IT, others have found no impacts (see Table 1). In terms of their conclusions, the above studies can also be classified as those that conclude that investments in IT add no business value and those that report that investments in IT do have a positive impact on firm performance and profitability. Table 2 summarizes a sample of

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